

## Education Committee Meeting

Thursday, August 6, 2026 6:00 PM

Board Room: Educational Services Center, 16 Welden Drive, Doylestown, PA 18901

|                                                                                                                                                                                                                                                                                                                    |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1. Call to Order                                                                                                                                                                                                                                                                                                   | Speaker (s) :<br>Chairperson     |
| 2. Public Comment                                                                                                                                                                                                                                                                                                  |                                  |
| 3. Review of Previous Meeting Report                                                                                                                                                                                                                                                                               |                                  |
| 4. Information Items                                                                                                                                                                                                                                                                                               |                                  |
| 4.A. Course Updates: Advanced Mathematics 5, Accelerated Algebra 1, Honors Geometry, Code and Create Updates                                                                                                                                                                                                       | Speaker (s) : Brian Novick       |
| 5. Recommendations for Approval at Next School Board Meeting                                                                                                                                                                                                                                                       |                                  |
| 5.A. Academic Math 6 Course of Study Approval, Math Intervention 7 Course of Study Approval, Math Intervention 8 Course of Study Approval, AP Cybersecurity Course of Study Approval, Calculus 3 Course of Study Approval, Introduction to Python Course of Study Approval                                         | Speaker (s) : Brian Novick       |
| 5.B. Navigate Course of Study Approval                                                                                                                                                                                                                                                                             | Speaker (s) : Chris Johnson      |
| 5.C. French 1A and French 1B Course of Study Approval, Spanish 1A and Spanish 1B Approval, Passports and Perspectives Course of Study Approval                                                                                                                                                                     | Speaker (s) : Stacy Gray         |
| 5.D. Kindergarten Decodable Books Adoption and Read Naturally Intervention Adoption                                                                                                                                                                                                                                | Speaker (s) : Ashley Christie    |
| 5.E. STEM 6 Course of Study Approval, STEM 7 Course of Study Approval, STEM 8 Course of Study Approval, STEAM Robotics 1, STEAM Robotics 2, STEAM Design 1 Exploring, STEAM Design 1, STEAM Design 2, STEAM Design 3, STEAM Fabrication 1 Exploring, STEAM Fabrication 1, STEAM Fabrication 2, STEAM Fabrication 3 | Speaker (s) : Jon Taylor         |
| 5.F. MTSS Management Programs Pilot                                                                                                                                                                                                                                                                                | Speaker (s) : Cassandra Oshinsky |
| 6. Adjournment                                                                                                                                                                                                                                                                                                     |                                  |

# **Central Bucks School District Education Committee Report**

## **Thursday, June 4, 2026**

**Meeting location: CBSD Educational Services Center, 16 Welden Drive, Doylestown, PA 18901**

### **In Attendance:**

Heather Reynolds, Chairperson pro tempore  
 Susan Gibson, Board member  
 Karen Smith, Board member  
 Charles Malone, Ed.D., Interim Superintendent  
 Helen Zaleski, Ed.D., Assistant Superintendent for Elementary Education  
 Richard Kratz, Director of Teaching and Learning  
 Stephanie Radcliffe, School Board Secretary

### **1. Meeting Opening**

**A. Call to Order:** The meeting was called to order at 6:01 p.m.

Mrs. Reynolds announced that since there is not a quorum this evening, these items will move forward to the board meeting without committee recommendation.

**B. Public Comment:** There was no public comment at the June 4, 2026 committee meeting.

**C. Review of Previous Meeting Report:** The previous committee meeting report was reviewed.

### **2. Information Items**

**A. West United:** CBSD students Madison D., Noah G., and Jane K. presented at the committee meeting about West United. West United hopes to help students feel included and welcome at CB West. Initiatives include welcome tours, gift bags, and orientation events. Committees include Women of West, Humans of CB West, West Pulse, Kindness Week, West Pride, Welcome to West, West Leadership Day, Peer Mentors, and Student Voice Day. West United hopes for increased support with recognition, exposure, and financial from the district, especially for bus costs to travel to other schools and for gift bag items.

Mrs. Reynolds spoke about this club having an audience at a future board meeting, sharing stories with the communications department, and getting a financial proposal together.

Mrs. Gibson commended the students on their poise and presentation, learning more about transportation costs to involve other schools.

Mrs. Smith spoke about recording videos to be shared with schools.

**B. CB South Bell Schedule for the 2026-2027 School Year:** House Principals Jennifer Opdyke and Joseph Piselli presented at the committee meeting about a bell schedule for the 2026-2027 school year at CB South. This proposed schedule is intended to be temporary during construction at CB South. Monday through Thursday would be "Begin to Learn" 7:25-7:45; Block 1 7:50-9:10; Block 2 9:15-10:35; Block 3 10:40-12:40; Block 4 12:45-2:05; "Return to Learn" 2:10-2:30. The Friday schedule would be "Begin to Learn" 7:25-7:50; Block 1 7:55-9:05; Block 2 9:10-10:20; Titan Forum 10:25-10:45; Block 3 10:50-12:50; Block 4 12:55-2:05; "Return to Learn-Blocks 1/2/4" 2:10-2:30. Mrs. Reynolds spoke about optional club meetings during the Begin to Learn period and movement times during the lunch periods.

Mrs. Smith spoke about students using Lunch and Learn processes during the Begin to Learn and Return to Learn periods.

Mrs. Gibson spoke about this temporary schedule during the construction period at CB South and confirmed that CB South will return to its traditional Lunch and Learn period after construction ends.

Mrs. Gibson spoke about linking this presentation so parents can view it.

### **3. Recommendations for Approval at Next School Board Meeting**

**A. Approval of Course of Study: Social Studies 6**

**B. Approval of Course of Study: Social Studies 7:** K-12 Social Studies Supervisor Chris Johnson presented at the committee meeting about social studies courses. Mr. Johnson shared curriculum overviews about the instructional units, themes, and interdisciplinary skills. There will be no fiscal impact for these courses.

Mrs. Smith confirmed 8th and 9th grade course offerings.

**C. Approval of Course of Study: Grade 6 Physical Education**

**D. Approval of Course of Study: Grade 6 Health**

**E. Approval of Course of Study: Grade 7 Physical Education**

**F. Approval of Course of Study: Grade 7 Health**

**G. Approval of Course of Study: Grade 8 Physical Education**

**H. Approval of Course of Study: Grade 8 Health**

**I. Approval of Course of Study: Health and Physical Education 1**

**J. Approval of Course of Study: Health and Physical Education 2:** K-12 Health & Physical Education and Realignment Coordinator Angela Hendershot and teachers Hanna Mokrynychuck, Sydney Ott, and Maxine Pullar presented at the committee meeting about Health and Physical Education courses. Course overviews, credits, and units of instruction were reviewed. There will be no fiscal impact for these courses.

Mrs. Reynolds discussed including the topic of self-harm in these courses.

**K. Approval of Resource: Do The Math Intervention:** K-12 Mathematics Supervisor Brian Novick presented at the committee meeting about mathematics resource "Do The Math". This will be used for elementary Math Tier 3 intervention, and focuses on building an understanding of Number and Operations and organizes instruction into four topics: Addition & Subtraction, Multiplication, Division, and Fractions. The fiscal impact for this resource is \$90,302.73.

Mrs. Gibson spoke about this curriculum being organized by function and skill-based rather than grade-based.

#### **4. Adjournment**

**A. Adjournment:** The meeting was adjourned at 7:27 p.m.

**B. Next Scheduled Meeting:** August 6, 2026

# **K-12 Math Course of Study Updates and Approvals**

**August 2026**



# Introductions



**Brian Novick**

K-12 Mathematics Supervisor

# Goal of Presentation



- ✓ Share updated course of study documents for:
  - ✓ Elementary: Advanced Math 5
  - ✓ High School: Accelerated Algebra 1, Honors Geometry, Code and Create
- ✓ Seek approval for new course of study documents:
  - ✓ Middle School: Academic Math 6, Intervention Math 7, Intervention Math 8
  - ✓ High School: Introduction to Python, AP Cybersecurity, and Calculus 3



10-15 minutes

# Agenda



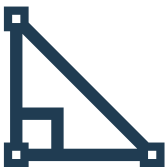
**Background**



**Elementary Courses**



**Middle School Courses**



**High School Courses**



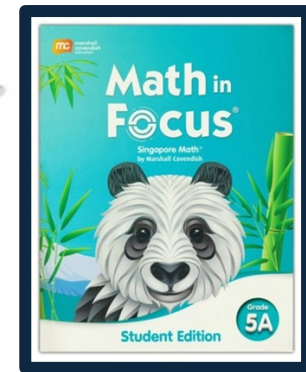
# Background

## Secondary Mathematics Sequence

|                     | 5               | 6               | 7                  | 8                     | Credit 1              | Credit 2              | Credit 3                                 | Credit 4                                 |
|---------------------|-----------------|-----------------|--------------------|-----------------------|-----------------------|-----------------------|------------------------------------------|------------------------------------------|
| Academic            | Academic Math 5 | Academic Math 6 | Academic Math 7    | Academic Math 8       | Academic Algebra 1A   | Academic Algebra 1B   | Academic Geometry                        | Academic Algebra 2<br>Applied Math       |
|                     |                 |                 |                    |                       | Accelerated Algebra 1 | Accelerated Geometry  | Accelerated Algebra 2                    | Algebra 3/Trig<br>Precalculus/Trig       |
| Accelerated         |                 |                 | Accelerated Math 7 | Accelerated Algebra 1 | Accelerated Geometry  | Accelerated Algebra 2 | Algebra 3/Trig<br>Precalculus/Trig       | Stat and Data<br>Calculus 1              |
|                     |                 |                 |                    |                       | Honors Geometry       | Honors Algebra 2      | Honors Precalculus/Trig                  | AP Calculus AB<br>AP CS<br>AP Statistics |
| Honors/<br>Advanced | Advanced Math 5 | Advanced Math 6 | Advanced Algebra 1 | Advanced Geometry     | Honors Algebra 2      | Honors Precalculus    | AP Calculus AB<br>AP CS<br>AP Statistics | AP Calculus BC<br>AP CS<br>AP Statistics |

\*This chart does not represent all the options. Please talk with your math teacher if you are interested in pursuing an alternative.

# Advanced Math 5 – Update Only



## Course Content

- Chapter 1: Whole Numbers and the Four Operations
- Chapter 2: Fractions and Mixed Numbers
- Chapter 3: Multiplying and Dividing Fractions and Mixed Numbers
- Chapter 4: Decimals
- Chapter 5: Four Operations of Decimals
- Chapter 6: Volume
- Chapter 7: Line Plots and Coordinate Plane
- Chapter 8: Polygons
- Chapter 9: Ratio
- Chapter 10: Percent
- Chapter 11: Integers and Rational Numbers

## *Course Overview*

- ❑ Challenges students through both rigorous content and an accelerated pace
- ❑ Engages students in all Grade 5 mathematical standards, selected Grade 6 standards, and ongoing enrichment experiences that deepen understanding and reasoning
- ❑ Prepares students for the expectations and demands of the district's most advanced mathematics pathway
- ❑ Includes targeted updates in pacing, fluency, core enrichment, WIN, and assessment practices

*Next Course: Advanced Math 6*



# Academic Math 6 – Seeking Approval

## Course Content

- Unit 1: Number Systems and Operations
- Unit 2: Ratios and Rate Reasoning
- Unit 3: Expressions, Equations, and Inequalities
- Unit 4: Relationships in Geometry
- Unit 5: Data Collection and Analysis
- Unit 6: Rational Number Operations



## **Course Overview**

- ☐ Replaces the existing Math 6 course
- ☐ Supports a structured transition from the elementary division to middle school expectations
- ☐ Addresses all Grade 6 mathematical standards using the *Into Math* curriculum
- ☐ Provides instruction within a double-block model with embedded small-group instruction, intervention, and enrichment
- ☐ Reflects targeted professional learning, with teachers participating in June training and receiving ongoing support throughout the year

**Next Course: Academic Math 7 or Accelerated Math 7**



# Intervention Math 7 and Intervention Math 8 – Seeking Approval

## Grade 7

Unit 1: Number Systems and Operations

Unit 2: Rational Number Operations

Unit 3a: Model with Expressions, Equations

Unit 3b: Angle Relationships and Inequalities

Unit 4: Geometry

Unit 5: Sampling and Data Analysis

Unit 6: Probability

## Grade 8

Unit 1: Transformational Geometry

Unit 2: Linear Equations and Applications

Unit 3: Relationships and Functions

Unit 4: Statistics and Probability

Unit 5: Real Numbers and Pythagorean Theorem

Unit 6: Exponents, Scientific Notation, and Volume

## *Course Overview*

- ☐ Uses Zearn as the primary instructional resource
- ☐ Aligns to Academic Math 7 and Academic Math 8 course expectations
- ☐ Supports mid-year movement based on student progress and performance
- ☐ Integrates embedded assessments, including Progress Checks, Mid-Mission Assessments, and End-of-Mission Assessments
- ☐ Emphasizes growth and productivity as the primary components of grading, with progress monitoring incorporated
- ☐ Provides built-in flexible instructional days



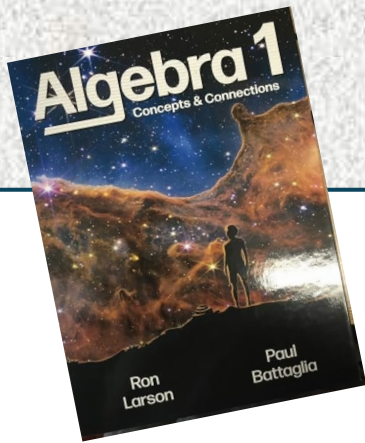




# Accelerated Algebra 1 – Update Only

## Course Content

- Chapter 1: Solving Linear Equations
- Chapter 2: Solving Linear Inequalities
- Chapter 3: Graphing Linear Functions
- Chapter 4: Writing Linear Functions
- Chapter 5: Solving Systems of Linear Equations
- Chapter 6: Exponents
- Chapter 7: Polynomial Equations and Factoring
- Chapter 9: Solving Quadratic Equations
- Chapter 11: Data Analysis and Displays
- Quadratics
- Radicals



## *Course Overview*

- ☐ Introduces a new offering at the high school
- ☐ Offers multiple pathways at the middle and high school levels
  - ☐ Advanced Algebra 1 – Algebra 1 + 7<sup>th</sup> Grade Standards
  - ☐ Accelerated Algebra 1 – Algebra 1 + 8<sup>th</sup> Grade Standards
  - ☐ Academic Algebra 1A – Algebra 1 Standards (Ch. 1-5)
  - ☐ Academic Algebra 1B – Algebra 1 Standards (Ch. 6-11)
  - ☐ **Accelerated Algebra HS – Algebra 1 Standards (Ch. 1-11)**
- ☐ Prepares students to take the Algebra 1 Keystone and the PSSA (Advanced and Accelerated)
- ☐ Includes built-in **retention** activities

*Next Course: Accelerated Geometry*





# Honors Geometry – Update Only

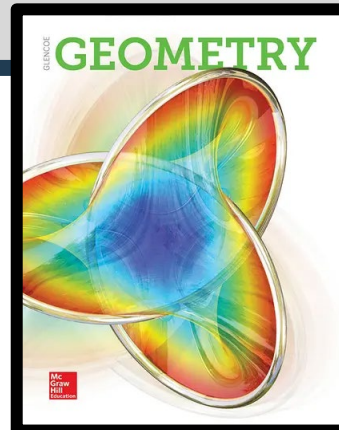
## Course Content

- Unit 1: Tools of Geometry
- Unit 2: Logical Arguments and Line Relationships
- Unit 3: Triangle Foundations and Similarity
- Unit 4: Right Triangles and Trigonometry
- Unit 5: Congruent Triangles
- Unit 6: Quadrilaterals and Polygons
- Unit 7: Circles
- Unit 8: Mixed Area, Surface Areas, and Volume

## *Course Overview*

- ❑ Updates Advanced Geometry to align with the high school schedule
- ❑ Undergoes a full rewrite in the 2026–27 school year
- ❑ Provides a rigorous, standards-aligned progression through geometric reasoning, proof, similarity, congruence, right-triangle trigonometry, polygons, circles, area, surface area, and volume, with continued emphasis on applying algebraic concepts to geometric situations

*Next Course: Honors Algebra 2*





# Code and Create – Update Only

## Course Content

- Unit 1: Getting to Know Your IDE
- Unit 2: Programming Basics
- Unit 3: Control Structures: Loops and Conditionals
- Unit 4: Smart Structures: Methods and Reuse
- Unit 5: Events and Handling

## **Course Overview**

- ☐ Renames and updates the former *Introduction to Computer Programming* course
- ☐ Offers an entry-level elective that requires no prior computer science experience
- ☐ Introduces computer science through accessible, block-based coding in an object-oriented programming environment
- ☐ Aligns with K–12 Computer Science standards



# Introduction to Python – Seeking Approval

## Course Content

- Unit 1: Introduction to Programming with Graphics
- Unit 2: Introduction to Python Basics
- Unit 3: Conditionals
- Unit 4: Loops
- Unit 5: Functions
- Unit 6: Strings
- Unit 7: Data Structures

## *Course Overview*

- ☐ Provides a new elective course in computer science
- ☐ Introduces students to the fundamentals of computer programming
- ☐ Requires no prerequisites, making computer science accessible to a broader range of students
- ☐ Develops logical thinking and problem-solving skills through designing, coding, testing, debugging, and refining Python programs
- ☐ Aligns with K–12 Computer Science standards

*Next Course: AP Computer Science A*



# AP Cybersecurity – Seeking Approval

## Course Content

- Unit 1: Introduction to Security
- Unit 2: Securing Spaces
- Unit 3: Securing Networks
- Unit 4: Securing Devices
- Unit 5: Securing Applications and Data

## *Course Overview*

- ❑ Provides a new Advanced Placement course in computer science
- ❑ Introduces students to the principles, practices, and tools used to secure digital systems
- ❑ Emphasizes applied, hands-on learning through AP Classroom labs, real-world cybersecurity scenarios, formative assessments, and project-based experiences
- ❑ Develops both technical understanding and risk-based decision-making as students analyze vulnerabilities, threats, security controls, encryption, authentication, access control, and attack detection
- ❑ Connects cybersecurity to ethical, personal, and societal issues

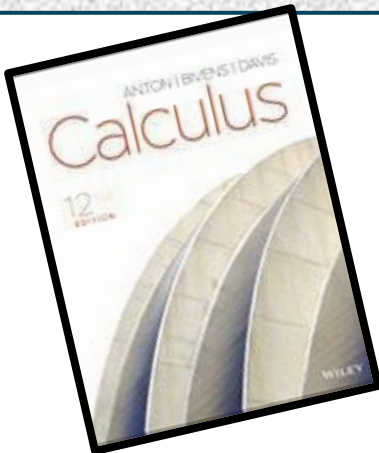
*Next Course: N/A*



# Calculus 3 – Seeking Approval

## Course Content

- Unit 1: Review of Single Variable Calculus
- Unit 2: Three-Dimensional Space
- Unit 3: Vector-Valued Functions
- Unit 4: Partial Derivatives
- Unit 5: Multiple Integrals
- Unit 6: Topics in Vector Calculus
- Unit 7: Second Order Differential Equations



## *Course Overview*

- ☐ Introduces a new course that parallels a third-semester college course
- ☐ Launches in a hybrid format in 2026–27
- ☐ Engages students in inquiry-based exploration of multivariable concepts
- ☐ Uses multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- ☐ Promotes mathematical discourse by requiring students to justify their reasoning, critique peers, and explain interpretations

*Next Course: N/A*



# Next Steps

- Seeking Approval for New Course of Study Documents
- Implementation
- Common Assessments
- Data Review



## Advanced Math 5

Course Level: Elementary

Grade: 5

Revision Date: September 2025 - August 2026

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901



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## **Central Bucks School District**

### **K-12 Mathematics Teaching and Learning Principles**

1. Investigating, problem-solving, and communicating about mathematics (speaking, reading, writing, representing, and listening) stimulates students' curiosity, builds confidence, and leads students toward deeper conceptual understanding.
2. Lessons should address students' strengths, interests, and learning styles through differentiated instruction.
3. All students can achieve excellence in mathematics when:
  - instruction is appropriately paced
  - teachers set high expectations
  - students feel supported by their teachers, parents and administrators
4. Students must be actively engaged in learning experiences designed to connect to their prior knowledge.
5. For students to transfer and use knowledge meaningfully teachers need to:
  - present new ideas within rich and meaningful contexts
  - help students to make connections to their lives both within and outside of school
6. Mathematics instruction is more effective when teachers incorporate:
  - manipulatives
  - calculators
  - technology
  - real-time data collection devices (motion detectors, temperature probes,...)
7. Assessment should be ongoing, diagnostic, and aligned with instruction.

#### Documents Considered:

(2000). Principles and Standards for School Mathematics. Reston, VA: National Council of Teachers of Mathematics.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

## **Central Bucks School District**

### **K – 12 Mathematics Program Enduring Understandings**

#### **Students will understand that:**

##### **The Nature of Mathematics**

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.

##### **Numbers and Operations**

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil using a variety of mathematically sound algorithms.
- Estimates help determine the reasonableness of an answer.
- Expressions are simplified using a predetermined order of operations.

##### **Measurement**

- Measurements collected using any tools (except for counting) are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing one linear dimension in a figure with two or three dimensions will have a different impact on the figure's perimeter, circumference, area, or volume.

##### **Geometry**

- Points, lines, and planes are the building blocks of geometry.
- Each geometric figure has a specific naming convention.
- Postulates, theorems, definitions, and properties are used to:
  - justify reasoning in a direct proof
  - establish relationships involving two and three-dimensional figures.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter and volume) are used for identification.
- The Pythagorean Theorem and trigonometric ratios are used to find missing quantities in right triangles.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.

##### **Algebraic Concepts**

- Algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems involving a constant rate of change can be modeled using proportional reasoning.
- Algebraic expressions, equations, inequalities, and functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic) are used to model relationships between quantities in real-world situations.
- Patterns and functions can be generalized and represented using; verbal models, tables, equations, and graphs.
- Systems of equations are solved both graphically and algebraically and are used to model real-life problems.

##### **Data Analysis and Probability**

- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Probability is used to make informed predictions and inferences.

## **Central Bucks School District**

### **K – 12 Mathematics Program Essential Questions**

#### **The Nature of Mathematics**

- What characteristics make mathematics a language?
- When is the correct solution not the answer to a problem?

#### **Numbers and Operations**

- How do you know that an answer is reasonable?
- Why are there different number systems?
- How do you determine when to calculate with pencil and paper, find an estimate, or use a calculator?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

#### **Measurement**

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension affect a figures length, area and volume?

#### **Geometry**

- Why do all statements need justification?
- What is the logical progression of statements in a proof?
- How are figures classified?
- How do you name a geometric figure and why are standard naming conventions important?
- Why are points, lines, and planes so important in Euclidean geometry?
- How and when is the Pythagorean Theorem used?
- What do similarity and congruency statements tell you about polygons?

#### **Algebraic Concepts**

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a pattern/function in different ways?

#### **Data Analysis and Probability**

- What is the purpose of collecting data?
- How is data used or abused?
- How do we make predictions based on probability?

Central Bucks School District  
**Course of Study Overview – Advanced Math 5**

## **Desired Results**

### Course Description:

Children come to school with a myriad of informal mathematical experiences which bear witness to their enthusiasm and curiosity in the mathematics classroom. As active learners, children continually seek to make sense of what is presented. Ultimately, they construct a personal theory about what mathematics is and what it means to do mathematics.

The teaching and learning of mathematics begins in a math rich environment. The activities, tasks, and discourse provide a framework for the development of mathematical power in all learners. Mathematical power (NCTM, 2000) is unmistakable in learners that exhibit conceptual and procedural understandings. It is evident in learners that can communicate mathematically. Mathematical power is apparent in learners who can reason logically, problem solve, and exhibit a disposition to persevere with real-life problem solving situations.

The Advanced Math 5 course is designed to appropriately challenge students through both content and pace. Students will study all Grade 5 mathematical standards, engage with select Grade 6 standards, and participate in regular enrichment experiences that deepen understanding and reasoning. This course prepares students for the expectations and demands of the district's most advanced mathematics pathway.

### Original Committee Members (August 2019):

Tricia Foster, Kathleen Bortz, Melissa Trouts, Michelle Jacobs, Michelle Decker, Jaime Lemon, Melissa Ruth, Frank Cerauli, Helene Rothman, Kathleen Ordile, Mike Lechniak, Stephanie Merson, Richard Kratz

### Updates and Textbook Review (March 2026):

Sean Kelly, Amy Jeffers, Keith Maduzia, Jon Reynard, Lynn Reigner, Mike Lechniak, Brian Novick

## **Acceptable Evidence**

### Common Summative Assessments

- There is a common summative assessment for each chapter.

### End-of-Year Test

- An end-of-year test that assesses understanding of the skills from the 5<sup>th</sup> grade curriculum is administered to all students.

## Pacing Guide

| Advanced Math 5 Pacing Guide                                                       |            |
|------------------------------------------------------------------------------------|------------|
| Course Overview                                                                    | Days       |
| Chapter 1: Whole Numbers and the Four Operations                                   | 18         |
| Chapter 2: Fractions and Mixed Numbers                                             | 17         |
| Chapter 3: Multiplying and Dividing Fractions and Mixed Numbers                    | 24         |
| Chapter 4: Decimals                                                                | 8          |
| Chapter 5: Four Operations of Decimals                                             | 21         |
| Chapter 6: Volume                                                                  | 12         |
| Chapter 7: Line Plots and Coordinate Plane                                         | 10         |
| Chapter 8: Polygons                                                                | 6          |
| Chapter 9: Ratio                                                                   | 14         |
| Chapter 10: Percent                                                                | 11         |
| Total Prior to PSSA Testing                                                        | <b>141</b> |
| Chapter 11: Integers and Rational Numbers                                          | 20         |
| Beginning of Year Activities/Review/Remediation                                    | 2          |
| Flex Days – Field Trips, Snow Days, Half Days, Assemblies, School Activities, etc. | 11         |
| PSSA Testing – 1 Day for ELA, 2 Days for Math                                      | 3          |
| EOY Test and Review                                                                | 3          |
| <b>Total Days</b>                                                                  | <b>180</b> |

## Instructional Time

| Chapter Contents                                                       | Chapter-Section       | 80 Minute Blocks/Days |
|------------------------------------------------------------------------|-----------------------|-----------------------|
| Class Building                                                         |                       | 1                     |
| Math Universal Screener                                                |                       | 1                     |
| <b>Chapter 1: Whole Numbers and the Four Operations</b>                |                       |                       |
| Chapter Opener, Recall Prior Knowledge, Quick Check                    |                       | 1 day                 |
| Numbers to 10,000,000                                                  | Chapter 1 - Section 1 | 2 days                |
| Multiplying by Tens, Hundreds, Thousands, and Powers of Ten            | Chapter 1 - Section 2 | 3 days                |
| Dividing by Tens, Hundreds, or Thousands                               | Chapter 1 - Section 3 | 2 days                |
| Multiplying and Dividing by Two-Digit Numbers Fluently                 | Chapter 1 - Section 4 | 3 days                |
| Order of Operations                                                    | Chapter 1 - Section 5 | 2 days                |
| Real-World Problems: Four Operations of Whole Numbers                  | Chapter 1 - Section 6 | 2 days                |
| Math Journal, Put on Your Thinking Cap                                 |                       | 1 day                 |
| Chapter Wrap-up, Chapter Review, Performance Task                      |                       | 1 day                 |
| Chapter Assessment                                                     |                       | 1 day                 |
| Total Days                                                             |                       | 18 days               |
| <b>Chapter 2: Fractions and Mixed Numbers</b>                          |                       |                       |
| Chapter Opener, Recall Prior Knowledge, Quick Check                    |                       | 1 day                 |
| Fractions, Mixed Numbers, and Division Expressions                     | Chapter 2 - Section 1 | 2 days                |
| Adding Unlike Fractions and Mixed Numbers                              | Chapter 2 - Section 2 | 4 days                |
| Subtracting Unlike Fractions and Mixed Numbers                         | Chapter 2 - Section 3 | 4 days                |
| Real-World Problems: Fractions and Mixed Numbers                       | Chapter 2 - Section 4 | 3 days                |
| Math Journal, Put on Your Thinking Cap                                 |                       | 1 day                 |
| Chapter Wrap-up, Chapter Review, Performance Task                      |                       | 1 day                 |
| Chapter Assessment                                                     |                       | 1 day                 |
| Total Days                                                             |                       | 17 days               |
| <b>Chapter 3: Multiplying and Dividing Fractions and Mixed Numbers</b> |                       |                       |
| Chapter Opener, Recall Prior Knowledge, Quick Check                    |                       | 1 day                 |
| Multiplying Fractions and Whole Numbers                                | Chapter 3 - Section 1 | 2 days                |
| Multiplying Proper Fractions                                           | Chapter 3 - Section 2 | 2 days                |
| Real-World Problems: Multiplying Proper Fractions                      | Chapter 3 - Section 3 | 2 days                |
| Multiplying Improper Fractions                                         | Chapter 3 - Section 4 | 2 days                |
| Multiplying Mixed Numbers and Whole Numbers                            | Chapter 3 - Section 5 | 3 days                |
| Real-World Problems: Multiplying with Mixed Numbers                    | Chapter 3 - Section 6 | 2 days                |
| Dividing Fractions and Whole Numbers                                   | Chapter 3 - Section 7 | 2 days                |
| Real-World Problems: Multiplying and Dividing with Fractions           | Chapter 3 - Section 8 | 3 days                |
| Math Journal, Put on Your Thinking Cap                                 |                       | 2 days                |
| Chapter Wrap-up, Chapter Review, Performance Task                      |                       | 2 days                |
| Chapter Assessment                                                     |                       | 1 day                 |
| Total Days                                                             |                       | 24 days               |
| <b>Chapter 4: Decimals</b>                                             |                       |                       |
| Chapter Opener, Recall Prior Knowledge, Quick Check                    |                       | 1 day                 |
| Understanding Thousandths                                              | Chapter 4 - Section 1 | 2 days                |
| Comparing, Ordering, and Rounding Decimals                             | Chapter 4 - Section 2 | 2 days                |
| Decimals, Fractions, and Mixed Numbers                                 | Chapter 4 - Section 3 | 2 days                |
| Math Journal, Put on Your Thinking Cap                                 |                       | 1 day                 |
| Chapter Wrap-up, Chapter Review, Performance Task                      |                       | 1 day                 |
| Chapter Assessment                                                     |                       | 1 day                 |
| Total Days                                                             |                       | 8 days                |
| <b>Chapter 5: Four Operations of Decimals</b>                          |                       |                       |
| Chapter Opener, Recall Prior Knowledge, Quick Check                    |                       | 1 day                 |



|                                                     |                        |         |
|-----------------------------------------------------|------------------------|---------|
| Adding Decimals                                     | Chapter 5 - Section 1  | 2 days  |
| Subtracting Decimals                                | Chapter 5 - Section 2  | 2 days  |
| Multiplying Decimals                                | Chapter 5 - Section 3  | 2 days  |
| Multiplying by Tens, Hundreds, and Thousands        | Chapter 5 - Section 4  | 3 days  |
| Dividing Decimals                                   | Chapter 5 - Section 5  | 2 days  |
| Dividing by Tens, Hundreds, and Thousands           | Chapter 5 - Section 6  | 3 days  |
| Estimating Decimals                                 | Chapter 5 - Section 7  | 3 days  |
| Converting Metric Units                             | Chapter 5 - Section 8  | 2 days  |
| Real-World Problems: Decimals                       | Chapter 5 - Section 9  | 2 days  |
| Math Journal, Put on Your Thinking Cap              |                        | 1 day   |
| Chapter Wrap-up, Chapter Review, Performance Task   |                        | 1 day   |
| Chapter Assessment                                  |                        | 1 day   |
| Total Days                                          |                        | 21 days |
| <b>Chapter 6: Volume</b>                            |                        |         |
| Chapter Opener, Recall Prior Knowledge, Quick Check |                        | 1 day   |
| Building Solids Using Unit Cubes                    | Chapter 6 - Section 1  | 1 day   |
| Understanding and Measuring Volume                  | Chapter 6 - Section 2  | 3 days  |
| Real-World Problems: Volume of Rectangular Prisms   | Chapter 6 - Section 3  | 3 days  |
| Real-World Problems: Volume of Composite Solids     | Chapter 6 - Section 4  | 2 days  |
| Math Journal, Put on Your Thinking Cap              |                        | 1 day   |
| Chapter Wrap-up, Chapter Review, Performance Task   |                        | 1 day   |
| Chapter Assessment                                  |                        | 1 day   |
| Total Days                                          |                        | 12 days |
| <b>Chapter 7: Line Plots and Coordinate Plane</b>   |                        |         |
| Chapter Opener, Recall Prior Knowledge, Quick Check |                        | 1 day   |
| Making and Interpreting Line Plots                  | Chapter 7 - Section 1  | 2 days  |
| Graphing on a Coordinate Plane                      | Chapter 7 - Section 2  | 3 days  |
| Number Patterns and Graphs                          | Chapter 7 - Section 3  | 2 days  |
| Math Journal, Put on Your Thinking Cap              |                        | 1 day   |
| Chapter Wrap-up, Chapter Review, Performance Task   |                        | 1 day   |
| Chapter Assessment                                  |                        | 1 day   |
| Total Days                                          |                        | 10 days |
| <b>Chapter 8: Polygons</b>                          |                        |         |
| Chapter Opener, Recall Prior Knowledge, Quick Check |                        | 1 day   |
| Classifying Triangles                               | Chapter 8 - Section 1  | 1 day   |
| Classifying Polygons                                | Chapter 8 - Section 2  | 1 day   |
| Math Journal, Put on Your Thinking Cap              |                        | 1 day   |
| Chapter Wrap-up, Chapter Review, Performance Task   |                        | 1 day   |
| Chapter Assessment                                  |                        | 1 day   |
| Total Days                                          |                        | 6 days  |
| <b>Chapter 9: Ratio</b>                             |                        |         |
| Chapter Opener, Recall Prior Knowledge, Quick Check |                        | 1 day   |
| Finding Ratio                                       | Chapter 9 - Section 1  | 3 days  |
| Equivalent Ratios                                   | Chapter 9 - Section 2  | 2 days  |
| Comparing Three Quantities                          | Chapter 9 - Section 3  | 2 days  |
| Real-World Problems: Ratio                          | Chapter 9 - Section 4  | 3 days  |
| Math Journal, Put on Your Thinking Cap              |                        | 1 day   |
| Chapter Wrap-up, Chapter Review, Performance Task   |                        | 1 day   |
| Chapter Assessment                                  |                        | 1 day   |
| Total Days                                          |                        | 14 days |
| <b>Chapter 10: Percent</b>                          |                        |         |
| Chapter Opener, Recall Prior Knowledge, Quick Check |                        | 1 day   |
| Percent                                             | Chapter 10 - Section 1 | 1 day   |
| Fractions, Decimals, and Percent                    | Chapter 10 - Section 2 | 3 days  |
| Percent of a Quantity                               | Chapter 10 - Section 3 | 1 day   |
| Real-World Problems: Percent                        | Chapter 10 - Section 4 | 2 days  |

|                                                   |                       |         |
|---------------------------------------------------|-----------------------|---------|
| Math Journal, Put on Your Thinking Cap            |                       | 1 day   |
| Chapter Wrap-up, Chapter Review, Performance Task |                       | 1 day   |
| Chapter Assessment                                |                       | 1 day   |
| Total Days                                        |                       | 11 days |
| <b>Chapter 11: Integers and Rational Numbers</b>  |                       |         |
| Words and Expressions                             | Chapter 1 – Section 2 | 1 day   |
| Integers and Absolute Value                       | Chapter 2 – Section 1 | 1 day   |
| Adding Integers                                   | Chapter 2 – Section 2 | 2 days  |
| Subtracting Integers                              | Chapter 2– Section 3  | 2 days  |
| Multiplying Integers                              | Chapter 2– Section 4  | 2 days  |
| Dividing Integers                                 | Chapter 2– Section 5  | 2 days  |
| Formative Assessment                              |                       | 1 day   |
| Rational Numbers                                  | Chapter 3– Section 2  | 1 day   |
| Multiplying Rational Numbers                      | Chapter 3– Section 3  | 2 days  |
| Dividing Rational Numbers                         | Chapter 3– Section 4  | 2 days  |
| Adding and Subtracting Like Fractions             | Chapter 3– Section 5  | 1 day   |
| Adding and Subtracting Unlike Fractions           | Chapter 3– Section 6  | 1 day   |
| Chapter Wrap-up, Chapter Review                   |                       | 1 day   |
| Chapter Assessment                                |                       | 1 day   |
| Total Days                                        |                       | 20 days |
|                                                   |                       |         |
| STEAM Projects                                    | Chapter               |         |
| National Park Service                             | 1                     |         |
| School Carnival                                   | 2                     |         |
| Work for Cause                                    | 4                     |         |
| Op Art                                            | 6                     |         |
| Cubism                                            | 8                     |         |
| MPG                                               | 9                     |         |

## Required and Supplementary Texts/Software

### Required Texts/Software:

Kheong, F.J., Ramakrishnan, C., Choo, M., (2020) *Math in Focus: Singapore Math, Student Edition*. Singapore: Houghton Mifflin Harcourt. ISBN: 978-0-358-10306-6

### Supplementary Texts/Software:

Fact Fluency ISBN: 978-0-358-10518-3

Glencoe Math Accelerated: A Pre-Algebra Program - John Carter, Gilbert Cuevas, Roger Day, Carol Malloy - Glencoe/McGraw-Hill, 2017  
ISBN: 978-0-07-672118-4 (Student Edition)

## Chapter 1: Whole Numbers and the Four Operations

### Desired Results

#### Essential Questions:

- When do we use 7-digit numbers in real world situations?
- Why are the four operations of whole numbers important in everyday life?

#### Enduring Understandings:

##### *Students will understand that...*

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Estimates help determine the reasonableness of an answer.
- Numbers are classified and compared within our number system.
- Expressions are simplified using a predetermined order of operations.
- Mathematics is used to make informed decisions about problems in everyday life.

#### Knowledge:

##### *Students will know the definitions for...*

- Standard form
- Word form
- Expanded form

#### Skills:

##### *Students will be able to...*

|                                                       |                                                                                                             |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 1.1                                                   | Read and write numbers to 10,000,000 in expanded form, standard form, and word form.                        |
| 1.2                                                   | Use patterns to multiply numbers by 10, 100 or 1,000.<br>Use multiples or powers of 10 to multiply.         |
| 1.3                                                   | Use patterns to divide numbers by 10, 100 or 1,000.<br>Use multiples of 10, 100 or 1,000 to divide.         |
| 1.4                                                   | Divide by a 2-digit number fluently.<br>Multiply by a 2-digit number fluently.                              |
| 1.5                                                   | Use order of operations to evaluate a numeric expression.<br>Evaluate numeric expressions with parentheses. |
| 1.6                                                   | Use different strategies to solve multi-step problems.                                                      |
| Math<br>Journal,<br>Put on<br>Your<br>Thinking<br>Cap | Solving part of the problem<br>Restate the problem<br>Make a list<br>Guess and check                        |

### PA Core Standards

**CC.2.1.5.B.1** Apply place-value concepts to show an understanding of operations and rounding as they pertain to whole numbers and decimals.

**CC.2.1.5.B.2** Extend an understanding of operations with whole numbers to perform operations including decimals.

**CC.2.2.5.A.1** Interpret and evaluate numerical expressions using order of operations.

### Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

### Acceptable evidence of learning other than Performance Tasks:

#### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review
- Calendar

#### Summative

- Quizzes
- Chapter Assessment

### Suggested learning experiences and instruction

| Sections | Activities                                                                    |
|----------|-------------------------------------------------------------------------------|
| 1        | Students use place value chips to show numbers in expanded form.              |
| 2        | Hands on Activity: Multiplying by a 100 and 1,000                             |
| 3        | Hands on Activities: Dividing by 10, Dividing Numbers by 100 and 1,000        |
| 4        | Students use place value chips to explore solving multi-digit multiplication. |
| 5        | Hands on Activity: Using Order of Operations                                  |
| 6        | Students will draw bar models to solve problems.                              |

### Cross Curricular Connections

**Reading/Language Arts:** Have volunteers read *The Great Rumble: A Story of Math in Surprising Places* by Cora Lee and Gillian O’Reilly (Annick Press, © 2007), which presents a myriad of ways math affects us in our everyday lives. Have students share ways they use multiplication and division in their everyday lives.

**Science:** Elephants eat about 300 pounds of food daily. Elephants spend at least 16 hours per day eating. Have students make a table showing how much food elephants eat each day, week, month, and year. Then, have them do the same for the number of hours elephants spend eating during each time period.

### **Differentiation Options**

| Sections | Reteaching | Extra Practice | Enrichment | ELL Support |
|----------|------------|----------------|------------|-------------|
| 1.1      | X          | X              | X          | X           |
| 1.2      | X          | X              | X          | X           |
| 1.3      | X          | X              | X          | X           |
| 1.4      | X          | X              | X          | X           |
| 1.5      | X          | X              | X          | X           |
| 1.6      | X          | X              | X          | X           |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| Sections | Enrichment                                                                                                                                                                                                 |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.1      | Use Enrichment Activity 1 – application questions incorporating place value to ten thousands place                                                                                                         |
| 1.2      | Use Enrichment Activity 2 – students complete puzzle using answers from more complex multiplication problems including factors with exponents                                                              |
| 1.3      | Use Enrichment Activity 3 – students complete puzzle using answers from division problems                                                                                                                  |
| 1.4      | Use Enrichment Activity 4 – students solve multiplication and division problems including more complex problem involving division where students need to use a non-routine approach to answer the question |
| 1.5      | Use Enrichment Activity 5 – students solve a variety of order of operation questions                                                                                                                       |
| 1.6      | Use Enrichment Activity 6 – students solve questions using any operation                                                                                                                                   |

Central Bucks School District – Course of Study  
**Chapter 2: Fractions and Mixed Numbers**

**Desired Results**

Essential Questions:

- How are fractions and division related?
- How is adding and subtracting unlike fractions and mixed numbers similar to adding and subtracting like fractions?

Enduring Understandings:

*Students will understand that...*

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Estimates help determine the reasonableness of an answer.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations.
- Mathematics is used to make informed decisions about problems in everyday life.

Knowledge:

*Students will know the definitions for...*

- Simplest form
- Division expression
- Numerator
- Denominator
- Mixed number
- Like fraction
- Unlike fraction

Skills:

*Students will be able to...*

|                                        |                                                                                                                                                                                                            |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1                                    | Understand and apply the relationships among fractions, mixed numbers and division expressions.                                                                                                            |
| 2.2                                    | Add two unlike fractions where one denominator may or may not be a multiple of the other.<br>Estimate sums of fractions and mixed numbers.<br>Add mixed numbers with or without renaming.                  |
| 2.3                                    | Subtract two unlike fractions where one denominator may or may not be a multiple of the other.<br>Estimate differences of fractions and mixed numbers.<br>Subtract mixed numbers with or without renaming. |
| 2.4                                    | Solve real-world problems involving fractions and mixed numbers.                                                                                                                                           |
| Math Journal, Put on Your Thinking Cap | Guess and check<br>Draw a diagram                                                                                                                                                                          |

### PA Core Standards

**CC.2.1.5.C.1** Use the understanding of equivalency to add and subtract fractions.

**CC.2.4.5.A.4** Solve problems involving computation of fractions using information provided in a line plot.

### Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

**Acceptable evidence of learning other than Performance Tasks:**

#### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

#### Summative

- Quizzes
- Chapter Assessment

### Suggested learning experiences and instruction

| Sections | Activities                                                                                                           |
|----------|----------------------------------------------------------------------------------------------------------------------|
| 1        | Hands-on Activities: Dividing a Whole Number by a 1-digit whole number, Using models to relate fractions to division |
| 2        | Hands on Activity: Using a common denominator to add unlike fractions                                                |
| 3        | Using fractions bars or circles to subtract unlike fractions                                                         |
| 4        | Hands on Activity: Solving Real-World Problems                                                                       |

### Cross Curricular Connections

**Reading/Language Arts:** Have students create one-step word problems on index cards involving any of the following: Division expressions that can be written as fractions or mixed numbers, and vice versa. Addition or subtraction of mixed numbers, or a whole number with a mixed number. Have students write the work and answer on the other side of their partners’ index cards. Use these cards to assess students at the start of sections or for revisions.

**Art:** Using the index cards with one-step word problems created by students, have the same or another student draw and illustrate the problem on the same or separate index card. If the problem and the illustration are on separate cards, students can play a matching game to match the problem with the illustration card.

### **Differentiation Options**

| <b>Sections</b> | <b>Reteaching</b> | <b>Extra Practice</b> | <b>Enrichment</b> | <b>ELL Support</b> |
|-----------------|-------------------|-----------------------|-------------------|--------------------|
| 2.1             | X                 | X                     | X                 | X                  |
| 2.2             | X                 | X                     | X                 | X                  |
| 2.3             | X                 | X                     | X                 | X                  |
| 2.4             | X                 | X                     | X                 | X                  |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                                                                           |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1             | Use Enrichment Activity 1 - Students find the sum of fractions, convert between fractions and decimals, and learn about fractions with a denominator 9.     |
| 2.2             | Use Enrichment Activity 2 - Students solve more complex application problems involving addition of fractions with unlike denominators.                      |
| 2.3             | Use Enrichment Activity 3 - Students solve more complex problems involving subtraction of fractions with unlike denominators.                               |
| 2.4             | Use Enrichment Activity 4 - Students complete a series of open ended problems incorporating addition and subtraction of fractions with unlike denominators. |



Central Bucks School District – Course of Study  
**Chapter 3: Multiplying and Dividing Fractions and Mixed Numbers**

**Desired Results**

Essential Questions:

- How do we multiply and divide fractions, mixed numbers, and whole numbers?
- How do the factors affect the product if one of the factors is a fraction?

Enduring Understandings:

*Students will understand that...*

- There are multiple representations for any number.
  - Numbers are classified and compared within our number system.
  - Estimates help determine the reasonableness of an answer.
  - Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations
- Mathematics is used to make informed decisions about problems in everyday life.

Knowledge:

*Students will know the definitions for...*

- Reciprocal
- Simplify
- Factor
- Proper fraction
- Improper fraction
- Mixed Number

Skills:

*Students will be able to...*

|     |                                                                                                                                        |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|
| 3.1 | Multiply proper fractions by whole numbers.<br>Multiply improper fractions by whole numbers.                                           |
| 3.2 | Multiply proper fractions.                                                                                                             |
| 3.3 | Solve real-world problems involving multiplication of proper fractions.                                                                |
| 3.4 | Multiply improper fractions by proper fractions.<br>Multiply improper fractions by improper fractions.                                 |
| 3.5 | Multiply a mixed number by a whole number.<br>Multiply two mixed numbers.<br>Compare the size of a product to the size of its factors. |
| 3.6 | Solve real-world problems involving multiplication of whole numbers and mixed numbers.                                                 |
| 3.7 | Divide a unit fraction by a whole number.<br>Divide a proper fraction by a whole number.<br>Divide a whole number by a unit fraction.  |

|                                        |                                                                                                           |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 3.8                                    | Solve real-world problems involving whole numbers, fractions, and mixed numbers, and the four operations. |
| Math Journal, Put on Your Thinking Cap | Look for patterns<br>Guess and check<br>Draw a diagram                                                    |

#### PA Core Standards

**CC.2.1.5.C.2** Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

#### Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

#### Acceptable evidence of learning other than Performance Tasks:

##### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

##### Summative

- Quizzes
- Chapter Assessment

#### Suggested learning experiences and instruction

| Sections | Activities                                                                                                                                  |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Hands-on Activity: Relating fractions of a set to multiplication                                                                            |
| 2        | Hands on Activity: Modeling the commutative law using fractions                                                                             |
| 3        | Using fraction circles and bar models to help us represent and solve real-world problems                                                    |
| 4        | Using paper strips to multiply fractions                                                                                                    |
| 5        | Hands on Activity: Multiplying fractions and comparing the product with its factors                                                         |
| 6        | Using bar models to solve problems                                                                                                          |
| 7        | Hands-on Activities: Relating division of a unit fraction by a whole number to multiplication, Dividing a proper fraction by a whole number |
| 8        | Hand-on Activity: Creating word problems                                                                                                    |

#### Cross Curricular Connections

**Drama:** Have students write a short skit in which one character is teaching another to multiply or divide fractions. Encourage students to make their skits humorous by writing them in genres such as science fiction or fantasy. Have pairs perform their skits.

### **Differentiation Options**

| <b>Sections</b> | <b>Reteaching</b> | <b>Extra Practice</b> | <b>Enrichment</b> | <b>ELL Support</b> |
|-----------------|-------------------|-----------------------|-------------------|--------------------|
| 3.1             | X                 | X                     | X                 | X                  |
| 3.2             | X                 | X                     | X                 | X                  |
| 3.3             | X                 | X                     | X                 | X                  |
| 3.4             | X                 | X                     | X                 | X                  |
| 3.5             | X                 | X                     | X                 | X                  |
| 3.6             | X                 | X                     | X                 | X                  |
| 3.7             | X                 | X                     | X                 | X                  |
| 3.8             | X                 | X                     | X                 | X                  |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.1             | Use Enrichment Activity 1 - Students solve multiplication problems with fractions including application questions.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 3.2             | Use Enrichment Activity 2 - Students solve problems involving fractions and make connections to geometric figures.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 3.3             | Use Enrichment Activity 3 - Students solve more complex problems involving fractions with complex language to make students think carefully. Example: Ian gave his father $\frac{1}{5}$ of his cash prize in a competition. He then gave $\frac{1}{4}$ of the remainder to his mother and $\frac{1}{8}$ of the remainder to his sister. He then had \$250 left. How much money did Ian win? (focus in on the importance of the word remainder, what it means in this problem, and how it impacts what fraction is used in the calculation) |
| 3.4             | Use Enrichment Activity 4 - Students complete a series of multiplication problems involving multiple steps.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 3.5             | Use Enrichment Activity 5 - Students complete problem solving questions involving mixed numbers and whole numbers.                                                                                                                                                                                                                                                                                                                                                                                                                         |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.6 | Use Enrichment Activity 6 - Students solve open ended problems with complex language to make students think carefully. Ex. A chef ordered some cooking oil for his restaurant. He uses the same amount of oil each day. He had $\frac{3}{5}$ of the cooking oil left after 6 days. $4\frac{2}{3}$ liters of cooking oil were left after another 5 days. How many liters of cooking oil did the chef order? (emphasize words like “left” in the problem) |
| 3.7 | Use Enrichment Activity 7 - Students solve division of fraction and whole number problems.                                                                                                                                                                                                                                                                                                                                                              |
| 3.8 | Use Enrichment Activity 8 - Students complete a series of open ended problems incorporating multiplication and division with fractions.                                                                                                                                                                                                                                                                                                                 |

Central Bucks School District – Course of Study  
**Chapter 4: Decimals**

**Desired Results**

Essential Questions:

- What is the value of the second decimal place?
- What will be the value of the third decimal place?

Enduring Understandings:

*Students will understand that...*

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.
- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Estimates help determine the reasonableness of an answer.
- Numbers are classified and compared within our number system.

Knowledge:

*Students will know the definitions for...*

- Thousandths
- hundredths

Skills:

*Students will be able to...*

|                                              |                                                                                             |
|----------------------------------------------|---------------------------------------------------------------------------------------------|
| 4.1                                          | Read and write thousandths in decimal and fractional form.                                  |
| 4.2                                          | Compare and order decimals to 3 decimal places.<br>Round decimals to the nearest hundredth. |
| 4.3                                          | Rewrite three-place decimals as fractions or mixed numbers in their simplest form.          |
| Math Journal,<br>Put on Your<br>Thinking Cap | Make a list<br>Solve part of the problem                                                    |

**PA Core Standards**

**CC.2.1.5.B.1** Apply place-value concepts to show an understanding of operations and rounding as they pertain to whole numbers and decimals.  
**CC.2.1.5.B.2** Extend an understanding of operations with whole numbers to perform operations including decimals.

**Acceptable Evidence**

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

**Acceptable evidence of learning other than Performance Tasks:**

### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

### Summative

- Quizzes
- Chapter Assessment

### **Suggested learning experiences and instruction**

| Sections | Activities                                                                                                                                                          |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Hands-on Activity: Expressing thousandths as decimals                                                                                                               |
| 2        | Hands on Activity: Comparing decimals using place-value chips and number lines<br>Hands-on Activity: Use place value chips to describe, compare, and order decimals |
| 3        | Game: Decimal Snap                                                                                                                                                  |

### **Cross Curricular Connections**

**Reading/Language Arts:** Have students use a  $15 \times 15$  grid to create word-find puzzle for the decimal terms in this chapter. To make their puzzles, students write one letter in each square, crossing words that share common letters. After all the terms are filled in, students fill in the empty squares with other random letters. Have students exchange and solve one another’s puzzles.

**Science:** The speed of sound is about 767.58 miles per hour. Have students research vehicles that have traveled faster than the speed of sound, such as airplanes, rockets, and even cars. Have students present their reports to the class. Encourage them to include visuals with their reports.

### **Differentiation Options**

| Sections | Reteaching | Extra Practice | Enrichment | ELL Support |
|----------|------------|----------------|------------|-------------|
| 4.1      | X          | X              | X          | X           |
| 4.2      | X          | X              | X          | X           |
| 4.3      | X          | X              | X          | X           |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.

- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

#### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                                                                                                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1             | Use Enrichment Activity 1 – This activity requires students to clearly express understanding of place value to the thousandths place through representing numbers using a variety of expanded forms for the same number. There is also practice of addition of decimals in a non-routine way. |
| 4.2             | Use Enrichment Activity 2 – Practice involving comparing and rounding numbers.                                                                                                                                                                                                                |
| 4.3             | Use Enrichment Activity 3 – Students look for patterns while representing fractions as decimals.                                                                                                                                                                                              |

Central Bucks School District – Course of Study  
**Chapter 5: Four Operations of Decimals**

**Desired Results**

Essential Questions:

- How can decimals be added, subtracted, multiplied, and divided?

Enduring Understandings:

*Students will understand that...*

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Estimates help determine the reasonableness of an answer.
- Numbers are classified and compared within our number system.
- Mathematics is used to make informed decisions about problems in everyday life.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.
- Mathematics is a language of carefully defined terms and symbols.

Knowledge:

*Students will know the definitions for...*

- Rounding
- Conversions

Skills:

*Students will be able to...*

|                                        |                                                                                                                                                             |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.1                                    | Add decimals without regrouping.<br>Add decimals with regrouping.                                                                                           |
| 5.2                                    | Subtract decimals without regrouping.<br>Subtract decimals with regrouping.                                                                                 |
| 5.3                                    | Multiply decimals up to 2 decimal places by 1-digit whole numbers.                                                                                          |
| 5.4                                    | Multiply decimals up to 3 decimal places by 10, 100, 1000 and their multiples.<br>Multiply decimals up to 3 decimal places by powers of 10.                 |
| 5.5                                    | Divide decimals up to 2 decimal places by 1-digit whole numbers.<br>Round quotients to the nearest tenth (1 decimal place) or hundredth (2 decimal places). |
| 5.6                                    | Divide decimals up to 2 decimal places by 10, 100, 1000 and their multiples.                                                                                |
| 5.7                                    | Estimate decimal sums, differences, products, and quotients.                                                                                                |
| 5.8                                    | Convert from a larger metric unit to a smaller unit.<br>Convert from a smaller metric unit to a larger unit.                                                |
| 5.9                                    | Solve word problems involving decimals.                                                                                                                     |
| Math Journal, Put on Your Thinking Cap | Solve part of the problem<br>Guess and check<br>Work backwards<br>Look for patterns                                                                         |



### PA Core Standards

**CC.2.1.5.B.1** Apply place-value concepts to show an understanding of operations and rounding as they pertain to whole numbers and decimals.

**CC.2.1.5.B.2** Extend an understanding of operations with whole numbers to perform operations including decimals.

### Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

**Acceptable evidence of learning other than Performance Tasks:**

#### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

#### Summative

- Quizzes
- Chapter Assessment

### Suggested learning experiences and instruction

| Sections | Activities                                                               |
|----------|--------------------------------------------------------------------------|
| 1        | Hands-on Activity: Adding Decimals                                       |
| 2        | Hands on Activity: Subtracting Decimals                                  |
| 3        | Using place value chips to explore ways to multiply decimals             |
| 4        | Hands- on Activity: Multiplying decimals by 10                           |
| 5        | Hands- on Activity: Dividing decimals                                    |
| 6        | Hands-on Activity: Dividing decimals by 10                               |
| 7        | Using place value chips to estimate adding and multiplying with decimals |
| 8        | Using connecting cubes to solve conversion problems                      |
| 9        | Creating real-world problems                                             |

### Cross Curricular Connections

**Reading/Language Arts:** Encourage partners to work together to write a hands-on activity, looking to the Student Edition for examples. Encourage students to make an activity that consolidates what they are learning and applies skills to the real world. Provide starting points for students, such as: measuring items, different units of measure, and dividing decimals by a whole number. Have pairs exchange and complete each other’s activity.

### Differentiation Options

| Sections | Reteaching | Extra Practice | Enrichment | ELL Support |
|----------|------------|----------------|------------|-------------|
| 5.1      | X          | X              | X          | X           |
| 5.2      | X          | X              | X          | X           |
| 5.3      | X          | X              | X          | X           |
| 5.4      | X          | X              | X          | X           |
| 5.5      | X          | X              | X          | X           |
| 5.6      | X          | X              | X          | X           |
| 5.7      | X          | X              | X          | X           |
| 5.8      | X          | X              | X          | X           |
| 5.9      | X          | X              | X          | X           |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| Sections | Enrichment                                                                                                                                      |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.1      | Use Enrichment Activity 1 – Students work on complex addition of decimal problems including critical thinking questions.                        |
| 5.2      | Use Enrichment Activity 2 – Students work on complex subtraction of decimal problems including critical thinking questions.                     |
| 5.3      | Use Enrichment Activity 3 – Students work on complex multiplication of decimal problems including critical thinking questions.                  |
| 5.4      | Use Enrichment Activity 4 – Students work on complex multiplication of decimal problems including powers of 10.                                 |
| 5.5      | Use Enrichment Activity 5 – Students work on complex division of decimal problems including critical thinking questions.                        |
| 5.6      | Use Enrichment Activity 6 – Students work on complex division of decimal problems including problems dividing by tens, hundreds, and thousands. |
| 5.7      | Use Enrichment Activity 7 – Students work on estimation problems and use estimation while solving an open ended problem.                        |
| 5.8      | Use Enrichment Activity 8 – Students solve a variety of conversion questions between metric units.                                              |
| 5.9      | Use Enrichment Activity 9 – Students solve a variety of application problems that involve all operations.                                       |

Central Bucks School District – Course of Study  
**Chapter 6: Volume**

**Desired Results**

Essential Questions:

- How can you measure the amount of space in a box or container?
- What units can we use?

Enduring Understandings:

*Students will understand that...*

- Estimates help determine the reasonableness of an answer.
- Mathematics is used to make informed decisions about problems in everyday life.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter and volume) are used for identification.
- Logical thinking and critical reasoning skills are important aspects of problem solving.

Knowledge:

*Students will know the definitions for...*

- Unit cube
- Congruent
- Edge
- Composite Solid

Skills:

*Students will be able to...*

|                                        |                                                                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.1                                    | Use unit cubes to build solids.<br>Determine the number of unit cubes in an irregular solid.<br>Recognize that the volume of a solid is the amount of space it occupies. |
| 6.2                                    | Find the volume of a solid made of unit cubes.<br>Find the volume of cubes and rectangular prisms.                                                                       |
| 6.3                                    | Use a formula to find the volume of a rectangular prism.<br>Find the capacity of a rectangular container.<br>Solve word problems of rectangular prisms and liquids.      |
| 6.4                                    | Find the volume of a solid figure composed of two rectangular prisms.<br>Solve real-world problems on the volume of a composite solid.                                   |
| Math Journal, Put on Your Thinking Cap | Make a list<br>Look for patterns<br>Solve part of the problem<br>Simplify the problem                                                                                    |

**PA Core Standards**

**CC.2.1.5.B.2** Extend an understanding of operations with whole numbers to perform operations including decimals.

### PA Core Standards

**CC.2.1.5.C.2** Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

**CC.2.4.5.A.5** Apply concepts of volume to solve problems and relate volume to multiplication and to addition.

### Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

**Acceptable evidence of learning other than Performance Tasks:**

#### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

#### Summative

- Quizzes
- Chapter Assessment

### Suggested learning experiences and instruction

| Sections | Activities                                                                                                                                                                                        |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Hands-on Activity: Using unit cubes to build different solids                                                                                                                                     |
| 2        | Hands on Activity: Discovering that different solids can have the same volume<br>Hands-on Activity: Building prisms layer by layer to establish the formula for the volume of a rectangular prism |
| 3        | Connecting cubes to make rectangular prisms to find dimensions related to volume                                                                                                                  |
| 4        | Finding the volume of composite solids                                                                                                                                                            |

### Cross Curricular Connections

**Science:** Provide students with this formula:  $\text{Density} = \text{mass} / \text{volume}$ . Have students make a three-column chart with the labels “Mass,” “Volume,” and “Density.” Ask student to work in pairs or small groups to calculate the volume and measure the mass of a variety of rectangular prisms, such as books, gift boxes, cereal boxes, and so on...Have them record the measurements on the chart and calculate the densities.

**Reading/Language Arts:** Give students these writing prompts: What are the similarities and differences between a cube and a rectangular prism? How do you find the volume of a cube or a rectangular solid? How is finding the volume of a cube and rectangular solid the same? Ask students to write a journal entry to answer a question of their choice.

### **Differentiation Options**

| <b>Sections</b> | <b>Reteaching</b> | <b>Extra Practice</b> | <b>Enrichment</b> | <b>ELL Support</b> |
|-----------------|-------------------|-----------------------|-------------------|--------------------|
| 6.1             | X                 | X                     | X                 | X                  |
| 6.2             | X                 | X                     | X                 | X                  |
| 6.3             | X                 | X                     | X                 | X                  |
| 6.4             | X                 | X                     | X                 | X                  |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                                       |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|
| 6.1             | Use Enrichment Activity 1 - Students work on complex problems as they build solids using unit cubes.                    |
| 6.2             | Use Enrichment Activity 2 - Students work on complex problems while understanding and measuring volume.                 |
| 6.3             | Use Enrichment Activity 3 - Students solve a variety of application problems that involve volume of rectangular prisms. |
| 6.4             | Use Enrichment Activity 4 - Students solve a variety of application problems that involve volume of composite solids.   |

Central Bucks School District – Course of Study  
**Chapter 7: Line Plots and Coordinate Plane**

**Desired Results**

Essential Questions:

- How can we represent data in line plots?
- How can you describe a point on a coordinate plane?
- How can you use the coordinate plane to show number patterns?

Enduring Understandings:

*Students will understand that...*

- Mathematics is used to make informed decisions about problems in everyday life.
- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Patterns and functions can be generalized and represented using; verbal models, tables, equations, and graphs.

Knowledge:

*Students will know the definitions for...*

Coordinate plane  
x-axis  
y-axis  
coordinates  
ordered pair  
origin  
x-coordinate  
y-coordinate  
term

Skills:

*Students will be able to...*

|                                        |                                                                                                                         |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 7.1                                    | Make and interpret line plots with fractional data.<br>Use fractions and their operations to solve problems using data. |
| 7.2                                    | Read points on a coordinate plane.<br>Plot points on a coordinate plane.<br>Use ordered pairs to draw line graphs.      |
| 7.3                                    | Identify and extend number patterns.<br>Identify the relationship between two sets of numbers.                          |
| Math Journal, Put on Your Thinking Cap | Look for patterns<br>Act it out                                                                                         |

### PA Core Standards

**CC.2.2.5.A.4** Analyze patterns and relationships using two rules.

**CC.2.3.5.A.1** Graph points in the first quadrant on the coordinate plane and interpret these points when solving real world and mathematical problems.

**CC.2.4.5.A.2** Represent and interpret data using appropriate scale.

**CC.2.4.5.A.4** Solve problems involving computation of fractions using information provided in a line plot.

### Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

### Acceptable evidence of learning other than Performance Tasks:

#### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

#### Summative

- Quizzes
- Chapter Assessment

### Suggested learning experiences and instruction

| Sections | Activities                                                                              |
|----------|-----------------------------------------------------------------------------------------|
| 1        | Collect data and display it in a meaningful way                                         |
| 2        | Game: Battleship Wars                                                                   |
| 3        | Identifying relationships between numbers and identifying and extending number patterns |

### Cross Curricular Connections

**Science:** Have students work in pairs to research the high and low temperatures in their area for one week. Have one partner create the line graph showing the data for the high temperatures, and the other create a line graph for the low temperatures. Have students discuss their graph.

**Reading/Language Arts:** Have students work in groups to complete this activity. Create a survey questionnaire and survey ten students. Choose one question from the survey and create a table. Then make a line plot to represent the data.

**Social Studies:** Relate the coordinates in a coordinate plane to latitude and longitude. Students can research online to identify the latitude and longitude of their city or town. Suggest that interested

students research how a global positioning system uses these coordinates report their findings to the class.

### **Differentiation Options**

| <b>Sections</b> | <b>Reteaching</b> | <b>Extra Practice</b> | <b>Enrichment</b> | <b>ELL Support</b> |
|-----------------|-------------------|-----------------------|-------------------|--------------------|
| 7.1             | X                 | X                     | X                 | X                  |
| 7.2             | X                 | X                     | X                 | X                  |
| 7.3             | X                 | X                     | X                 | X                  |

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                                     |
|-----------------|-----------------------------------------------------------------------------------------------------------------------|
| 7.1             | Use Enrichment Activity 1 - Students work on complex problems involving making and interpreting line plots.           |
| 7.2             | Use Enrichment Activity 2 - Students work on complex problems involving graphing on a coordinate plane.               |
| 7.3             | Use Enrichment Activity 3 - Students solve a variety of application problems that involve number patterns and graphs. |



Central Bucks School District – Course of Study  
**Chapter 8: Polygons**

**Desired Results**

Essential Questions:

- What properties can we use to identify triangles?
- How can we classify polygons using a hierarchy?

Enduring Understandings:

*Students will understand that...*

- Each geometric figure has a specific naming convention.

Knowledge:

*Students will know the definitions for...*

Equilateral triangle  
Isosceles triangle  
Scalene triangle  
Regular polygon  
Kite  
Heptagon  
Octagon  
Nonagon  
Decagon

Skills:

*Students will be able to...*

|                                        |                                                                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 8.1                                    | Identify right, isosceles, scalene, and equilateral triangles.<br>Classify triangles by their side lengths and angle measures. |
| 8.2                                    | Classify polygons using a hierarchy.                                                                                           |
| Math Journal, Put on Your Thinking Cap | Make a list<br>Simplify the problem                                                                                            |

**PA Core Standards**

**CC.2.3.5.A.2** Classify two-dimensional figures into categories based on an understanding of their properties.

**Acceptable Evidence**

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

**Acceptable evidence of learning other than Performance Tasks:**

### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

### Summative

- Quizzes
- Chapter Assessment

### **Suggested learning experiences and instruction**

| Sections | Activities                                                  |
|----------|-------------------------------------------------------------|
| 1        | Exploring the angles in different kinds of triangles.       |
| 2        | Comparing similarities and differences between two figures. |

### Cross Curricular Connections

**Reading/Language Arts:** Have students work in pairs. Each student draws a figure (isosceles or equilateral triangle, rhombus, parallelogram, or trapezoid) on the sheet of paper, but does not show it to their partner. Each student writes directions that can be followed to draw the unseen figure. Then the partners exchange and follow each other’s directions. When they have finished, students compare drawings to see how well the directions were written and followed.

**Art:** Challenge students to be architects and design a house using as many of the figures they have learned about in this chapter as possible. Have students make presentations of their buildings identifying the unique and interesting ways they used each figure, and the properties that helped them decide to use it.

### Differentiation Options

| Sections | Reteaching | Extra Practice | Enrichment | ELL Support |
|----------|------------|----------------|------------|-------------|
| 8.1      | X          | X              | X          | X           |
| 8.2      | X          | X              | X          | X           |

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.

- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                       |
|-----------------|---------------------------------------------------------------------------------------------------------|
| 8.1             | Use Enrichment Activity 1 - Students work on complex problems as they classify triangles.               |
| 8.2             | Use Enrichment Activity 2 - Students solve a variety of application problems as they classify polygons. |

Central Bucks School District – Course of Study  
**Chapter 9: Ratio**

**Desired Results**

Essential Questions:

- How can you relate and compare two or three quantities?

Enduring Understandings:

*Students will understand that...*

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- Mathematics is used to make informed decisions about problems in everyday life.

Knowledge:

*Students will know the definitions for...*

Ratio  
Equivalent ratios  
Simplest form

Skills:

*Students will be able to...*

|                                        |                                                                                                                    |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 9.1                                    | Read and write ratios.                                                                                             |
| 9.2                                    | Find equivalent ratios using multiplication or division.<br>Solve ratio problems using multiplication or division. |
| 9.3                                    | Read and write ratios of three quantities.                                                                         |
| 9.4                                    | Solve real-world problems involving ratios.                                                                        |
| Math Journal, Put on Your Thinking Cap | Draw a diagram<br>Make a list                                                                                      |

**PA Core Standards**

**CC.2.1.5.C.2** Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

**Acceptable Evidence**

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

**Acceptable evidence of learning other than Performance Tasks:**

Formative

- Quick Check
- “Try” Practice

- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

#### Summative

- Quizzes
- Chapter Assessment

#### **Suggested learning experiences and instruction**

| Sections | Activities                                                                                                                                                                                            |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Hands-on Activity: Writing ratio statements to compare to quantities<br>Hands-on Activity: Drawing bar models to represent ratios<br>Hands-on Activity: Drawing part-whole models to represent ratios |
| 2        | Game: Simplify it Fast!                                                                                                                                                                               |
| 3        | Using connecting cubes to demonstrate ratios                                                                                                                                                          |
| 4        | Using connecting cubes to solve real-world ratio problems                                                                                                                                             |

#### **Cross Curricular Connections**

**Reading/Language Arts:** Have students write a brief biography using ratios to tell about their family, pets, activity time, and so on. Encourage students to illustrate their biography. Invite students to share their biography and illustrations to the class.

**Social Studies:** Display a large map of the United States. Have students stick a push-pin or sticky note on each state they have visited. Using the map, have students find each of these ratios and an equivalent ratio.

- Number of states visited by member of the class: total number of states
- Number of states visited: number of states not visited by member of class

**Art:** Have students make scale figures, such as squares and rectangles, using a ratio of 1:2.

#### **Differentiation Options**

| Sections | Reteaching | Extra Practice | Enrichment | ELL Support |
|----------|------------|----------------|------------|-------------|
| 9.1      | X          | X              | X          | X           |
| 9.2      | X          | X              | X          | X           |
| 9.3      | X          | X              | X          | X           |
| 9.4      | X          | X              | X          | X           |

#### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                             |
|-----------------|---------------------------------------------------------------------------------------------------------------|
| 9.1             | Use Enrichment Activity 1 - Students work on real-world complex problems as they find ratios.                 |
| 9.2             | Use Enrichment Activity 2 - Students solve a variety of equivalent ratio computation and real-world problems. |
| 9.3             | Use Enrichment Activity 3 - Students work on complex problems as they classify triangles.                     |
| 9.4             | Use Enrichment Activity 4 - Students solve a variety of multi-step ratio application problems.                |

Central Bucks School District – Course of Study  
**Chapter 10: Percent**

**Desired Results**

Essential Questions:

- What does percent mean?
- How can you represent a percent in different ways?
- How can a percent be used in real-world situations?

Enduring Understandings:

*Students will understand that...*

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Estimates help determine the reasonableness of an answer.
- Mathematics is used to make informed decisions about problems in everyday life.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.

Knowledge:

*Students will know the definitions for...*

Percent  
Sales tax  
Meals tax  
Discount  
Interest

Skills:

*Students will be able to...*

|                                        |                                                                                                                                                     |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 10.1                                   | Relate a percent to parts of a whole where the whole is made up of 100 equal parts.                                                                 |
| 10.2                                   | Relate and compare percent, decimal, and fraction.<br>Express fractions as a percent and vice-versa.<br>Express decimals as percent and vice-versa. |
| 10.3                                   | Find the value of a percent of a quantity, given the amount and the percent.                                                                        |
| 10.4                                   | Solve real-world problems involving percent.                                                                                                        |
| Math Journal, Put on Your Thinking Cap | Solving part of the problem<br>Draw a diagram                                                                                                       |

**PA Core Standards**

**CC.2.1.5.C.2** Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

## Acceptable Evidence

Performance Tasks: Math Journal, Put on Your Thinking Cap, Performance Task

### Acceptable evidence of learning other than Performance Tasks:

#### Formative

- Quick Check
- “Try” Practice
- Independent Practice
- Slate Assessments
- Exit Slips
- Extra Practice
- Chapter Review

#### Summative

- Quizzes
- Chapter Assessment

## Suggested learning experiences and instruction

| Sections | Activities                                                                |
|----------|---------------------------------------------------------------------------|
| 1        | Using hundred square grid to represent parts of a whole                   |
| 2        | Hands on Activity: Express parts of a whole as a percent<br>Game: Pair Up |
| 3        | Using bar models to find a percent of a quantity                          |
| 4        | Hands on Activity: Solve percent problems                                 |

## Cross Curricular Connections

**Reading/Language Arts:** Have students choose a book to read over five school days. Have them write the part of the book they have read by the end of each day in fraction form and then percent form. Students can record their percent in a table. By the end of day five, they should have all read 100% of the book.

**Social Studies:** Brainstorm a list of students’ five favorite presidents. Have students pretend the five presidents are running for the office of class president. Then have a class election. Calculate the percent of votes each president received.

## Differentiation Options

| Sections | Reteaching | Extra Practice | Enrichment | ELL Support |
|----------|------------|----------------|------------|-------------|
| 10.1     | X          | X              | X          | X           |
| 10.2     | X          | X              | X          | X           |
| 10.3     | X          | X              | X          | X           |
| 10.4     | X          | X              | X          | X           |

## For Language Development



- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Have a vocabulary bee by giving a definition and having students identify the term defined.
- Make flash cards for terms and examples, then mix and match.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Enrichment practices
- Put On Your Thinking Cap! questions in Student Edition and Extra Practice and Homework

| <b>Sections</b> | <b>Enrichment</b>                                                                                                                                      |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10.1            | Use Enrichment Activity 1 - Students work on complex percent problems.                                                                                 |
| 10.2            | Use Enrichment Activity 2 - Students solve a variety of computation and real-world problems as they convert between fractions, decimals, and percents. |
| 10.3            | Use Enrichment Activity 3 - Students work on complex problems while finding the percent of a quantity.                                                 |
| 10.4            | Use Enrichment Activity 4 - Students solve a variety of multi-step percent application problems.                                                       |

Central Bucks School District – Course of Study  
**Chapter 11: Integers and Rational Numbers**

**Desired Results**

Essential Questions:

- What happens when you add, subtract, multiply, and divide integers?
- What happens when you add, subtract, multiply, and divide rational numbers?

Enduring Understandings:

*Students will understand that...*

- Some situations must be represented using negative values.
- Fractions are used to represent real-life situations.
- Common denominators are needed to add and subtract fractions.
- Fractions have reciprocals, and their product is 1.
- To divide fractions, use the reciprocal of the second fraction and multiply.

Knowledge:

*Students will know...*

- Definitions for: equation, evaluate, numerical expression, simplify, absolute value, additive inverse, inequality, integer, opposite, quadrant, bar notation, like fractions, rational number, reciprocal, unlike fractions, real number
- How to order rational numbers.
- How to find the reciprocal.
- When it is appropriate to simplify a fraction during the process of addition, subtraction, multiplication, and division.
- How rational numbers, integers, and whole numbers relate to each other.

Skills:

*Students will be able to...*

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

| PA Core Standards                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------|
| <b>CC.2.1.7.E.1</b> Apply and extend previous understandings of operations with fractions to operations with rational numbers. |

**Acceptable Evidence**

**Assignments:**

- Warm-Ups

- Guided Notes/Instruction
- Check for Understanding Assignments
- Hands-On Activity
- Guided Practice Problems from book
- Independent Practice Problems from book
- H.O.T. Problems (Higher-Order Thinking)
- Extra Practice Problems from book
- Exit Slips

### **Problem Solving Tasks:**

#### **21<sup>st</sup> Century Career**

- In Astronomy p. 68
- In Fashion Design p. 113

### **Suggested learning experiences and instruction**

- Emphasize integer rules.
- Emphasize vocabulary.
- Use of a calculator is prohibited.

### **Differentiation Options**

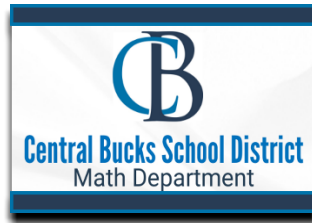
- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.

### **For Advanced Learners**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.



## **Accelerated Algebra 1**

Course Number: 2912

Course Level: Accelerated

Grade: 9

Time/Credit: 1 semester/ 83 minutes daily

Development Date: Fall 2025 - Spring 2026

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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# K – 12 Mathematics Program Learning Principles

## Teaching and Learning Principles:

1. Teaching mathematics for understanding requires providing experiences that stimulate students' curiosity and build confidence in investigating, problem solving, and communicating (speaking, reading, writing, representing, and listening).
2. Differentiated instruction addresses student strengths, interests, and learning styles.
3. Instruction should be appropriately paced to make the curriculum accessible to all students.
4. High expectations with strong support from teachers, parents and administrators motivate all students to achieve excellence in mathematics.
5. To create new understanding, students must be actively engaged in learning experiences designed to connect to their prior knowledge.
6. Presenting new ideas within rich and meaningful contexts helps learners to transfer and use knowledge meaningfully.
7. Making connections both within and outside of school helps learners to transfer and use knowledge meaningfully.
8. The learning process is enhanced when new ideas are presented using manipulatives, computers, calculators, and real-time data collection devices.
9. Teacher collaboration and reflection enrich learning experiences for students.
10. Assessment is an ongoing process that guides instruction and monitors student progress to include mastery of mathematics content and higher-level thinking skills.

## Documents Considered:

(2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

# Mathematics Program Enduring Understandings

**Students will understand that:**

## The Nature of Mathematics

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.

## Numbers and Operations

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.
- Estimates help determine the reasonableness of an answer.
- Expressions are simplified using a predetermined order of operations.

## Measurement

- Measurements collected using any tools (except for counting) are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing one linear dimension in a figure with two or three dimensions will have a different effect on the figure's perimeter, circumference, area, or volume.

## Geometry

- Points, lines, and planes are the building blocks of geometry.
- Each geometric figure has a specific naming convention.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter, and volume) are used for identification.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.

## Algebraic Concepts

- Algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems involving a constant rate of change can be modeled using proportional reasoning.
- Algebraic expressions, equations, inequalities, and functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic) are used to model relationships between quantities in real-world situations.

- Patterns and functions can be generalized and represented using verbal models, tables, equations, and graphs.
- Systems of equations are solved both graphically and algebraically and are used to model real-life problems.

### **Data Analysis and Probability**

- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Probability is used to make informed predictions and inferences.



# Mathematics Program Essential Questions

## The Nature of Mathematics

- What characteristics make mathematics a language?
- When is the correct solution not the answer to a problem?

## Numbers and Operations

- How do you know that an answer is reasonable?
- Why are there different number systems?
- How do you determine when to calculate with pencil and paper, find an estimate, or use a calculator?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

## Measurement

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension affect a figure's length, area, and volume?

## Geometry

- How are figures classified?
- How do you name a geometric figure and why are standard naming conventions important?
- Why are points, lines, and planes so important in Euclidean geometry?
- What do similarity and congruency statements tell you about polygons?

## Algebraic Concepts

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a pattern/function in different ways?

## Data Analysis and Probability

- What is the purpose of collecting data?
- How is data used or abused?
- How do we make predictions based on probability?

## Accelerated Algebra 1 Overview

### Desired Results

#### Course Description:

#### **2812 Accelerated Algebra 1**

This course is intended for college-bound students who have successfully completed Academic Math 8 and have demonstrated excellent mathematical ability. Algebra 1 extends previously learned arithmetic skills to expressions involving variables. Major topics include linear equations and inequalities in one and two variables, exponents and polynomials, factoring, quadratic equations, proportions, functions, radicals, rational expressions, and data analysis. Problem-solving applications, communication, and reasoning are emphasized throughout the course. Students in this class will take the Algebra 1 Keystone Exams.

**Prerequisite: Academic Math 8 (A-, 90% or higher) and teacher recommendation.**

#### **Committee Members:**

Jeff Lake, Melissa Greenberg, William Smith, Katie Marttila, Brian Novick

**Course Grading:** The final course grade is calculated as follows:

- Each marking period grade counts for 45% of the students' course grade.
- The final exam counts for 10% of the students' course grade.

## Accelerated Algebra 1 Pacing Guide

| Accelerated Algebra 1 Pacing Guide                                                 |           |
|------------------------------------------------------------------------------------|-----------|
| Course Overview                                                                    | Days      |
| Chapter 1 Solving Linear Equations                                                 | 9         |
| Chapter 2 Solving Linear Inequalities                                              | 7         |
| Chapter 3 Graphing Linear Functions                                                | 10        |
| Chapter 4 Writing Linear Functions                                                 | 8         |
| Chapter 5 Solving Systems of Linear Equations                                      | 10        |
| Chapter 6 Exponential Functions and Sequences                                      | 5         |
| Chapter 7 Polynomial Equations & Factoring                                         | 14        |
| Chapter 9 Radicals                                                                 | 5         |
| Chapter 11 Data Analysis and Displays                                              | 4         |
| Interleaving Practice Format (IPF)                                                 | 3         |
| Keystone Review                                                                    | 3         |
| Beginning of Year Activities/Review/Remediation                                    | 2         |
| Flex Days – Field Trips, Snow Days, Half Days, Assemblies, School Activities, etc. | 6         |
| Final Exam and Review                                                              | 4         |
| <b>Total Days</b>                                                                  | <b>90</b> |

| Chapter 1 – 9 Days<br>Solving Linear Equations                                                                                                                                                                                                                                                                                     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Properties, Order of Operations, Classifying Numbers, Simplifying Expressions<br>Section 1.1: Solving Simple Equations<br>Section 1.2: Solving Multi – Step Equations<br>Section 1.3: Proportions & Measurements – increase rigor $\frac{x-1}{3} = \frac{2x-1}{-5}$<br>Section 1.4: Solving Equations with Variables on Both Sides | 4  |
| Intervention and Enrichment                                                                                                                                                                                                                                                                                                        | .5 |
| Summative Quiz                                                                                                                                                                                                                                                                                                                     | .5 |
| Section 1.5: Solving Absolute Value Equations<br>Section 1.6: Rewriting Equations & Formulas                                                                                                                                                                                                                                       | 2  |
| Intervention and Enrichment; Review; Performance Task                                                                                                                                                                                                                                                                              | 1  |
| Chapter 1 Summative Assessment                                                                                                                                                                                                                                                                                                     | 1  |

| Interleaving Practice Format (IPF) #1                                                                                                                                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Chapter 2 – 7 Days<br>Solving Linear Inequalities                                                                                                                                                                                       |    |
| Section 2.1: Writing & Graphing Inequalities<br>Section 2.2: Solving Inequalities Using Addition or Subtraction<br>Section 2.3: Solving Inequalities Using Multiplication or Division<br>Section 2.4: Solving Multi – Step Inequalities | 2  |
| Intervention and Enrichment                                                                                                                                                                                                             | .5 |
| Summative Quiz                                                                                                                                                                                                                          | .5 |
| Section 2.5: Solving Compound Inequalities<br>Section 2.6: Solving Absolute Value Inequalities                                                                                                                                          | 2  |
| Intervention and Enrichment; Review; Performance Task                                                                                                                                                                                   | 1  |
| Chapter 2 Summative Assessment                                                                                                                                                                                                          | 1  |

| Interleaving Practice Format (IPF) #2                                                     |   |
|-------------------------------------------------------------------------------------------|---|
| Chapter 3 – 10 days<br>Graphing Linear Functions                                          |   |
| Section 3.1: Functions<br>Section 3.3: Linear Functions<br>Section 3.4: Function Notation | 3 |

|                                                                                                                                                           |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Intervention and Enrichment                                                                                                                               | .5 |
| Summative Quiz                                                                                                                                            | .5 |
| Section 3.5: Graphing Linear Equations in Standard Form (Table of Values, Intercepts)<br>Section 3.6: Graphing Linear Equations in Slope – Intercept Form | 4  |
| Intervention and Enrichment; Review; Performance Task                                                                                                     | 1  |
| Chapter 3 Summative Assessment                                                                                                                            | 1  |

|                                                                                                                                                                                                                    |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Interleaving Practice Format (IPF) -3                                                                                                                                                                              |    |
| <b>Chapter 4 – 8 days</b><br><b>Writing Linear Functions</b>                                                                                                                                                       |    |
| Section 4.1: Writing Equations in Slope – Intercept Form<br>Supplement: Writing Equations in Standard form- including converting between forms<br>Section 4.3: Writing Equations of Parallel & Perpendicular Lines | 3  |
| Intervention and Enrichment                                                                                                                                                                                        | .5 |
| Summative Quiz                                                                                                                                                                                                     | .5 |
| Section 4.4: Scatter Plots & Lines of Fit<br>Section 4.5: Analyzing Lines of Fit                                                                                                                                   | 2  |
| Intervention and Enrichment; Review; Performance Task                                                                                                                                                              | 1  |
| Chapter 4 Summative Assessment                                                                                                                                                                                     | 1  |

|                                                                                                                                                                                                                                                                 |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Interleaving Practice Format (IPF) - 4                                                                                                                                                                                                                          |    |
| <b>Chapter 5 – 10 days</b><br><b>Solving Systems of Linear Equations</b>                                                                                                                                                                                        |    |
| Section 5.1: Solving Systems of Linear Equations by Graphing<br>Section 5.2: Solving Systems of Linear Equations by Substitution<br>Section 5.3: Solving Systems of Linear Equations by Elimination<br>Section 5.4: Solving Special Systems of Linear Equations | 5  |
| Intervention and Enrichment                                                                                                                                                                                                                                     | .5 |
| Summative Quiz                                                                                                                                                                                                                                                  | .5 |
| Section 5.6: Graphing Linear Inequalities in Two Variables<br>Section 5.7: Systems of Linear Inequalities                                                                                                                                                       | 2  |
| Intervention and Enrichment; Review; Performance Task                                                                                                                                                                                                           | 1  |
| Chapter 5 Summative Assessment                                                                                                                                                                                                                                  | 1  |

| Interleaving Practice Format (IPF) - #5                                 |    |
|-------------------------------------------------------------------------|----|
| Chapter 6 – 5 days<br>Exponents                                         |    |
| Section 6.1: Properties of Exponents<br>Supplement: Scientific Notation | 4  |
| Intervention and Enrichment; Review; Performance Task                   | .5 |
| Chapter 6 Summative Assessment                                          | .5 |

| Interleaving Practice Format (IPF) - #6                                                                                                                                                                                                                                                                                                                        |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Chapter 7 – 14 days<br>Polynomial Equations & Factoring                                                                                                                                                                                                                                                                                                        |    |
| Section 7.1: Adding & Subtracting Polynomials<br>Section 7.2: Multiplying & Dividing Polynomials<br>Section 7.3: Special Products of Polynomials                                                                                                                                                                                                               | 3  |
| Intervention and Enrichment                                                                                                                                                                                                                                                                                                                                    | .5 |
| Summative Quiz                                                                                                                                                                                                                                                                                                                                                 | .5 |
| Section 7.4: Solving Polynomial Equations in Factored Form<br>Supplement: Factoring by GCF<br>Section 7.5: Factoring $x^2 + bx + c$<br>Supplement: Factoring by Grouping<br>Section 7.6: Factoring $ax^2 + bx + c$<br>Section 7.7: Factoring Special Products<br>Section 7.8: Factoring Polynomials Completely<br>Supplement: Simplifying Rational Expressions | 8  |
| Intervention and Enrichment; Review; Performance Task                                                                                                                                                                                                                                                                                                          | 1  |
| Chapter 7 Summative Assessment                                                                                                                                                                                                                                                                                                                                 | 1  |

| Interleaving Practice Format (IPF) - #7                                                                                                                                                 |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Chapter 9 – 5 Days<br>Solving Quadratic Equations                                                                                                                                       |    |
| Section 9.1: Properties of Radicals (Simplify; Simplify with limited variables)<br>Section 9.1: Operations with Radicals<br>Section 9.3: Solving Quadratic Equations Using Square Roots | 4  |
| Intervention and Enrichment; Review; Performance Task                                                                                                                                   | .5 |
| Chapter 9 Summative Quiz                                                                                                                                                                | .5 |

| Interleaving Practice Format (IPF) -8                                                                                                                                                                                             |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Chapter 11 – 4 Days (9 possible days)<br>Data Analysis & Displays and Standards-based Review                                                                                                                                      |    |
| Section 11.1: Measures of Center & Variation<br>Section 11.2: Box – and – Whisker Plots<br>Supplement: Reading All Types of Data Displays (bar graph, circle graph, histogram, stem and leaf)<br>Supplement: Probability and Odds | 4  |
| Intervention and Enrichment (if time allows)                                                                                                                                                                                      | .5 |
| Summative Quiz (if time allows)                                                                                                                                                                                                   | .5 |

| KEYSTONE REVIEW AND TESTING (5-7 DAYS) |     |
|----------------------------------------|-----|
| Keystone Review Days                   | 3   |
| Keystone Days                          | 2-4 |

| Chapter 11 – 4 Days (9 possible days)<br>Data Analysis & Displays and Standards-based Review                             |   |
|--------------------------------------------------------------------------------------------------------------------------|---|
| Section 11.4: Two – Way Tables (if time allows)<br>Section 11.5: Two – Way Tables & Relative Frequencies(if time allows) | 2 |
| Intervention and Enrichment; Review; Performance Task                                                                    | 1 |
| Quadratics Summative Assessment                                                                                          | 1 |

| End of Year Test – 3 days |   |
|---------------------------|---|
| Review                    | 3 |
| Final Exam                | 1 |

## Required and Supplementary Texts/Software

### **Math & YOU – Algebra 1: Concepts and Connections**

ISBN: 979-8-88802-853-7

Larson, R., & Battaglia, P., & Big Ideas Learning. (2025). *Math & YOU: Algebra 1 – Concepts and Connections*. Erie, Pennsylvania: Big Ideas Learning

### **Calculator Recommendation**

The secondary mathematics department of Central Bucks School District recognizes the use of calculators as a valuable tool for learning in the mathematics classroom. In certain advanced courses, graphing calculators with specific capabilities are important for daily classroom performance and are required for Advanced Placement tests. While no specific brands are endorsed, there are restrictions on the types of calculators allowed on certain classroom tests and final exams. Calculators that perform operations with variables, such as the TI-89, TI-92, and HP49G, will not be permitted on district final exams, even though they may be used on some nationwide tests. Teachers have discretion as to whether these calculators can be used for classroom-related purposes.



## Chapter 1: Solving Linear Equations

### Desired Results

#### Essential Questions:

- What does it mean to solve an equation?
- Why is it important to perform the same calculation to both sides of an equation?
- How can we use the properties of equality to solve and model real-world problems with one-step linear equations?
- How do we solve and model real-life problems using multi-step equations and inverse operations?
- How can ratios, rates, and unit conversions be used to solve real-world problems accurately and efficiently?
- How can we determine the number of solutions to an equation and apply strategies to solve equations with variables on both sides?
- How does choosing the correct level of accuracy affect the reliability of a solution in real-world contexts?
- How do we solve absolute value equations and determine whether they have one, two, or no solutions?
- How can we manipulate literal equations to isolate a variable and apply formulas to real-life problems?

#### Enduring Understandings:

*Students will understand that...*

- Solve simple and multi-step equations.
- Describe how to solve equations.
- Analyze the measurements used to solve a problem and judge the level of accuracy appropriate for the solution.
- Apply equation-solving techniques to solve real-life problems.

#### Knowledge:

*Students will know...*

Definitions for: linear equation in one variable, equivalent equation, ratio, proportion, rate, precision, accuracy, identity, absolute value equation, extraneous solution

#### Skills:

*Students will be able to...*

- Solve simple linear equations using addition, subtraction, multiplication, and division.
- Solve multi-step equations by applying inverse operations, the distributive property, and combining like terms.
- Use ratios, proportions, and unit conversions to solve measurement and real-world problems.
- Solve equations with variables on both sides and identify when equations have one, none, or infinitely many solutions.
- Solve absolute value equations and determine the number of possible solutions.
- Rewrite literal equations and formulas to isolate a specific variable and use them to solve problems.

**Standards:**

| Algebra 1 Standard | Algebra 1 Standard Description                                                  | PA Keystone Algebra I Standards |
|--------------------|---------------------------------------------------------------------------------|---------------------------------|
| CC.2.2.HS.D.7      | Create and graph equations or inequalities to describe numbers or relationships | A1.1.2.1                        |
| CC.2.2.HS.D.8      | Apply inverse operations to solve equations or formulas                         | A1.1.2.1                        |
| CC.2.2.HS.D.9      | Use reasoning to solve equations and justify the method                         | A1.1.2.2                        |
| CC.2.2.HS.D.1      | Interpret the structure of expressions                                          | A1.1.2.1                        |
| CC.2.1.HS.F.3      | Apply quantitative reasoning for units and scales                               | A1.1.2.1                        |
| CC.2.1.HS.F.4      | Use units to guide multi-step solutions                                         | A1.1.2.1                        |
| CC.2.1.HS.F.5      | Choose appropriate accuracy                                                     | A1.1.2.2                        |

**Acceptable Evidence**

**Problem Solving Tasks:**

- Performance Task: Every Drop Counts, pg. 54 – 55
- STEM Performance Task: Dead Reckoning (Supplemental)
- Big Idea Tasks: Writing Equivalent Equations (Supplemental)

### **Acceptable evidence of learning other than Problem Solving Tasks:**

#### **Formative Assessment**

- Big Ideas of the Chapter
- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications:

#### **Summative Assessment**

- Chapter 1 Common Assessment: Sections 1.1 – 1.6
  - Chapter 1 Quiz: Sections 1.1 – 1.3

### **Suggested Learning Experiences and Instructional Strategies**

#### **Instructional Strategies:**

| Lesson | Title                        | Key Objectives                                                                                                                                                                                       | Instructional Strategies                                                                                                                                                                    |
|--------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.1    | Solving Simple Equations     | <ul style="list-style-type: none"> <li>- Write and solve one-step equations.</li> <li>- Use properties of equality.</li> <li>- Model real-life equations.</li> </ul>                                 | <ul style="list-style-type: none"> <li>- CPA (Concrete–Representational–Abstract)</li> <li>- Think-Aloud Modeling</li> <li>- Real-World Context Problems</li> <li>- Exit Tickets</li> </ul> |
| 1.2    | Solving Multi-Step Equations | <ul style="list-style-type: none"> <li>- Apply distributive property and combine like terms.</li> <li>- Use multiple inverse operations.</li> <li>- Write and solve multi-step equations.</li> </ul> | <ul style="list-style-type: none"> <li>- Annotated Modeling</li> <li>- Graphic Organizers</li> <li>- Error Analysis</li> <li>- Collaborative Problem Solving</li> </ul>                     |

|     |                                        |                                                                                                                                                                                                    |                                                                                                                                                                     |
|-----|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.3 | Proportions and Measurements           | <ul style="list-style-type: none"> <li>- Use ratios, rates, and unit conversions.</li> <li>- Choose appropriate measurement accuracy.</li> <li>- Solve real-life proportional problems.</li> </ul> | <ul style="list-style-type: none"> <li>- Real-World Tasks</li> <li>- Card Sorts</li> <li>- Measurement Labs</li> <li>- Think-Pair-Share</li> </ul>                  |
| 1.4 | Equations with Variables on Both Sides | <ul style="list-style-type: none"> <li>- Solve equations with variables on both sides.</li> <li>- Identify number of solutions.</li> </ul>                                                         | <ul style="list-style-type: none"> <li>- Matching Activities</li> <li>- Error Analysis</li> <li>- Sentence Starters</li> <li>- Math Journaling</li> </ul>           |
| 1.5 | Solving Absolute Value Equations       | <ul style="list-style-type: none"> <li>- Solve absolute value equations.</li> <li>- Identify special solutions.</li> <li>- Interpret and write compound equations.</li> </ul>                      | <ul style="list-style-type: none"> <li>- Visual Modeling</li> <li>- Graphic Organizers</li> <li>- Error Analysis</li> <li>- Technology (Desmos/GeoGebra)</li> </ul> |
| 1.6 | Rewriting Equations and Formulas       | <ul style="list-style-type: none"> <li>- Rearrange literal equations.</li> <li>- Apply rewritten formulas to real-life problems.</li> <li>- Solve for a specified variable.</li> </ul>             | <ul style="list-style-type: none"> <li>- Think-Alouds</li> <li>- Exit Tickets</li> <li>- Real-Life Applications</li> </ul>                                          |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
  - Skill Builder Quick Check
- Tier 3:
  - Skills Foundation to support skill development
  - Skills Foundation Quick Check
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment
- Additional Topics & Lessons that go beyond the standard curriculum

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

#### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Chapter 2: Solving Linear Inequalities

### Desired Results

#### Essential Questions:

- How can inequalities represent real-world situations?
- What are different ways to show the solution of an inequality?
- When might inequalities be more useful than equations?
- Why do rules for solving inequalities differ slightly from solving equations?
- How does multiplication or division of an inequality affect the direction of the inequality?
- How can we solve inequalities that require more than one step?
- What does it mean to have a solution for a compound inequality?
- How are compound inequalities used in real-life scenarios?
- How do we interpret and solve absolute value inequalities?
- What is the relationship between absolute value inequalities and compound inequalities?

#### Enduring Understandings:

*Students will understand that...*

- Solving inequalities requires understanding the properties of inequalities and how they differ from equations.
- Solutions to inequalities can be represented and interpreted in multiple ways including number lines, graphs, and real-world applications.
- Inequalities allow us to model and solve problems where a range of values is acceptable rather than a single solution.
- Understanding compound and absolute value inequalities expands the ability to represent complex relationships and constraints in problem-solving.

#### Knowledge:

*Students will know...*

Definitions for: inequality, solution of inequality, solution set, graph of an inequality, equivalent, inequalities, compound inequality, absolute value inequality, bounded interval, unbounded interval, absolute deviation

#### Skills:

*Students will be able to...*

### 2.1 Writing and Graphing Inequalities

- Translate verbal descriptions into inequalities.
- Identify solutions to inequalities.
- Graph and interpret simple inequalities.

## **2.2 Solving Inequalities Using Addition or Subtraction**

- Apply properties of inequalities to isolate variables.
- Solve inequalities using inverse operations.
- Model situations with addition or subtraction inequalities.

## **2.3 Solving Inequalities Using Multiplication or Division**

- Solve one-step inequalities involving multiplication or division.
- Interpret the effects of multiplying/dividing by a negative number.
- Represent real-life contexts with multiplicative/divisional inequalities.

## **2.4 Solving Multi-Step Inequalities**

- Combine properties of inequality to solve complex expressions.
- Break down and solve inequalities with more than one operation.
- Apply real-life contexts to multi-step inequality models.

## **2.5 Solving Compound Inequalities**

- Solve and graph conjunction and disjunction inequalities.
- Interpret compound inequalities in context.
- Represent solution sets on number lines.

## **2.6 Solving Absolute Value Inequalities**

- Rewrite absolute value inequalities as compound inequalities.
- Solve and graph absolute value inequality solutions.
- Apply absolute value concepts to real-world scenarios.

### **Standards:**

| Algebra 1<br>Standard Code | Algebra 1 Standard Description             | PA Keystone Algebra I Standards |
|----------------------------|--------------------------------------------|---------------------------------|
| CC.2.2.HS.D.7              | Create and graph equations or inequalities | A1.1.2.1                        |
| CC.2.2.HS.D.8              | Apply inverse operations                   | A1.1.2.1                        |
| CC.2.2.HS.D.1              | Interpret structure of expressions         | A1.1.2.1                        |

### **Acceptable Evidence**

### **Problem Solving Tasks:**

- Performance Task: Summitting Everest, pg. 104 – 105
- STEM Performance Task: Planning Electrical Circuits (Supplemental)
- Big Idea Tasks: Achieving a Goal (Supplemental)
- Big Idea Tasks: Connecting Inequalities to Circumference. (Supplemental)

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessment**

- Warm-ups & exit slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Formative Quizzes
- Online Applications

#### **Summative Assessment**

- Chapter 2 Common Assessment: Sections 2.1 – 2.6

Chapter 2 Quiz: Sections 2.1 – 2.4

### **Suggested Learning Experiences and Instructional Strategies**

#### **Instructional Strategies:**

| Lesson | Title                                   | Key Objectives                                                                                                                                         | Instructional Strategies                                                                                                                                                                             |
|--------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1    | Writing and Graphing Inequalities       | Write word sentences as inequalities<br>Graph and interpret inequalities<br>Determine solutions on number lines                                        | CPA models using number lines<br>Word problem matching activities<br>Visual demonstrations with inequality rulers<br>Real-life inequality examples<br>Guided group practice                          |
| 2.2    | Solving with Addition or Subtraction    | Apply properties of inequality (add/subtract)<br>Solve one-step inequalities<br>Create models from word problems                                       | Interactive notebooks with addition/subtraction rules<br>Online graphing tools<br>Peer teaching stations<br>Number line games<br>Scaffolded worksheet progressions                                   |
| 2.3    | Solving with Multiplication or Division | Apply multiplication/division rules, including direction changes<br>Solve inequalities using multiplication/division<br>Model with real-world examples | Demonstration with inequality flip cards<br>Error analysis on solving steps<br>Technology-based graphing simulations<br>Real-world word problem analysis<br>Think-Pair-Share to test direction rules |



|     |                                     |                                                                                                                                            |                                                                                                                                                                                                   |
|-----|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.4 | Solving Multi-Step Inequalities     | Use multiple steps to isolate variables<br>Apply inverse operations in order<br>Solve and model multi-step contexts                        | Math talk on solution strategies<br>Partner puzzle matching for steps<br>Scaffolded problem sequencing<br>Problem-based learning with budgets or constraints<br>Desmos activities for exploration |
| 2.5 | Solving Compound Inequalities       | Recognize and solve compound inequalities<br>Graph solutions and interpret them<br>Translate real-life scenarios into compound models      | Compound inequality card sorts<br>Digital graph modeling<br>Matching graphs to verbal contexts<br>Create-your-own inequality stations<br>Real-world compound scenario journals                    |
| 2.6 | Solving Absolute Value Inequalities | Translate absolute value into compound inequalities<br>Solve and check absolute value solutions<br>Model and apply to real-world scenarios | Absolute value foldables<br>Interactive Desmos sliders<br>Real-world problems (tolerance/range limits)<br>Exit ticket checks with error corrections<br>Think-aloud modeling of structure          |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.

- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

#### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Chapter 3: Graphing Linear Functions

### Desired Results

#### Essential Questions:

- What is a function, and how can you determine whether a relation is a function?
- How can you describe the behavior and characteristics of a function using a graph?
- How can function notation be used to describe and interpret mathematical relationships?
- How do slope and intercepts influence the graph of a linear equation in standard and slope-intercept form?

#### Enduring Understandings:

*Students will understand that...*

- Students will understand that a function represents a relationship between quantities that can be described and analyzed using graphs, tables, and equations.
- Students will understand that linear functions model real-world relationships and can be graphed in multiple forms using slope and intercepts.
- Students will understand that function notation provides a way to represent, evaluate, and communicate mathematical relationships clearly.

#### Knowledge:

*Students will know...*

Definitions for: relation, function, domain, range, independent variable, dependent variable, x-intercept, y-intercept, increasing, decreasing, linear function, solution of a linear equation in two variables, discrete domain, continuous domain, function notation, standard form, slope, rise, run, slope-intercept form, constant function

#### Skills:

*Students will be able to...*

- Determine if a relation is a function and identify domain and range.
- Describe characteristics of graphs and sketch them from verbal descriptions.
- Identify, interpret, and graph linear functions in various forms.
- Evaluate and interpret functions using function notation.
- Find slope and graph lines in standard and slope-intercept forms.

#### Standards:

| Algebra 1<br>Standard Code | Algebra 1 Standard<br>Description          | PA Keystone Algebra I Standards |
|----------------------------|--------------------------------------------|---------------------------------|
| CC.2.2.HS.C.6              | Interpret functions in context             | A1.2.1.1                        |
| CC.2.2.HS.D.7              | Create and graph equations or inequalities | A1.1.2.1<br>A1.1.3.1            |
| CC.2.2.HS.D.1              | Interpret expressions                      | A1.1.1.5                        |
| CC.2.2.HS.D.10             | Represent and solve systems                | A1.1.3.2                        |
| CC.2.1.HS.F.6              | Apply arithmetic to complex numbers        | A1.4.2.2                        |
| CC.2.1.HS.F.7              | Apply complex numbers to quadratics        | A1.4.2.2                        |

### Acceptable Evidence

#### **Problem Solving Tasks:**

- Performance Task: Into the Deep, pg. 176 – 177
- STEM Performance Task: Speed of Light (Supplemental)
- Big Idea Tasks: Identifying a Function (Supplemental)
- Big Idea Tasks: Understanding a Linear Function (Supplemental)
- Big Idea Tasks: Using Function Notation (Supplemental)
- Big Idea Tasks: Finding the Area of a Trapezoid in the Coordinate Plane (Supplemental)

#### **Acceptable evidence of learning other than Performance Tasks:**

### Formative Assessment

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications

### Summative Assessment

- Chapter 3 Common Assessment: Sections 3.1, 3.3, 3.4, 3.5, 3.6
  - Chapter 3 Quiz: Sections 3.1, 3.2, 3.4

### **Suggested Learning Experiences and Instructional Strategies**

#### Instructional Strategies:

| Lesson | Title             | Key Objectives                                                                                                                                                                                    | Instructional Strategies                                                                                                                                                                                                                                                                       |
|--------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.1    | Functions         | <ul style="list-style-type: none"><li>- Determine whether a relation is a function</li><li>- Find domain and range</li><li>- Identify dependent and independent variables</li></ul>               | <ul style="list-style-type: none"><li>- Use mapping diagrams and tables</li><li>- Card sort activity for function vs non-function</li><li>- Graph simple functions on Desmos</li><li>- CPA using input/output machines</li><li>- Real-life relation examples (e.g., vending machine)</li></ul> |
| 3.3    | Linear Functions  | <ul style="list-style-type: none"><li>- Identify linear functions from graphs/tables/equations</li><li>- Graph linear functions</li><li>- Create and interpret real-world linear models</li></ul> | <ul style="list-style-type: none"><li>- Graphing paper and slope triangles</li><li>- Table-to-graph practice</li><li>- Function machine simulations</li><li>- Graphing challenges with real-life data</li><li>- Gallery walk of different representations</li></ul>                            |
| 3.4    | Function Notation | <ul style="list-style-type: none"><li>- Evaluate functions using notation</li><li>- Interpret functional statements</li><li>- Graph from function notation expressions</li></ul>                  | <ul style="list-style-type: none"><li>- Interactive notebooks for notation practice</li><li>- Function matching card games</li><li>- Create-your-own function notation mini-poster</li><li>- Technology-based evaluation (e.g., Desmos sliders)</li></ul>                                      |

|     |                           |                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                            |
|-----|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                           |                                                                                                                                                                                                  | - CPA examples using notation                                                                                                                                                                                                                                                              |
| 3.5 | Graphing in Standard Form | <ul style="list-style-type: none"> <li>- Graph horizontal/vertical lines</li> <li>- Graph standard form using intercepts</li> <li>- Solve problems modeled by standard form equations</li> </ul> | <ul style="list-style-type: none"> <li>- Anchor chart for intercept method</li> <li>- Guided practice with intercept finding</li> <li>- Use graphing calculator to verify graphs</li> <li>- Hands-on whiteboard graphing</li> <li>- Real-life examples like budgeting equations</li> </ul> |
| 3.6 | Slope-Intercept Form      | <ul style="list-style-type: none"> <li>- Find slope from graph or points</li> <li>- Graph using slope-intercept form</li> <li>- Model real-world linear relationships</li> </ul>                 | <ul style="list-style-type: none"> <li>- Slope foldable with guided notes</li> <li>- Interactive slope race activity</li> <li>- Real-world graphs (e.g., distance over time)</li> <li>- Use of color-coded graphing practice</li> <li>- Desmos linear function challenges</li> </ul>       |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Chapter 4: Writing Linear Functions

### Desired Results

#### Essential Questions:

- How can linear functions model relationships between two variables in real-world situations?
- What information is needed to write an equation of a line?
- How do changes in slope and intercept affect the graph and equation of a line?
- In what ways can data trends be interpreted and predicted using lines of fit?

#### Enduring Understandings:

*Students will understand that...*

- Linear functions can be used to model and solve problems involving constant rates of change.
- Equations of lines can be written in various forms depending on the information provided.
- Scatter plots and lines of best fit can help interpret data and make predictions.

#### Knowledge:

*Students will know...*

Definitions for: linear model, point-slope form, parallel lines, perpendicular lines, scatter plot, correlation, causation, line of fit, linear regression, line of best fit, interpolation, extrapolation

#### Skills:

*Students will be able to...*

- Write equations in slope-intercept and point-slope form.
- Recognize and write equations of parallel and perpendicular lines.
- Interpret and analyze scatter plots and lines of fit.

#### Standards:

| Algebra 1 Standard | Algebra 1 Description                                                                     | PA Keystone Algebra I Standards |
|--------------------|-------------------------------------------------------------------------------------------|---------------------------------|
| CC.2.2.HS.D.7      | Create and graph equations or inequalities                                                | A1.1.2.1<br>A1.1.3.1            |
| CC.2.2.HS.D.4      | Write the zeros of a polynomial function and use them to sketch the graph of the function | A1.4.1.2                        |



|               |                                                                                    |          |
|---------------|------------------------------------------------------------------------------------|----------|
| CC.2.2.HS.D.5 | Use polynomial identities to solve problems                                        | A1.4.2.1 |
| CC.2.2.HS.D.6 | Rewrite rational expressions in different forms                                    | A1.1.1.5 |
| CC.2.2.HS.C.2 | Graph functions expressed symbolically and show key features of the graph          | A1.4.1.2 |
| CC.2.2.HS.C.5 | Construct and compare linear, quadratic, and exponential models                    | A1.5.1.2 |
| CC.2.2.HS.C.6 | Interpret the parameters in a linear or exponential function in terms of a context | A1.5.1.1 |
| CC.2.2.HS.C.1 | Use function notation and interpret statements in terms of a context               | A1.1.2.1 |
| CC.2.2.HS.D.1 | Interpret the structure of expressions                                             | A1.1.2.1 |

### **Acceptable Evidence**

#### **Problem Solving Tasks:**

- Performance Task: This One's a Breeze, pg. 234 – 235
- STEM Performance Task: Future Wind Power (Supplemental)
- Big Idea Tasks: Analyzing Lines of Fit (Supplemental)
- Big Idea Tasks: Writing Functions (Supplemental)
- Big Idea Tasks: Comparing Memberships (Supplemental)
- Big Idea Tasks: Stacking Firewood (Supplemental)

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications

##### **Summative Assessment**

- Chapter 4 Common Assessment: Sections 4.1 – 4.5
  - Chapter 4 Quiz: Sections 4.1 – 4.3

## Suggested Learning Experiences and Instructional Strategies

### Instructional Strategies:

| Lesson | Title                                     | Key Objectives                                                                                                                                                                                            | Instructional Strategies                                                                                                                                                                                                                                                                                                          |
|--------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1    | Writing Equations in Slope-Intercept Form | <ul style="list-style-type: none"> <li>- Find slope and y-intercept of a line</li> <li>- Write equations using slope-intercept form</li> <li>- Solve real-life problems using linear equations</li> </ul> | <ul style="list-style-type: none"> <li>- Use of real-world application scenarios</li> <li>- Graphing calculators or Desmos for visual understanding</li> <li>- Concrete-pictorial-abstract (CPA) approach</li> <li>- Collaborative group work and peer discussion</li> <li>- Use of technology and data analysis tools</li> </ul> |
| 4.2    | Writing Equations in Point-Slope Form     | <ul style="list-style-type: none"> <li>- Use slope and a point to write an equation</li> <li>- Write equations using two given points</li> <li>- Apply point-slope form to real-life contexts</li> </ul>  | <ul style="list-style-type: none"> <li>- Use of real-world application scenarios</li> <li>- Graphing calculators or Desmos for visual understanding</li> <li>- Concrete-pictorial-abstract (CPA) approach</li> <li>- Collaborative group work and peer discussion</li> <li>- Use of technology and data analysis tools</li> </ul> |
| 4.3    | Parallel and Perpendicular Lines          | <ul style="list-style-type: none"> <li>- Identify parallel and perpendicular lines</li> <li>- Write equations for parallel lines</li> <li>- Write equations for perpendicular lines</li> </ul>            | <ul style="list-style-type: none"> <li>- Use of real-world application scenarios</li> <li>- Graphing calculators or Desmos for visual understanding</li> <li>- Concrete-pictorial-abstract (CPA) approach</li> <li>- Collaborative group work and peer discussion</li> <li>- Use of technology and data analysis tools</li> </ul> |
| 4.4    | Scatter Plots and Lines of Fit            | <ul style="list-style-type: none"> <li>- Read and interpret scatter plots</li> <li>- Determine correlation and causation</li> <li>- Write and</li> </ul>                                                  | <ul style="list-style-type: none"> <li>- Use of real-world application scenarios</li> <li>- Graphing calculators or Desmos for visual understanding</li> <li>- Concrete-pictorial-abstract (CPA) approach</li> <li>- Collaborative group work and peer discussion</li> </ul>                                                      |

|     |                        |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                   |
|-----|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                        | interpret lines of fit                                                                                                                                                                       | - Use of technology and data analysis tools                                                                                                                                                                                                                                                                                       |
| 4.5 | Analyzing Lines of Fit | <ul style="list-style-type: none"> <li>- Use technology to find lines of best fit</li> <li>- Analyze fit using residuals</li> <li>- Solve real-life problems using best fit lines</li> </ul> | <ul style="list-style-type: none"> <li>- Use of real-world application scenarios</li> <li>- Graphing calculators or Desmos for visual understanding</li> <li>- Concrete-pictorial-abstract (CPA) approach</li> <li>- Collaborative group work and peer discussion</li> <li>- Use of technology and data analysis tools</li> </ul> |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.

- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Chapter 5: Solving Systems of Linear Equations

### Desired Results

#### Essential Questions:

- How can systems of linear equations be used to model and solve real-world problems?
- What methods can be used to solve a system of equations, and how do we decide which is most efficient?
- What does the solution to a system of equations represent in context?
- How can you determine the number of solutions a system of equations or inequalities has?

#### Enduring Understandings:

*Students will understand that...*

- Systems of linear equations can be solved using multiple methods including graphing, substitution, and elimination.
- The most efficient method of solving a system depends on the specific form of the equations.
- Systems of equations can have one solution, no solution, or infinitely many solutions, and these represent real-world contexts.
- Graphing inequalities and systems of inequalities helps visualize solutions and constraints in real-world scenarios.

#### Knowledge:

*Students will know...*

Definitions for: systems of linear equations, solution of a system of linear equations, linear inequality in two variables, solution of a linear inequality in two variables, graph of a linear inequality, half-planes, system of linear inequalities, solution of a system of linear inequalities, graph of a system of linear inequalities

#### Skills:

*Students will be able to...*

- Solve systems of equations by graphing, substitution, and elimination.
- Determine the number of solutions to a system of equations or inequalities.
- Graph linear inequalities and systems of inequalities.
- Apply systems of equations and inequalities to solve real-life problems.
- Interpret the solution of a system of equations and inequalities from graphs.

### Standards:

| Algebra 1 Standard | Algebra 1 Description                                     | PA Keystone Algebra I Standards |
|--------------------|-----------------------------------------------------------|---------------------------------|
| CC.2.2.HS.D.7      | Create and graph equations or inequalities                | A1.1.2.1                        |
| CC.2.2.HS.D.9      | Use reasoning to solve equations and justify the method   | A1.1.2.2                        |
| CC.2.2.HS.D.10     | Represent and solve systems of equations and inequalities | A1.1.3.2                        |

### Acceptable Evidence

#### Problem Solving Tasks:

- Performance Task: A Challenging Descent, pg. 286 – 287
- STEM Performance Task: Setting Fishery Limits (Supplemental)
- Big Idea Tasks: Writing A System of Linear Equations (Supplemental)
- Big Idea Tasks: Solving Systems of Linear Equations (Supplemental)
- Big Idea Tasks: Solving a Special System of Linear Equations (Supplemental)
- Big Idea Tasks: Withdrawing Money from the Bank (Supplemental)

#### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications

#### Summative Assessment

- Chapter 5 Common Assessment: Sections 5.1 – 5.4, 5.6 – 5.7
  - Chapter 5 Quiz: Sections 5.1 – 5.4

### Suggested Learning Experiences and Instructional Strategies

#### Instructional Strategies:

| Lesson | Title | Key Objectives | Instructional Strategies |
|--------|-------|----------------|--------------------------|
|--------|-------|----------------|--------------------------|

|     |                                 |                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                             |
|-----|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.1 | Solving Systems by Graphing     | <ul style="list-style-type: none"> <li>• Determine if an ordered pair is a solution to a system</li> <li>• Graph linear systems</li> <li>• Approximate solutions graphically</li> </ul>                               | <ul style="list-style-type: none"> <li>• Graphing calculators or Desmos</li> <li>• CPA: Tables → Graphs → Equations</li> <li>• Partner pair-ups to compare solutions</li> <li>• Use of real-world contexts like budgeting or speed/time problems</li> </ul> |
| 5.2 | Solving Systems by Substitution | <ul style="list-style-type: none"> <li>• Substitute one equation into another</li> <li>• Solve resulting equations</li> <li>• Interpret real-world substitution solutions</li> </ul>                                  | <ul style="list-style-type: none"> <li>• Worked examples with color-coding</li> <li>• Interactive notebooks</li> <li>• Algebra tiles (CPA)</li> <li>• Substitution scavenger hunt activity</li> </ul>                                                       |
| 5.3 | Solving Systems by Elimination  | <ul style="list-style-type: none"> <li>• Align and manipulate equations</li> <li>• Add or subtract to eliminate a variable</li> <li>• Solve real-world elimination problems</li> </ul>                                | <ul style="list-style-type: none"> <li>• Real-world shopping scenarios</li> <li>• Elimination domino cards</li> <li>• CPA using integer chips</li> <li>• Elimination matching games</li> </ul>                                                              |
| 5.4 | Solving Special Systems         | <ul style="list-style-type: none"> <li>• Classify systems (one, none, infinite solutions)</li> <li>• Interpret solutions algebraically and graphically</li> <li>• Identify consistent/inconsistent systems</li> </ul> | <ul style="list-style-type: none"> <li>• Card sort for types of systems</li> <li>• Graphical software or apps</li> <li>• Use of number lines for modeling solutions</li> <li>• Think-pair-share for different solution scenarios</li> </ul>                 |
| 5.5 | Solving Equations by Graphing   | <ul style="list-style-type: none"> <li>• Graph both sides of equations</li> <li>• Find the point of intersection</li> <li>• Interpret absolute value graph solutions</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Desmos activities</li> <li>• Graph &amp; compare approach</li> <li>• Technology-based practice</li> <li>• Anchor chart on solution meanings</li> </ul>                                                             |
| 5.6 | Graphing Linear Inequalities    | <ul style="list-style-type: none"> <li>• Determine if a point satisfies an inequality</li> <li>• Graph linear inequalities</li> <li>• Model real-life constraints</li> </ul>                                          | <ul style="list-style-type: none"> <li>• Use of shading and boundary line games</li> <li>• CPA with inequality tiles</li> <li>• Desmos graphing tool</li> <li>• Interactive flipbooks</li> </ul>                                                            |
| 5.7 | Systems of Linear               | <ul style="list-style-type: none"> <li>• Graph systems of inequalities</li> </ul>                                                                                                                                     | <ul style="list-style-type: none"> <li>• Real-world business models</li> <li>• Graphing games (color-by-</li> </ul>                                                                                                                                         |

|  |              |                                                                                                                                            |                                                                                                                                                           |
|--|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Inequalities | <ul style="list-style-type: none"> <li>• Identify solutions to systems graphically</li> <li>• Write systems from shaded regions</li> </ul> | region)<br><ul style="list-style-type: none"> <li>• Tech integration: Geogebra or Desmos</li> <li>• Mini-projects: planning within constraints</li> </ul> |
|--|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
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- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
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### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects



## Chapter 6: Exponents

### Desired Results

#### Essential Questions:

- How can properties of exponents be applied to simplify expressions and solve problems?
- In what ways can exponential functions model real-world phenomena?
- In what ways can scientific notation model real-world numbers?

#### Enduring Understanding:

*Students will understand that...*

- Students will understand that properties of exponents allow simplification and interpretation of expressions with powers.
- Students will understand that scientific notation can be used to model extreme numbers.

#### Knowledge:

*Students will know...*

- Definitions for: exponent, base, polynomial, area, scientific notation
- How to apply properties of exponents: multiplying monomials with the same base, raising a power to a power, dividing monomials, power of a product (including zero and negative exponents)
- Formulas:
  - Product of Powers Property  $a^m \cdot a^n = a^{m+n}$
  - Power of a Power Property  $(a^m)^n = a^{mn}$
  - Power of a Product Property  $(ab)^m = a^m b^m$
  - Negative Exponent Property  $a^{-m} = \frac{1}{a^m}, a \neq 0$
  - Zero Exponent Property  $a^0 = 1, a \neq 0$
  - Quotient of Powers Property  $\frac{a^m}{a^n} = a^{m-n}, a \neq 0$
  - Power of a Quotient Property  $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$

**Skills:**

*Students will be able to...*

- Simplify expressions involving exponents.
- Find the area of geometric shapes.
- Convert numbers between scientific notation and standard forms.
- Multiply and divide numbers in scientific notation and solve scientific notation word problems.

**Standards:**

| Algebra 1 Standard | Algebra 1 Description                                                                   | PA Keystone Algebra I Standards |
|--------------------|-----------------------------------------------------------------------------------------|---------------------------------|
| CC.2.1.HS.F.1      | Apply and extend the properties of exponents to solve problems with rational exponents. | A1.1.1.2                        |
| CC.2.2.7.B.1       | Apply properties of operations to generate equivalent expressions.                      | A1.1.1.2                        |

**Acceptable Evidence****Problem Solving Tasks:**

- Big Idea Tasks: Understanding Exponential Expressions (Supplemental)
- Big Idea Tasks: Using Properties of Exponents (Supplemental)

**Acceptable evidence of learning other than Performance Tasks:****Formative Assessment**

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications

**Summative Assessment**

- Chapter 6 Common Assessment: Sections 6.1, Supp. Scientific Notation

## Suggested Learning Experiences and Instructional Strategies

### Instructional Strategies:

| Lesson     | Title                   | Key Objectives                                                                                                                                                                                                 | Instructional Strategies                                                                                                                                                                                                                                                                                                                  |
|------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.1        | Properties of Exponents | <ul style="list-style-type: none"><li>• Explain and apply zero and negative exponents.</li><li>• Simplify expressions using exponent rules.</li><li>• Evaluate numerical expressions with exponents.</li></ul> | <ul style="list-style-type: none"><li>• Use base-ten blocks to visualize exponent patterns (CPA).</li><li>• Create foldables for exponent rules.</li><li>• Use online exponent calculators and simulations.</li><li>• Problem-based learning with exponent puzzles.</li><li>• Exit tickets focusing on simplifying expressions.</li></ul> |
| Supplement | Scientific Notation     | <ul style="list-style-type: none"><li>• Convert between scientific notation and standard form</li></ul>                                                                                                        | <ul style="list-style-type: none"><li>• Problem-based learning with scientific notation puzzles.</li><li>• Exit tickets focusing on scientific notation expressions.</li></ul>                                                                                                                                                            |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Chapter 7: Polynomial Equations and Factoring

### Desired Results

#### Essential Questions:

- How can we classify and manipulate polynomials to model real-world scenarios?
- What methods can be used to simplify and solve polynomial expressions and equations?
- How does factoring help us solve polynomial equations and understand the structure of algebraic expressions?
- Why are special products and factoring patterns important in simplifying and solving polynomial equations?

#### Enduring Understandings:

*Students will understand that...*

- Polynomials can be classified, added, subtracted, multiplied, and factored to model and solve mathematical and real-life problems.
- Factoring is a critical skill for solving polynomial equations and interpreting algebraic expressions.
- Recognizing patterns in polynomials allows for efficient problem-solving and deeper conceptual understanding.
- Polynomial operations extend foundational algebra skills and are essential for higher-level mathematics.

#### Knowledge:

*Students will know...*

Definitions for: monomial, degree of a monomial, polynomial, binomial, trinomial, degree of a polynomial, standard form, leading coefficient, closed, FOIL Method, factored form of an equation, Zero-Product Property, roots, factored form of a polynomial, factoring by grouping, factored completely

#### Skills:

*Students will be able to...*

- Classify polynomials by degree and number of terms.
- Add and subtract polynomials.
- Multiply and divide polynomials using various methods (Distributive Property, FOIL).

- Recognize and apply special product patterns.
- Factor polynomials using GCF, grouping, and other methods.
- Solve polynomial equations by factoring.
- Apply factoring skills to real-life problem contexts.

#### Standards:

| Algebra 1 Standard | Algebra 1 Description                            | PA Keystone Algebra I Standards |
|--------------------|--------------------------------------------------|---------------------------------|
| CC.2.2.HS.D.1      | Interpret the structure of expressions           | A1.1.1.1                        |
| CC.2.2.HS.D.2      | Write equivalent expressions                     | A1.1.1.2                        |
| CC.2.2.HS.D.3      | Perform arithmetic operations on polynomials     | A1.1.1.3                        |
| CC.2.2.HS.D.6      | Rewrite rational expressions                     | A1.1.1.2                        |
| CC.2.2.HS.D.7      | Create and graph equations or inequalities       | A1.1.2.1                        |
| CC.2.2.HS.D.8      | Solve for a variable in terms of other variables | A1.1.1.2                        |

#### Acceptable Evidence

##### Problem Solving Tasks:

- Performance Task: Gravity Check, pg. 410 – 411
- STEM Performance Task: Birds Dropping Food (Supplemental)
- Big Idea Tasks: Understanding Polynomials (Supplemental)
- Big Idea Tasks: Writing a Polynomial (Supplemental)
- Big Idea Tasks: Factoring a Polynomial (Supplemental)
- Big Idea Tasks: Factoring Polynomials Completely (Supplemental)
- Big Idea Tasks: Finding the Volume of a Box (Supplemental)

##### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote

- Homework
- Quizzes
- Online Applications

### Summative Assessment

- Chapter 7 Common Assessment: Sections 7.1 – 7.8, Supp. Simplifying Rational Expressions
  - Chapter 7 Quiz: Sections 7.1 – 7.4

### **Suggested Learning Experiences and Instructional Strategies**

#### Instructional Strategies:

| Lesson | Topic                                         | Learning Targets                                                                                                                                                                               | Instructional Strategies                                                                                                                                                                                                                        |
|--------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.1    | Adding and Subtracting Polynomials            | <ul style="list-style-type: none"> <li>- Classify polynomials by degree and terms</li> <li>- Add and subtract polynomial expressions</li> <li>- Apply to real-life examples</li> </ul>         | <ul style="list-style-type: none"> <li>- CPA approach (use algebra tiles)</li> <li>- Interactive notebooks for organizing polynomial terms</li> <li>- Real-world modeling tasks</li> <li>- Guided practice with error analysis</li> </ul>       |
| 7.2    | Multiplying and Dividing Polynomials          | <ul style="list-style-type: none"> <li>- Multiply/divide polynomials by monomials</li> <li>- Multiply binomials using Distributive Property and FOIL</li> <li>- Multiply trinomials</li> </ul> | <ul style="list-style-type: none"> <li>- Foldables to show FOIL patterns</li> <li>- Use of visual diagrams and area models</li> <li>- Practice with digital algebra tools</li> <li>- Real-life problem-solving applications</li> </ul>          |
| 7.3    | Special Products of Polynomials               | <ul style="list-style-type: none"> <li>- Apply square of binomial pattern</li> <li>- Use sum and difference pattern</li> <li>- Solve problems using special products</li> </ul>                | <ul style="list-style-type: none"> <li>- Pattern discovery via manipulatives</li> <li>- Color-coding pattern components</li> <li>- Problem sets that model financial growth or physics applications</li> <li>- Peer teaching</li> </ul>         |
| 7.4    | Solving Polynomial Equations in Factored Form | <ul style="list-style-type: none"> <li>- Apply Zero Product Property</li> <li>- Factor using GCF</li> <li>- Solve polynomial equations using factoring</li> </ul>                              | <ul style="list-style-type: none"> <li>- Solve &amp; discuss with vertical whiteboards</li> <li>- Use of flow maps for factoring process</li> <li>- CPA progression to abstract solving</li> <li>- Real-life algebra-based scenarios</li> </ul> |

|     |                                  |                                                                                                                                                                                                          |                                                                                                                                                                                                                                             |
|-----|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.5 | Factoring $x^2+bx+c$             | <ul style="list-style-type: none"> <li>- Factor simple quadratics</li> <li>- Identify binomial pairs that produce the middle and last terms</li> </ul>                                                   | <ul style="list-style-type: none"> <li>- Use of puzzle-style factoring grids</li> <li>- Number bond practice to build understanding</li> <li>- Think-pair-share on choosing factor pairs</li> <li>- Mini-whiteboard practice</li> </ul>     |
| 7.6 | Factoring $ax^2+bx+c$            | <ul style="list-style-type: none"> <li>- Apply GCF first</li> <li>- Factor with <math>a \neq 1</math> using box or grouping method</li> <li>- Justify binomial factor choices</li> </ul>                 | <ul style="list-style-type: none"> <li>- Graphic organizers for trial factoring</li> <li>- Box method visuals</li> <li>- Factoring relay races</li> <li>- Scaffolded problem breakdown</li> </ul>                                           |
| 7.7 | Factoring Special Products       | <ul style="list-style-type: none"> <li>- Recognize and factor difference of squares</li> <li>- Identify perfect square trinomials</li> <li>- Apply to real-life situations</li> </ul>                    | <ul style="list-style-type: none"> <li>- Gallery walk for pattern spotting</li> <li>- Practice with color-coded examples</li> <li>- Case studies (e.g., area and finance problems)</li> <li>- Matching cards for factoring types</li> </ul> |
| 7.8 | Factoring Polynomials Completely | <ul style="list-style-type: none"> <li>- Factor using multiple strategies</li> <li>- Recognize combinations of factoring techniques</li> <li>- Solve real-world problems using full factoring</li> </ul> | <ul style="list-style-type: none"> <li>- Strategy sort cards</li> <li>- Structured choice practice (students select method)</li> <li>- Digital interactive factoring explorations</li> <li>- Real-world word problems</li> </ul>            |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice



- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

#### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

#### **For Advanced Learners**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Central Bucks School District – Course of Study

### Chapter 9: Radicals

#### Desired Results

##### Essential Questions:

- Why should radical expressions be simplified?
- How do you know when a radical expression is simplified?
- How can radical expressions be simplified and applied to solve problems?
- What are the different strategies for solving quadratic equations, and when is each most effective?

##### Enduring Understandings:

*Students will understand that...*

- Radicals need to be represented in simplest form.
- Radicals can be combined using addition, subtraction, multiplication and division.
- Radical expressions can be simplified using mathematical properties and operations.

##### Knowledge:

*Students will know...*

Definitions for: radical expression, simplest form of a radical, rationalizing the denominator, conjugates, like radicals, quadratic equation

##### Skills:

*Students will be able to...*

- Simplify square and cube roots.
- Simplify square roots with limited variables.
- Perform operations with radicals.
- Rationalize denominators.
- Write equivalent radical expressions.
- Solve quadratics using square roots.
- Approximate irrational solutions.
- Evaluate square roots of perfect squares.
- Evaluate expressions involving square roots.

### Standards:

| Algebra 1 Standard | Algebra 1 Standard Description                                                       | PA Keystone Algebra I Standards |
|--------------------|--------------------------------------------------------------------------------------|---------------------------------|
| CC.2.2.8.B.1       | Apply concepts of radicals and integer exponents to generate equivalent expressions. | A1.1.1.1                        |
| CC.2.2.HS.D.2      | Write expressions in equivalent forms to solve problems                              | A1.1.1.2                        |
| CC.2.2.HS.D.8      | Apply inverse operations to solve equations or formulas                              | A1.1.2.1                        |

### Acceptable Evidence

#### **Problem Solving Tasks:**

- Performance Task: A Stellar View, pg. 522 – 523
- STEM Performance Task: Golden Rectangle (Supplemental)
- Big Idea Tasks: Performing Operations with Square Roots (Supplemental)
- Big Idea Tasks: Writing and Solving Quadratic Equations (Supplemental)

#### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessment**

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications

#### **Summative Assessment**

- Chapter 9 Common Assessment: Sections 9.1, 9.3

### Suggested Learning Experiences and Instructional Strategies

### Instructional Strategies:

| Lesson | Title                                          | Key Objectives                                                                                                                                                                | Instructional Strategies                                                                                                                                                                                                                                                          |
|--------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.1    | Properties of Radicals                         | <ul style="list-style-type: none"><li>- Simplify expressions using radical properties</li><li>- Rationalize denominators</li><li>- Perform operations with radicals</li></ul> | <ul style="list-style-type: none"><li>- CPA approach with radical tiles</li><li>- Real-world problems with measurements</li><li>- Interactive whiteboard practice</li><li>- Math stations: simplify, rationalize, operate</li><li>- Use of radical expression foldables</li></ul> |
| 9.3    | Solving Quadratic Equations Using Square Roots | <ul style="list-style-type: none"><li>- Solve quadratics using square roots</li><li>- Estimate irrational solutions</li></ul>                                                 | <ul style="list-style-type: none"><li>- CPA with solving equations</li><li>- Anchor chart of square root properties</li><li>- Number line estimation</li><li>- Solve-and-swap peer activity</li><li>- Spiral review station</li></ul>                                             |

### Differentiation Options

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

### For Advanced Learners

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.

- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Chapter 11: Data Analysis and Displays

### Desired Results

#### Essential Questions:

- How can data be represented in various forms to accurately communicate information?
- What do measures of center and variation tell us about a data set?
- How can box-and-whisker plots and data distributions help compare and analyze sets of data?
- How do we determine the most appropriate way to display data?

#### Enduring Understandings:

*Students will understand that...*

- Data analysis involves understanding, organizing, representing, and interpreting data using various tools.
- Measures of center and variation provide insight into the distribution and spread of data.
- Different graphical displays highlight different features of data, and selecting the right display is critical to accurate data interpretation.
- Analyze relationships and patterns between two categorical variables.
- Awareness of misleading data displays is key in critical analysis of presented information.

#### Knowledge:

*Students will know...*

Definitions for: measure of center, mean, median, mode, outlier, measure of variation, range, box-and-whisker plot, quartile, five-number summary, interquartile range, segmented bar graph, qualitative (categorical) data, misleading graph, probability, compound probability

#### Skills:

*Students will be able to...*

- Calculate and interpret measures of center and variation (mean, median, mode, range, IQR).
- Create and analyze data displays, such as box-and-whisker plots, segmented bar graphs, and others.

- Determine probability of compound events.
- Choose the most appropriate data display for a given data set and recognize misleading representations.

### Standards:

| Algebra 1 Standard Code | Algebra 1 Standard Description                                                          | PA Keystone Algebra I Standards |
|-------------------------|-----------------------------------------------------------------------------------------|---------------------------------|
| CC.2.4.HS.B.1           | Summarize, represent, and interpret data on a single count or measurement variable.     | A1.2.3.1<br>A1.2.3.2            |
| CC.2.4.HS.B.2           | Summarize, represent, and interpret data on two categorical and quantitative variables. | A1.2.3.1<br>A1.2.3.2            |

### **Acceptable Evidence**

#### **Problem Solving Tasks:**

- Performance Task: Robotics, pg. 610 – 611
- STEM Performance Task: Shoe Ownership (Supplemental)
- Big Idea Tasks: Understanding Measures of Center and Variation (Supplemental)
- Big Idea Tasks: Writing and Comparing Data Sets (Supplemental)
- Big Idea Tasks: Understanding a Two – Way Table (Supplemental)
- Big Idea Tasks: Analyzing Data for a Company (Supplemental)

#### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessment**

- Warm-ups & Exit Slips
- Checkpoint assignments for each cycle
- Resources from the textbook, including remedial practice and enrichment opportunities
- Classwork
- Keep a notebook with pen and paper or use Microsoft OneNote
- Homework
- Quizzes
- Online Applications

#### **Summative Assessment**

- Chapter 11 Common Assessment: Sections 11.1 – 11.2, 11.4 – 11.6, Supp. Stem and Leaf, Probability and Odds
  - Chapter 11 Quiz: Sections 11.1 – 11.2, Supp. Stem and Leaf

## Suggested Learning Experiences and Instructional Strategies

### Instructional Strategies:

| Lesson | Title                            | Key Objectives                                                                                                                                                                                             | Instructional Strategies                                                                                                                                                                                                                                                                                       |
|--------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.1   | Measures of Center and Variation | <ul style="list-style-type: none"><li>• Find mean, median, and mode.</li><li>• Calculate range and interquartile range.</li><li>• Compare and interpret data sets.</li></ul>                               | <ul style="list-style-type: none"><li>• Use of real-world data sets (e.g., sports stats).</li><li>• CPA model with manipulatives and visuals.</li><li>• Interactive graphing tools (technology integration).</li><li>• Pair-share data interpretation tasks.</li><li>• Math journals for reflection.</li></ul> |
| 11.2   | Box-and-Whisker Plots            | <ul style="list-style-type: none"><li>• Create box-and-whisker plots.</li><li>• Interpret components of plots.</li><li>• Identify and analyze outliers.</li><li>• Compare data sets using plots.</li></ul> | <ul style="list-style-type: none"><li>• Technology: graphing calculators or Desmos.</li><li>• Real-world application: test score analysis.</li><li>• Cooperative learning in small groups.</li><li>• Anchor charts for visual reference.</li></ul>                                                             |



|      |                         |                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                |
|------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.6 | Choosing a Data Display | <ul style="list-style-type: none"> <li>• Classify qualitative vs. quantitative data.</li> <li>• Select appropriate data displays.</li> <li>• Recognize and critique misleading graphs.</li> </ul> | <ul style="list-style-type: none"> <li>• Project-based learning (create a misleading vs accurate graph).</li> <li>• Kahoot quizzes to reinforce concepts.</li> <li>• Use of flowcharts for display selection.</li> <li>• Student presentations of created displays.</li> </ul> |
|------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### **Differentiation Options**

- Utilize study guide and intervention for students who need more reteaching.
- Tier 1:
  - In – Class Practice Quick Check Exercises
  - Lesson Extra Practice
  - Lesson Dig Deeper
  - Differentiating the lesson to reinforce or extend student learning
- Tier 2:
  - Skill Builder for prior learning skills
- Tier 3:
  - Skills Foundation to support skill development
- Skills Trainer for additional skills-based practice
- Performance, STEM, and Big Idea Tasks for lesson extension and enrichment

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Closure, encouraging students to use the chapter vocabulary.
- Multi-Language Glossaries/Online Translate feature

### **For Advanced Learners**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.

- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects



## Honors Geometry

Course Number: 2415

Course Level: Honors

Grade: 9-12

Time/Credit:      Grades 9 – 12: 1 credit  
Senior High –1 block daily

Revision: Fall 2025 – Spring 2026

School Board Approval: August 2021

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District**  
**K-12 Mathematics Teaching and Learning Principles**

1. Investigating, problem-solving, and communicating about mathematics (speaking, reading, writing, representing, and listening) stimulates students' curiosity, builds confidence, and leads students' toward deeper conceptual understanding.
2. Lessons should address students' strengths, interests, and learning styles through differentiated instruction.
3. All students can achieve excellence in mathematics when:
  - instruction is appropriately paced
  - teachers set high expectations
  - students feel supported by their teachers, parents and administrators
4. Students must be actively engaged in learning experiences designed to connect to their prior knowledge.
5. For students to transfer and use knowledge meaningfully teachers need to:
  - a. present new ideas within rich and meaningful contexts
  - help students to make connections to their lives both within and outside of school
6. Mathematics instruction is more effective when teachers incorporate:
  - manipulatives
  - calculators
  - technology
  - real-time data collection devices (motion detectors, temperature probes,...)
7. Assessment should be ongoing, diagnostic, and aligned with instruction.

**Documents Considered:**

- (2000). Principles and Standards for School Mathematics. Reston, VA: National Council of Teachers of Mathematics.
- Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.
- Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.
- Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann

**Central Bucks School District**  
**K – 12 Mathematics Program Enduring Understandings**

**Students will understand that:**

**The Nature of Mathematics**

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.

**Numbers and Operations**

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.
- Estimates help determine the reasonableness of an answer.
- Expressions are simplified using a predetermined order of operations.

**Measurement**

- Measurements collected using any tools (except for counting) are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing one linear dimension in a figure with two or three dimensions will have a different effect on the figure's perimeter, circumference, area, or volume.

**Geometry**

- Points, lines, and planes are the building blocks of geometry.
- Each geometric figure has a specific naming convention.
- Postulates, theorems, definitions, and properties are used to:
  - justify reasoning in a direct proof
  - establish relationships involving two and three-dimensional figures.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter and volume) are used for identification.
- The Pythagorean Theorem and trigonometric ratios are used to find missing quantities in right triangles.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.

**Algebraic Concepts**

- Algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems involving a constant rate of change can be modeled using proportional reasoning.
- Algebraic expressions, equations, inequalities, and functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic) are used to model relationships between quantities in real-world situations.
- Patterns and functions can be generalized and represented using; verbal models, tables, equations, and graphs.
- Systems of equations are solved both graphically and algebraically and are used to model real-life problems.

**Data Analysis and Probability**

- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Probability is used to make informed predictions and inferences.

**Central Bucks School District**  
**K – 12 Mathematics Program Essential Questions**

**The Nature of Mathematics**

- What characteristics make mathematics a language?
- When is the correct solution not the answer to a problem?

**Numbers and Operations**

- How do you know that an answer is reasonable?
- Why are there different number systems?
- How do you determine when to calculate with pencil and paper, find an estimate, or use a calculator?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

**Measurement**

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension affect a figure's length, area and volume?

**Geometry**

- Why do all statements need justification?
- What is the logical progression of statements in a proof?
- How are figures classified?
- How do you name a geometric figure and why are standard naming conventions important?
- Why are points, lines, and planes so important in Euclidean geometry?
- How and when is the Pythagorean Theorem used?
- What do similarity and congruency statements tell you about polygons?

**Algebraic Concepts**

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a pattern/function in different ways?

**Data Analysis and Probability**

- What is the purpose of collecting data?
- How is data used or abused?
- How do we make predictions based on probability?

**Central Bucks School District – Course of Study**  
**Honors Geometry Overview**

**Desired Results**

**Course Description:**

This course is designed for students who have successfully completed Algebra 1. Honors Geometry covers topics including but not limited to deductive reasoning and proofs, parallel lines and planes, congruence, similarity, quadrilaterals and polygons, right triangles, right triangle trigonometry, circles, areas, volumes, and coordinate geometry. There will be an emphasis on applying algebra to geometric figures and applying geometric concepts to real world scenarios. This course is weighted at .25 as a recognition of the fact that it is more demanding and has more requirements that go beyond those of the standard mathematics course.

**Prerequisite:** (2812) Accelerated Algebra 1, A- (90% or better) or teacher recommendation, or (2810 or 2915) Algebra 1, A- (90% or better) and teacher recommendation.

**Committee Members (Original):** Janet Bachelor, Vicki Blasko, Alexis Carp, Ali Coleman, Laura Domzalski, Kari Farrell, Melinda Fuller, Melissa Greenberg, Leanne Jarossy, Dan Mager, Rich Mirable, Rachel Pileggi, Madeline Putterman, Matt Timmins, Frank Woodring, Richard Kratz: K – 12 Mathematics Supervisor

**Committee Members (2026 Update):** Janet Bachelor, Molly Landis, Dan Mager, Erin Walsh, Brian Novick: K – 12 Mathematics Supervisor

**Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Right Triangle Applications

**Common Summative Assessment 1 Description:** Students are asked to use right triangle trigonometry to solve an application problem.

**Common Summative Assessment 2 Title:** Area & Perimeter of Plane Figures

**Common Summative Assessment 2 Description:** Students are asked to calculate area and perimeter of a composite figure and answer application questions.

**HS Final Exam and Course Grading** – Final Exam: 10%, Marking Period 1 or 3: 45%, Marking Period 2 or 4: 45%



## Honors Geometry Pacing Guide

| Content                                                                                                                                                                                                                                                                                                                                        | H.S. Days |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Tools of Geometry</b>                                                                                                                                                                                                                                                                                                              | <b>12</b> |
| Welcome, Introductions, Syllabus                                                                                                                                                                                                                                                                                                               | 1         |
| 1-1 Points, Lines, and Planes<br>0-9 Simplifying Square Roots (no conjugates, no rationalizing denominators)<br>1-2 Line Segments and Distance (Include Distance Formula; Include Segment Addition Algebra Connections; No Constructions)<br>1-3 Locating Points and Midpoints (Midpoint Formula Optional)<br>Formative Assessment             | 4         |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                     | 1         |
| 1-4 Angle Measure (No Constructions; Include Algebra Connections of Angle Addition)<br>1-5 Angle Relationships (with Algebra Connections)<br>1-6 Two Dimensional Figures<br>Formative Assessment                                                                                                                                               | 4         |
| Unit 1 Review                                                                                                                                                                                                                                                                                                                                  | 1         |
| Unit 1 Summative Assessment                                                                                                                                                                                                                                                                                                                    | 1         |
| <b>Unit 2 – Logical Arguments and Line Relationships</b>                                                                                                                                                                                                                                                                                       | <b>14</b> |
| 0-8 Algebra Skill: Systems of Equations                                                                                                                                                                                                                                                                                                        | 1         |
| 2-1 Part 2 and 2-2 Part 2 Conditional Statements (Conditionals, Converse, Counterexample, and Biconditional)<br>2-4 Writing Proofs; Postulates; Properties of Equality<br>2-5 Properties of Congruence; Algebraic Proofs<br>2-5 Proving Segment Relationships (optional)<br>2-6 Proving Angle Relationships (optional)<br>Formative Assessment | 4         |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                     | 1         |
| 2-7 Parallel Lines and Transversals<br>2-8 Slope and Equations of Lines (no point-slope)<br>2-9 Proving Lines Parallel<br>Formative Assessment                                                                                                                                                                                                 | 5         |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                     | 1         |
| Unit 2 Review                                                                                                                                                                                                                                                                                                                                  | 1         |
| Unit 2 Summative Assessment                                                                                                                                                                                                                                                                                                                    | 1         |
| <b>Unit 3 – Triangle Foundations &amp; Similarity</b>                                                                                                                                                                                                                                                                                          | <b>10</b> |
| Supplement and 5-2 Triangle Classification & Vocabulary<br>Angles of Triangles<br>5-3 Part 2 Inequalities in One Triangle (Angle-Side Inequalities)<br>5-5 part 1 The Triangle Inequality<br>Formative Assessment                                                                                                                              | 3         |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                     | 1         |
| Algebra Review: Solving Quadratics by Factoring ( $a = 1$ ; Difference of Two Squares); Solving Proportions                                                                                                                                                                                                                                    | 2         |

|                                                                                                                                                                                                                                    |           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 7-2 Similar Polygons<br>7-3 AA Similarity (Including Indirect Measurement; Some practice problems in 7-4)<br>7-4 SSS and SAS Similarity (optional)<br>7-5 Parallel Lines and Proportional Parts (optional)<br>Formative Assessment | 2         |
| Unit 3 Remediation and Enrichment                                                                                                                                                                                                  | 1         |
| Unit 3 Summative Assessment                                                                                                                                                                                                        | 1         |
| <b>Unit 4 – Right Triangles and Trigonometry</b>                                                                                                                                                                                   | <b>12</b> |
| 0-9 Square Roots and Simplifying Radicals<br>8-1 Geometric Mean (optional)<br>8-2 The Pythagorean Theorem & Its Converse<br>8-3 Special Right Triangles<br>Formative Assessment                                                    | 4         |
| Remediation and Enrichment                                                                                                                                                                                                         | 1         |
| 8-4 Trigonometry<br>8-5 Angle of Elevation and Depression; Applications; Area & Perimeter of Triangles<br>Formative Assessment                                                                                                     | 4         |
| Remediation and Enrichment                                                                                                                                                                                                         | 1         |
| Core 1<br>Unit 4 Review                                                                                                                                                                                                            | 1         |
| Unit 4 Summative Assessment                                                                                                                                                                                                        | 1         |
| <b>Unit 5 – Congruent Triangles</b>                                                                                                                                                                                                | <b>8</b>  |
| 4-2 Congruent Triangles<br>4-3 Proving Triangles Congruent – SSS, SAS<br>4-4 Proving Triangles Congruent – ASA, AAS<br>Formative Assessment                                                                                        | 4         |
| Remediation and Enrichment                                                                                                                                                                                                         | 1         |
| 4-5 Proving Right Triangles Congruent (optional)<br>4-6 Isosceles and Equilateral Triangles<br>8-6, 8-7 Law of Sines & Law of Cosines (optional)<br>Formative Assessment                                                           | 1         |
| Unit 5 Remediation and Enrichment                                                                                                                                                                                                  | 1         |
| Unit 5 Summative Assessment                                                                                                                                                                                                        | 1         |
| <b>Unit 6 – Quadrilaterals &amp; Polygons</b><br><b>Note: Integrate Area and Perimeter from 10-1 and 10-2 throughout the Unit</b>                                                                                                  | <b>12</b> |
| 6-1 Angles of Polygons<br>6-2 Parallelograms<br>6-3 Tests for Parallelograms (optional)<br>Formative Assessment                                                                                                                    | 3         |
| Remediation and Enrichment                                                                                                                                                                                                         | 1         |
| 6-4 Special Parallelograms: Rectangles<br>6-5 Special Parallelograms: Rhombi & Squares<br>6-6 Trapezoids (Kites Optional)<br>Formative Assessment                                                                                  | 4         |
| Remediation and Enrichment                                                                                                                                                                                                         | 1         |
| Core 2                                                                                                                                                                                                                             | 0.5       |

|                                                                                                                                                                                                                                       |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit 6 Review                                                                                                                                                                                                                         | 1.5       |
| Unit 6 Summative Assessment                                                                                                                                                                                                           | 1         |
| <b>Unit 7 – Circles</b>                                                                                                                                                                                                               | <b>7</b>  |
| 9-1 Circles & Circumference & Circle Vocabulary<br>9-2 Measuring Angles & Arcs; Arc Length<br>10-3 Area of Circle; Sector Area<br>Formative Assessment                                                                                | 5         |
| Remediation and Enrichment                                                                                                                                                                                                            | 1         |
| 9-3 Arcs & Chords<br>9-4 Inscribed Angles<br>9-5 Tangents<br>9-6 Secants, Tangents, and Angle Measures<br>9-7 Equation of Circles                                                                                                     | Optional  |
| Unit 7 Review                                                                                                                                                                                                                         | 0.5       |
| Unit 7 Summative Assessment                                                                                                                                                                                                           | 0.5       |
| <b>Unit 8: Mixed Area, Surface Areas, &amp; Volume</b>                                                                                                                                                                                | <b>9</b>  |
| Ch 10 Mixed Area Review<br>10-4 Regular Polygons (optional)<br>1-8 Three Dimensional Figures<br>10-6 Surface Area<br>11-2 Volume of Prisms and Cylinders<br>11-3 Volume of Pyramids and Cones<br>11-4 Spheres<br>Formative Assessment | 7         |
| Unit 8 Remediation and Enrichment                                                                                                                                                                                                     | 1         |
| Unit 8 Summative Assessment                                                                                                                                                                                                           | 1         |
|                                                                                                                                                                                                                                       |           |
| Final Exam Review & Final Exam                                                                                                                                                                                                        | 4         |
| <b>Total</b>                                                                                                                                                                                                                          | <b>88</b> |

NOTE: Additional remediation in standards/content from the grade level (or previous grade level) where the student completes this course will be provided for students when the teacher determines a student has not yet mastered that content. Enrichment opportunities will also be provided to meet the needs of students that acquire an understanding of the content faster than their class peers.

## Required Texts and Software

**Glencoe Geometry, McGraw-Hill Publishing Company, Copyright 2018**

**Citation:** J. Carter, G. Cuevas, R. Day, C. Malloy, C. Glencoe Geometry, McGraw-Hill Education, Columbus, Ohio, 2018. ISBN: 978-0-07-903994-1

Geometer's Sketchpad (computer software)

Scientific Calculator

### Calculator Recommendation

The secondary mathematics department of Central Bucks School district recognizes the use of calculators as a valuable tool for learning in the mathematics classroom. In certain advanced courses graphing calculators with specific capabilities are important for daily classroom performance and are required for advanced placement tests. While no specific brands are endorsed, there are restrictions on the type of calculators allowed on certain classroom tests and final exams. Calculators which do operations with variables, such as the TI-89, TI-92 and HP49G will not be permitted to be used on district final exams, even though they may be used on some nationwide tests. Teachers have discretion as to whether these types can be used for particular classroom-related purposes.

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 1 – Tools of Geometry

### Desired Results:

#### Essential Questions:

- Why is it important to use consistent symbols and vocabulary to communicate?
- How are algebraic equations applied to geometric situations?
- How can we determine if a solution is reasonable?

#### Enduring Understandings:

##### Students will understand that...

- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- assumptions about figures cannot be made.

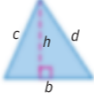
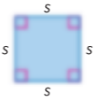
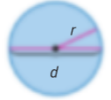
#### Knowledge:

##### Students will know...

- Vocabulary: acute angle, adjacent angles, angle, angle bisector, area, base, circumference, collinear, complementary angles, concave, congruent, convex, coplanar, degree, distance, edge, equiangular polygon, equilateral polygon, exterior, interior, intersection, line, line segment, linear pair, midpoint, n-gon, obtuse angle, opposite rays, perfect square, perimeter, perpendicular, plane, point, polygon, radical, ray, regular polygon, right angle, segment bisector, side, space, square root, supplementary angles, undefined term, vertex, vertex of a polygon, vertical angles
- Symbols/Notation:
  - Point: A
  - Line:  $\overleftrightarrow{AB}$
  - Plane: ABC or ABCD
  - Angle:  $\angle ABC$
  - Angle Measure:  $m\angle ABC$
  - Degree:  $^{\circ}$
  - Segment:  $\overline{AB}$
  - Segment Length: AB
  - Ray:  $\overrightarrow{AB}$
  - Perpendicular:  $\perp$
  - Congruent: @
- Postulates:
  - Segment Addition Postulate: If B is between A and C, then  $AB + BC = AC$ .  
Note: Textbook (p. 14) refers to this concept as “betweenness of points.”
  - Angle Addition Postulate:
    - If point B lies in the interior of  $\angle AOC$ , then  $m\angle AOB + m\angle BOC = m\angle AOC$ .
    - If  $\angle AOC$  is a straight angle and B is any point not on line AC, then  $m\angle AOB + m\angle BOC = 180$ .  
Note: The book does not formally introduce this until chapter 2.
- Theorems:
  - Through a line and a point not in the line there is exactly one plane.
  - If two lines intersect, then exactly one plane contains the lines.
  - Vertical Angle Theorem: Vertical angles are congruent.  
Note: The book does not formally introduce this as a Theorem until chapter 2.

• **Formulas:**

- Distance Formula:  $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Optional: Midpoint Formula:  $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
- Introduction to Area & Perimeter/Circumference Formulas (see p. 58)

| Key Concept Perimeter, Circumference, and Area                                    |                                                                                   |                                                                                   |                                                                                    |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Triangle                                                                          | Square                                                                            | Rectangle                                                                         | Circle                                                                             |
|  |  |  |  |
| $P = b + c + d$                                                                   | $P = s + s + s + s$<br>$= 4s$                                                     | $P = \ell + w + \ell + w$<br>$= 2\ell + 2w$                                       | $C = 2\pi r$ or<br>$C = \pi d$                                                     |
| $A = \frac{1}{2}bh$                                                               | $A = s^2$                                                                         | $A = \ell w$                                                                      | $A = \pi r^2$                                                                      |
| $P$ = perimeter of polygon<br>$b$ = base, $h$ = height                            |                                                                                   | $A$ = area of figure<br>$\ell$ = length, $w$ = width                              |                                                                                    |
|                                                                                   |                                                                                   | $C$ = circumference<br>$r$ = radius, $d$ = diameter                               |                                                                                    |

**Skills:**

**Students will be able to...**

- draw or list physical representations of the terms point, line, and plane to develop a foundation for Geometry.
- discuss, visualize, and answer questions about fundamental rules relating the building blocks of geometry (point, line, plane, and space).
- classify points as collinear, not collinear, coplanar, and/or noncoplanar.
- use the proper symbols for lines, segments, rays, distances, angles, and angle measures.
- identify the vertex and sides of an angle.
- classify an angle by measure.
- identify and calculate measure of special pairs of angles.
- apply algebra to geometric diagrams to solve for unknowns and measurements (segment addition, angle addition, complementary and supplementary angles, angle bisector, midpoint, special pairs of angles, and vertical angles).
- determine if numeric solutions are logical.
- draw accurate conclusions about geometric situations.
- simplify square roots.
- calculate and apply distance using coordinate geometry.

**Standards:**

Priority:

CC.2.3.HS.A.11: Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.2.HS.A.14: Apply geometric concepts to model and solve real world problems.

CC.2.2.HS.D.5: Use polynomial identities to solve problems.

Supporting:

CC.2.2.HS.D.2: Write expressions in equivalent forms to solve problems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

CC.2.2.HS.D.9: Use reasoning to solve equations and justify the solution method.

**Acceptable Evidence:**

**Performance Tasks –**

- Geometry Lab – Describing What You See (p. 13)

## Acceptable evidence of learning other than Performance Tasks:

### Formative Assessment

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, Delta Math, IXL, etc.
- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

### Assessment, Remediation, & Enrichment after section 1-3 and 1-6

### Summative Assessment

- Unit 1 Exam

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Emphasize use of proper notation and vocabulary throughout course is critical
- Use physical examples in the room, school, and world to represent points, lines, and planes.
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL
- For simplifying square roots, if students have a calculator that will simplify for them, require students to show work and/or give a non-calculator assessment on this skill.

### Instructional Strategies:

- Use mnemonic devices/phrases to remember key concepts:
  - part + part = whole
  - complementary comes before supplementary alphabetically and numerically.

### Differentiation/Intervention/Enrichment Options:

| Sections | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|----------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| 0-9      | X                            | X               | X                  | X                     | X                |
| 1-1      | X                            | X               | X                  | X                     | X                |
| 1-2      | X                            | X               | X                  | X                     | X                |
| 1-3      | X                            | X               | X                  | X                     | X                |
| 1-4      | X                            | X               | X                  | X                     | X                |
| 1-5      | X                            | X               | X                  | X                     | X                |
| 1-6      | X                            | X               | X                  | X                     | X                |

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

**For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

**For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects



# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 2 – Logical Arguments and Line Relationships

### Desired Results:

#### Essential Questions:

- Why is it important to use consistent symbols and vocabulary to communicate?
- What is the logical progression of statements in a proof?
- Why do all statements need justification?
- How can geometric properties be used to prove relationships?
- When two lines are cut by a transversal, what can be concluded?

#### Enduring Understandings:

##### Students will understand that...

- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- learning geometric proofs helps us with reason logically, defend arguments, and organize our thoughts.
- every statement or conclusion requires justification.
- assumptions about figures cannot be made.
- an algebraic relationship exists between special angle pairs formed by parallel lines and a transversal.

#### Knowledge:

##### Students will know...

Vocabulary: (Vocabulary from required sections): conditional statement, hypothesis, conclusion, converse, counterexample, biconditional, postulate, proof, parallel lines, algebraic proof, theorem, two column proof, parallel lines, intersecting lines, skew lines, parallel planes, transversal, alternate interior angles, alternate exterior angles, consecutive interior angles, corresponding angles, perpendicular lines, slope, slope-intercept form (Vocabulary from optional sections): deductive reasoning, inductive reasoning, negation, contrapositive, axiom, flow proof, paragraph proof, informal proof, formal proof

- Rules:
  - Slope Formula:  $m = \frac{y_2 - y_1}{x_2 - x_1}$
  - Slope-Intercept:  $y = mx + b$
- Symbols:
  - Parallel: //
  - Perpendicular:  $\perp$
- Properties:
  - Properties of Equality:
    - Addition Property of Equality: If  $a = b$  and  $c = d$ , then  $a + c = b + d$ .
    - Subtraction Property of Equality: If  $a = b$  and  $c = d$ , then  $a - c = b - d$ .
    - Multiplication Property of Equality: If  $a = b$ , then  $ca = cb$ .
    - Division Property of Equality: If  $a = b$  and  $c \neq 0$ , then  $\frac{a}{c} = \frac{b}{c}$ .
    - Substitution Property of Equality: If  $a = b$ , then either  $a$  or  $b$  may be substituted for the other in any equation (or inequality).
    - Reflexive Property of Equality:  $a = a$ .
    - Symmetric Property of Equality: If  $a = b$ , then  $b = a$ .
    - Transitive Property of Equality: If  $a = b$  and  $b = c$ , then  $a = c$ .

- Distributive Property of Equality:  $a(b + c) = ab + ac$ .
- Properties of Congruence:
  - Reflexive Property of Congruence:  $\overline{DE} \cong \overline{DE}$
  - Symmetric Property of Congruence: If  $\overline{DE} \cong \overline{FG}$ , then  $\overline{FG} \cong \overline{DE}$ .
  - Transitive Property of Congruence: If  $\overline{DE} \cong \overline{FG}$  and  $\overline{FG} \cong \overline{JK}$ , then  $\overline{DE} \cong \overline{JK}$ .
- Postulates:
  - Segment Addition Postulate: If B is between A and C, then  $AB + BC = AC$ .
  - Angle Addition Postulate: If point B lies in the interior of  $\angle AOC$ , then  $m\angle AOB + m\angle BOC = m\angle AOC$
  - A line contains at least 2 points; a plane contains at least 3 noncollinear points; space contains at least 4 points not all in one plane.
  - Through any two points there is exactly one line.
  - Through any three noncollinear points there is exactly one plane.
  - If two points are in a plane, then the line that contains the points is in that plane.
  - If two planes intersect, then their intersection is a line.
  - Corresponding Angles Postulate: If two lines are cut by transversal, then each pair of corresponding angles is congruent.
  - Converse of Corresponding Angles Postulate: If two lines are cut by a transversal so that corresponding angles are congruent, then the lines are parallel.
  - Parallel Postulate: If given a line and a point not on the line, then there exists exactly one line through the point that is parallel to the given line.
  - Perpendicular Postulate: If given a line and a point not on the line, then there exists exactly one line through the point that is perpendicular to the given line.
- Theorems:
  - If two lines intersect, then they intersect in exactly one point.
  - Vertical Angles Theorem: Vertical angles are congruent.
  - Alternate Interior Angles Theorem: If two lines are cut by transversal, then each pair of alternate interior angles is congruent.
  - Consecutive Interior Angles Theorem: If two lines are cut by transversal, then each pair of consecutive interior angles is supplementary.
  - Alternate Exterior Angles Theorems: If two lines are cut by transversal, then each pair of alternate exterior angles is congruent.
  - Alternate Exterior Angles Converse: If two lines in a plane are cut by a transversal so that a pair of alternate interior angles is congruent, then the two lines are parallel.
  - Consecutive Interior Angles Converse: If two lines in a plane are cut by a transversal so that a pair of consecutive interior angles is supplementary, then the lines are parallel.
  - Alternate Interior Angles Converse: If two lines in a plane are cut by a transversal so that a pair of alternate interior angles is congruent, then the lines are parallel.
  - Slopes of Parallel Lines Theorem: Two distinct nonvertical lines have the same slope if and only if they are parallel. All vertical lines are parallel.
  - Slopes of Perpendicular Lines Theorem: Two nonvertical lines are perpendicular if and only if the product of their slopes is -1. Vertical and horizontal lines are perpendicular.
- Additional knowledge, rules, properties, postulates, and theorems used for enrichment (optional):
  - Through a point outside a line, there is exactly one line perpendicular to the given line.
  - Supplement Theorem: If two angles form a linear pair, then they are supplementary angles. (Linear Pair Postulate).
  - Complement Theorem: If the noncommon sides of two adjacent angles form a right angle, then the angles are complementary angles.
  - Congruent Supplements Theorem: Angles supplementary to the same angle or to congruent angles are congruent.

- Congruent Complements Theorem: Angles complementary to the same angle or to congruent angles are congruent.
- Perpendicular lines intersect to form four right angles.
- All right angles are congruent.
- Perpendicular lines form congruent adjacent angles.
- If two angles are congruent and supplementary, then each angle is a right angle.
- If two congruent angles form a linear pair, then they are right angles.
- Perpendicular Transversal Theorem: In a plane, if a line is perpendicular to one of two parallel lines, then it is perpendicular to the other.
- Perpendicular Transversal Converse: In a plane, if two lines are perpendicular to the same line, then they are parallel.
- Distance Between a Point and a Line: The distance between a line and a point not on the line is the length of the segment perpendicular to the line from the point.

#### **Skills:**

##### **Students will be able to...**

- classify lines as parallel, perpendicular, or neither.
- identify conditional statements, hypothesis, conclusion.
- create converse statements and determine whether they are true or false.
- provide either a counterexample or a biconditional statement.
- solve basic algebra equations in a proof form.
- defend geometric statements using theorems, postulates, and properties.
- defend proof statements using properties, definition, postulates, and theorems.
- write equations of lines given parameters.
- use properties of pairs of lines to identify angle relationships and find angle measures.
- prove that lines are parallel.
- solve systems of linear equations using the substitution method and the elimination method.

#### **Standards:**

##### Priority:

CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.

##### Supporting:

CC.2.3.HS.A.11: Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

CC.2.2.HS.D.9: Use reasoning to solve equations and justify the solution method.

#### **Acceptable Evidence:**

##### **Performance tasks –**

- p. 157 #17 – Critique Arguments
- Extend 2-8: Equations of Perpendicular Bisectors (p. 185)
- Preparing for Assessment – Chapter 2 – Performance Task (p. 212)

##### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, Delta Math, IXL, etc.

- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

Assessment, Remediation, & Enrichment after section 2-5 and 2-9

Summative Assessment

- Unit 2 Quizzes and Exam

## Suggested Learning Experiences and Instruction

Learning Experiences:

- Introduce proofs using algebraic justifications of statements.
- Uno Activity: Use the game Uno to allow students to explain their moves in the game (defend their move). For example, if there is a red 4 showing and they play a red 7, they can defend this move with “Same Color Rule.” Students can make strings of cards and defend the moves from one card to another in a proof format.
- Introduce geometric proofs by using algebraic justification of statements.
- Progress through introduction of proofs using scaffolding. Provide some reasons and/or statements and have students fill in to develop student understanding of formal geometric proofs.
- Use real world and geometric examples to demonstrate logical statements.
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL
- Use Parallel Lines Sketchpad or Desmos Activities to learn about special angle relationships

Instructional Strategies:

- Color code special pairs of angles to identify alternate interior, alternate exterior, consecutive interior, and corresponding angles. Color code parallel lines and transversal.
- Emphasize that the special pairs of angles exist with any coplanar lines cut by a transversal, not just parallel lines. The pairs are only congruent or supplementary if the lines are parallel.
- Use real world examples of parallel and perpendicular lines.

## Differentiation Options

| Sections | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|----------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| 0.8      | X                            | X               | X                  | X                     | X                |
| 2-1      | X                            | X               | X                  | X                     | X                |
| 2-2      | X                            | X               | X                  | X                     | X                |
| 2-4      | X                            | X               | X                  | X                     | X                |
| 2-5      | X                            | X               | X                  | X                     | X                |
| 2-6      | X                            | X               | X                  | X                     | X                |
| 2-7      | X                            | X               | X                  | X                     | X                |
| 2-8      | X                            | X               | X                  | X                     | X                |
| 2-9      | X                            | X               | X                  | X                     | X                |

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.

- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

#### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

#### **For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 3 – Triangle Foundations & Similarity

### Desired Results:

#### Essential Questions:

- Why is it important to use consistent symbols and vocabulary to communicate?
- How can triangles be classified based on angle and side properties?
- What are important properties of triangles and how will they help us with higher level mathematics?
- What does a similarity statement say about polygons?
- What information is needed to show similar figures?
- How can similarity be applied to real world applications?

#### Enduring Understandings:

##### Students will understand that...

- triangles are a foundational shape and the properties of triangles have far reaching application in mathematics.
- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- assumptions about figures cannot be made.
- similar figures can be used to draw conclusions about sides and angles.
- similarity can be used to model real world applications.

#### Knowledge:

##### Students will know...

- Vocabulary: acute triangle, right triangle, obtuse triangle, equiangular triangle, scalene triangle, isosceles triangle, equilateral triangle, exterior angle, median, altitude, perpendicular bisector, scale factor, similar figures, similarity, proportional, cross product, reciprocal, proportional lengths, factoring, quadratic, ratio, solve, difference of two squares, factor
- Notation:
  - Similar:  $\sim$
  - Triangle:  $\triangle ABC$
- Postulates:
  - AA Similarity Postulate: If two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.
- Theorems:
  - Triangle Sum Theorem: The sum of the measures of the angles of a triangle is 180.
  - Exterior Angle Theorem: The measure of an exterior angle of a triangle equals the sum of the measures of the two remote interior angles.
  - If one side of a triangle is longer than a second side, then the angle opposite the first side is larger than the angle opposite the second side.
  - If one angle of a triangle is larger than a second angle, then the side opposite the first angle is longer than the side opposite the second angle.
  - The Triangle Inequality: The sum of the lengths of any two sides of a triangle is greater than the length of the third side.
  - The Isosceles Triangle Theorem: The base angles of an isosceles triangle are congruent.
  - Perimeters of Similar Polygons: If two polygons are similar, then their perimeters are proportional to the scale factor between them.
- Corollaries:

- An equilateral triangle is also equiangular.
- An equilateral triangle has three  $60^\circ$  angles.
- The bisector of the vertex angle of an isosceles triangle is perpendicular to the base at its midpoint.
- In a triangle, there can be at most one right angle or obtuse angle.
- The acute angles of a right triangle are complementary.
- Additional knowledge, rules, properties, postulates, and theorems used for enrichment (optional):
  - SAS Similarity Theorem: If an angle of one triangle is congruent to an angle of another triangle and the sides including those angles are in proportion, then the triangles are similar.
  - SSS Similarity Theorem: If the sides of two triangles are in proportion, then the triangles are similar.
  - Triangle Proportionality Theorem: If a line parallel to one side of a triangle intersects the other two sides, then it divides those sides proportionally.
  - Triangle Angle-Bisector Theorem: If a ray bisects an angle of a triangle, then it divides the opposite side into segments proportional to the other two sides.
  - If three parallel lines intersect two transversals, then they divide the transversals proportionally.

### **Skills:**

#### **Students will be able to...**

- classify triangles by their sides and their angles.
- use the Triangle Sum Theorem and Exterior Angle Theorem to set up algebraic equations to find missing angle measures.
- identify the legs, base angles, base, and vertex angle of an isosceles triangle to use the Isosceles Triangle Theorem.
- distinguish between the segments drawn in a triangle (altitude, median, perpendicular bisector).
- apply the relationships of a triangle to identify the longest and shortest sides, and largest to smallest angles.
- apply the Triangle Inequality to determine if three given side lengths can create a triangle.
- apply the Triangle Inequality to determine the possible lengths of the third side of a triangle given two sides (greater than difference, less than sum).
- set up and solve algebraic equations involving sides of isosceles and equilateral triangles.
- write similarity statements using proper notation for similar figures.
- find and interpret the scale factor between two figures.
- determine whether figures are similar.
- solve proportions for missing variables.
- use scale factors to set up proportions and calculate unknown measures of similar polygons.
- use proportions to solve for missing sides in similar figures.
- solve application problems involving similar figures.
- solve quadratics by factoring (leading coefficient = 1).
- solve quadratics by factoring using difference of two squares.

### **Standards:**

#### Priority:

CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.5: Create justifications based on transformations to establish similarity of plane figures.

CC.2.2.HS.A.14: Apply geometric concepts to model and solve real world problems.

#### Supporting:

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

CC.2.2.HS.D.9: Use reasoning to solve equations and justify the solution method.

## Acceptable Evidence:

### Performance tasks –

- Geometry Lab: Constructing Medians and Altitudes (p. 364)
- Model Maker Chapter 7 Project (Online Textbook Teacher Edition, Chapter 7, Plan and Present tab, chapter projects)

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, Delta Math, IXL, etc.
- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

#### Assessment, Remediation, & Enrichment after section 5-5.1 and 7-3

#### Summative Assessment

- Unit 3 Quizzes and Exam

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Emphasize use of proper notation and vocabulary throughout course is critical
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL
- Individual Scale Drawing Project: Students select a cartoon image and create a grid. They create a larger grid on graph paper and recreate the cartoon to scale.
- Alternate Group Scale Drawing Project: each student receives a piece of a larger whole picture that has previously been cut into squares. These squares are enlarged using similarity, given a specific scale factor. When they have finished, the class puts the pieces together to create the entire enlarged picture.
- Activity: Students measure their shadow length and height use proportions to estimate heights of tall objects (trees, buildings, etc.). This can also be accomplished using a mirror on the ground acting as the only common vertex for two similar triangles.

### Differentiation Options:

| Sections | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|----------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| 5-2      | X                            | X               | X                  | X                     | X                |
| 4-1      | X                            | X               | X                  | X                     | X                |
| 5-3      | X                            | X               | X                  | X                     | X                |
| 5-5      | X                            | X               | X                  | X                     | X                |
| 7-2      | X                            | X               | X                  | X                     | X                |
| 7-3      | X                            | X               | X                  | X                     | X                |
| 7-4      | X                            | X               | X                  | X                     | X                |
| 7-5      | X                            | X               | X                  | X                     | X                |



- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

#### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

#### **For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 4 – Right Triangles and Trigonometry

### Desired Results:

#### Essential Questions:

- Why is it important to use consistent symbols and vocabulary to communicate?
- What are important properties of triangles and how will they help us with higher level mathematics?
- How are right triangles applied in real world applications?
- Given two measurements of a right triangle, how can the remaining measurements be determined?

#### Enduring Understandings:

##### Students will understand that...

- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- triangles are a foundational shape and the properties of triangles have far reaching application in mathematics.
- assumptions about figures cannot be made.
- sometimes the correct mathematical answer is not the best solution to real-world problems.
- right triangles can be used to model real world applications.
- the Pythagorean Theorem can be used to calculate a missing side length of a right triangle.
- special right triangles result in exact values and trigonometric ratios result in approximations.

#### Knowledge:

##### Students will know...

- Vocabulary: Required: right triangle, rationalize, altitude, Pythagorean triple, leg, hypotenuse, 45-45-90, 30-60-90, trigonometry, trigonometric ratio, opposite, adjacent, sine, cosine, tangent, inverse sine, inverse cosine, inverse tangent, angle of elevation, angle of depression, geometric mean (optional)
- when to use Pythagorean Theorem, Special Right Triangles or Trigonometric ratios
- Theorems:
  - Pythagorean Theorem: In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the legs.
  - Converse of the Pythagorean Theorem: If the square of one side of a triangle is equal to the sum of the squares of the other two sides, then the triangle is a right triangle.
    - If the square of the length of the longest side of a triangle is less than the sum of the squares of the lengths of the two shorter sides, then the triangle is acute.
    - If the square of the length of the longest side of a triangle is greater than the sum of the squares of the lengths of the two shorter sides, then the triangle is obtuse.
  - In a 45-45-90 triangle, the hypotenuse is  $\sqrt{2}$  times as long as the leg.
  - In a 30-60-90 triangle, the hypotenuse is twice as long as the shorter leg, and the longer leg is  $\sqrt{3}$  times as long as the shorter leg.
- Formula:
  - Distance Formula:  $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
  - Area of a Triangle ( $A = \frac{1}{2}bh$ )

- Additional knowledge, rules, properties, postulates, and theorems used for enrichment (optional):
  - Theorem 8.1: If the altitude is drawn to the hypotenuse of a right triangle, then the two triangles formed are similar to the original triangle and to each other.
  - Geometric Mean (Altitude) Theorem: When the altitude is drawn to the hypotenuse of a right triangle, the lengths of the altitude is the geometric mean between the segments of the hypotenuse.
  - Geometric Mean (Leg) Theorem: When the altitude is drawn to the hypotenuse of a right triangle, each leg is the geometric mean between the hypotenuse and the segment of the hypotenuse that is adjacent to that leg.

#### **Skills:**

##### **Students will be able to...**

- use the Pythagorean Theorem to determine a missing side of a right triangle and use the Converse of the Pythagorean Theorem to determine whether the triangles are right, acute or obtuse.
- apply the distance formula to find the distance between two given points.
- determine the lengths of two sides of a 45-45-90 or 30-60-90 triangle when the length of the third side is known.
- label the sides of a triangle as opposite, adjacent and hypotenuse given an angle.
- determine when to use trig functions and their inverses.
- set up sine, cosine, and tangent ratios.
- solve right triangles. (In other words, find the length of each side and the measure of each angle using various given information. Techniques include: The Pythagorean Theorem, Special Right Triangles, and three trigonometric functions).
- apply trig functions (and angles of elevation and depression) to real world application problems.
- calculate area and perimeter of triangles.

#### **Standards:**

##### Priority:

CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.8.A.3: Understand and apply the Pythagorean Theorem to solve problems.

CC.2.3.HS.A.7: Apply trigonometric ratios to solve problems involving right triangles.

##### Supporting:

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

CC.2.2.HS.D.9: Use reasoning to solve equations and justify the solution method.

CC.2.3.HS.A.11: Apply coordinate geometry to prove simple geometric theorems algebraically.

#### **Acceptable Evidence:**

##### **Performance tasks –**

- Coordinate Geometry Connection: p. 581 #30-33
- Multiple Representations: p. 604 #61
- Challenge: p. 604 #62
- Chapter 8 Performance Task: p. 636

##### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessments**

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework

- Online Applications: IXL, Quizizz, Kahoot, Forms, Canvas, Delta Math, IXL etc.
- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

Assessment, Remediation, & Enrichment after section 8-3 and 8-5

Summative Assessment

- Unit 5 Quizzes and Exam
- Core Assessment 1

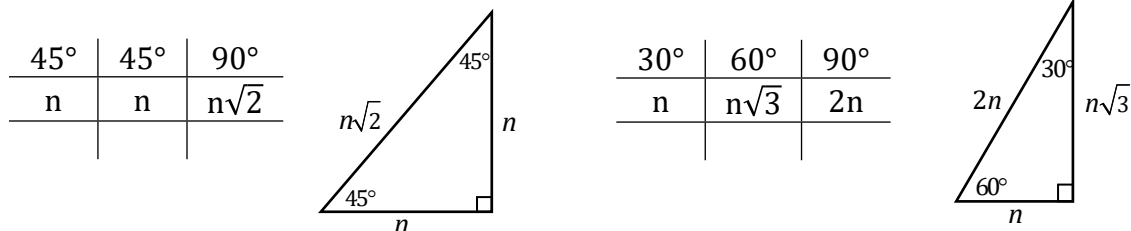
## Suggested Learning Experiences and Instruction

Learning Experiences:

- Emphasize use of proper notation and vocabulary throughout course is critical
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL
- Use <http://www.shodor.org/interactivate/activities/PythagoreanExplorer/> to practice finding the missing side of a right triangle
- Jigsaw Activity: Students can be placed in groups to work through sets of real-world trig application problems. Each group of students is responsible for presenting how to solve the problem to the whole class. A quiz can be given after the presentations.

Instructional Strategies:

- Connect the distance formula and Pythagorean Theorem.
- Emphasize that all 45-45-90 triangles are similar (scale factor/proportions can be used).
- Emphasize that all 30-60-90 triangles are similar (scale factor/proportions can be used).
- Use a chart to organize the 45°-45°-90° and 30°-60°-90° ratios:



- Pneumonic device for trig ratios: SOH-CAH-TOA.
- Pneumonic device for trig ratios:  $S_H^O C_H^A T_A^O$

Differentiation Options:

| Sections | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|----------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| 0-9      | X                            | X               | X                  | X                     | X                |
| 8-1      | X                            | X               | X                  | X                     | X                |
| 8-2      | X                            | X               | X                  | X                     | X                |
| 8-3      | X                            | X               | X                  | X                     | X                |
| 8-4      | X                            | X               | X                  | X                     | X                |
| 8-5      | X                            | X               | X                  | X                     | X                |

- Utilize study guide and intervention for students who need more reteaching.

- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

#### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

#### **For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 5 – Congruent Triangles

### Desired Results:

#### Essential Questions:

- What is the purpose of a congruency statement?
- What is the least amount of information needed to verify triangles are congruent?
- What is the relationship between the methods of proving triangles congruent?
- Why is it important to use consistent symbols and vocabulary to communicate?
- What are important properties of triangles and how will they help us with higher level mathematics?
- What information is required to make a unique/distinct triangle?

#### Enduring Understandings:

##### Students will understand that:

- two triangles can be classified as congruent using the triangle congruence postulates and theorems.
- congruent triangles can be used to draw conclusions about sides and angles.
- congruent polygons consist of congruent corresponding parts.
- triangles are a foundational shape and the properties of triangles have far reaching application in mathematics.
- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- learning geometric proofs helps us with reason logically, defend arguments, and organize our thoughts.
- assumptions about figures cannot be made.

#### Knowledge:

##### Students will know...

- Vocabulary: Congruent Polygons, Corresponding Parts, Corresponding Angles, Corresponding Sides, Included Side, Included Angle, Unique Triangle, Congruent Triangles, Legs of an Isosceles Triangle, Vertex Angle, Base Angles, Ambiguous Case (optional)
- Acronyms: CPCTC, SSS, SAS, ASA, AAS
- Postulates:
  - Side-Side-Side (SSS) Congruence Postulate: If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent.
  - Side-Angle-Side (SAS) Congruence Postulate: If two sides and the included angle of one triangle are congruent to two sides and the included angle of another triangle, then the triangles are congruent.
  - Angle-Side-Angle (ASA) Congruence Postulate: If two angles and the included side of one triangle are congruent to two angles and the included side of another triangle, then the triangles are congruent.
- Theorems:
  - The Isosceles Triangle Theorem: If two sides of a triangle are congruent, then the angles opposite those sides are congruent.
  - Converse of Isosceles Triangles Theorem: If two angles of a triangle are congruent, then the sides opposite those angles are congruent.
  - AAS Theorem: If two angles and the non-included side of one triangle are congruent to the corresponding two angles and side of a second triangle, then the two triangles are congruent.
  - Corollaries for Equilateral Triangles
    - A triangle is equilateral if and only if it is equiangular.

- Each angle of an equilateral triangle measures 60.
- Additional knowledge, rules, properties, postulates, and theorems used for enrichment (optional):
  - Third Angles Theorem: If two angles in one triangle are congruent to two angles in a second triangle, then the third angles are congruent.
  - HL Theorem: If the hypotenuse and a leg of one right triangle are congruent to the corresponding parts of another right triangle, then the triangles are congruent.
  - LL Theorem: If the legs of one right triangle are congruent to the corresponding legs of another right triangle, then the triangles are congruent.
  - HA Theorem: If the hypotenuse and acute angle of one right triangle are congruent to the hypotenuse and corresponding acute angle of another right triangle, then the two triangles are congruent.
  - LA Theorem: If one leg and an acute angle of one right triangle are congruent to the corresponding leg and acute angle of another right triangle, then the triangles are congruent.
  - Law of Sines: In  $\triangle ABC$  if sides with lengths  $a$ ,  $b$ , and  $c$  have opposite angles with measures  $A$ ,  $B$ , and  $C$ , respectively, then the following is true:  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$
  - Law of Cosines: In  $\triangle ABC$  if sides with lengths  $a$ ,  $b$ , and  $c$  are opposite angles with measures  $A$ ,  $B$ , and  $C$ , respectively, then the following are true:
    - $a^2 = b^2 + c^2 - 2bc \cdot \cos A$
    - $b^2 = a^2 + c^2 - 2ac \cdot \cos B$
    - $c^2 = a^2 + b^2 - 2ab \cdot \cos C$

#### **Skills:**

##### **Students will be able to...**

- identify the corresponding parts of congruent figures to determine the measure of an angle or side (CPCTC).
- use SSS, SAS, ASA Postulates or AAS, HL (optional) Theorems to prove two triangles are congruent.
- write congruence statements using proper notation for congruent figures.
- use congruent triangles to prove statements about the figures.

#### **Standards:**

##### Priority:

CC.2.3.HS.A.1: Use geometric figures and their properties to represent transformations in the plane.

CC.2.3.HS.A.2: Apply rigid transformations to determine and explain congruence.

CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.

##### Supporting:

CC.2.2.HS.A.14: Apply geometric concepts to model and solve real world problems.

#### **Acceptable Evidence:**

##### **Performance Tasks -**

- Complex Proof: p. 328 – Real World Examples 4 (Biosphere)
- Apply the Strategy: p. 347 – bottom of page.

##### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, Delta Math, IXL, etc.
- ConnectED.McGraw-Hill digital resources

- Vocabulary
- Self-check practice
- Practice Sheet

Assessment, Remediation, & Enrichment after section 4-4 and 4-6

Summative Assessment

- Unit 5 Quizzes and Exam

## **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Have students draft proofs (example: show the needed support to use SAS) before writing a formal proof.
- Activity: Teacher has a specific triangle drawn (hidden). Students try to draw the triangle after asking the least amount of questions.
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL

Instructional Strategies:

- Be sure to show students why Angle, Angle, Angle or Side, Side, Angle (or Angle, Side, Side) does not prove triangles are congruent.
- Use color coding, redrawing, and separation of figures to help students visualize congruent triangles.

## **Differentiation Options**

| <b>Sections</b>   | <b>Study Guide and Intervention</b> | <b>Skills Practice</b> | <b>Practice Worksheet</b> | <b>Word Problem Practice</b> | <b>Enrichment Sheet</b> |
|-------------------|-------------------------------------|------------------------|---------------------------|------------------------------|-------------------------|
| 4-2               | X                                   | X                      | X                         | X                            | X                       |
| 4-3               | X                                   | X                      | X                         | X                            | X                       |
| 4-4               | X                                   | X                      | X                         | X                            | X                       |
| 4-5               | X                                   | X                      | X                         | X                            | X                       |
| 4-6<br>(Optional) | X                                   | X                      | X                         | X                            | X                       |
| 8-6<br>(Optional) | X                                   | X                      | X                         | X                            | X                       |
| 8-7<br>(Optional) | X                                   | X                      | X                         | X                            | X                       |

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

## **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.



- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

#### **For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 6 – Quadrilaterals & Polygons

### Desired Results:

#### Essential Questions:

- How would you find the sum of the interior angles of a convex polygon without a formula?
- What is the relationship between the number of sides and the measure of each interior/exterior angle of a regular convex polygon?
- How do the properties of special quadrilaterals overlap and how are they distinct?
- Why is it important to use consistent symbols and vocabulary to communicate?

#### Enduring Understandings:

##### Students will understand that...

- triangles are a foundational shape and the properties of triangles have far reaching application in mathematics.
- the sum of the interior angles of a convex polygon is directly related to the number of sides.
- the sum of the exterior angles of a convex polygon is independent to the number of sides (it is always  $360^\circ$ ).
- special quadrilaterals are classified by the characteristics of their angles and sides.
- assumptions about figures cannot be made
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.

#### Knowledge:

##### Students will know...

- Vocabulary: diagonal, base, legs of a trapezoid, base angle, polygon, equilateral, equiangular, regular polygon, convex polygon, concave polygon, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon, n-gon, parallelogram, rectangle, square, rhombus, trapezoid, isosceles trapezoid, midsegment of a trapezoid
- Theorems:
  - The sum of the measures of the angles of a convex polygon with  $n$  sides is  $(n - 2)(180)$ .
- The sum of the measures of the exterior angles of any convex polygon, one angle at each vertex, is 360.
- Properties:
  - Parallelogram:
    - Opposite sides of a parallelogram are congruent.
    - Opposite angles of a parallelogram are congruent.
    - Consecutive angles are supplementary.
    - Diagonals of a parallelogram bisect each other.
  - Rectangle:
    - The diagonals of a rectangle are congruent.
  - Rhombus:
    - The diagonals of a rhombus are perpendicular.
    - Each diagonal of a rhombus bisects two angles of the rhombus.
  - Trapezoid:
    - Base angles of an isosceles trapezoid are congruent.
    - The midsegment of a trapezoid is parallel to the bases and has a length equal to the average of the base lengths.

- **Formulas:**
  - Area of a Parallelogram:  $A = bh$
  - Area of a Rectangle:  $A = bh$
  - Area of a Rhombus:  $A = bh$  or  $A = d_1 \cdot d_2$
  - Area of a Square:  $A = bh$  or  $A = s^2$
  - Area of a Trapezoid:  $A = \frac{1}{2}(b_1 + b_2) \cdot h$
  - Note: Base & Height are always perpendicular.
- **Additional knowledge, rules, properties, postulates, and theorems used for enrichment (optional):**
  - **Ways to Prove that a Quadrilateral is a Parallelogram:**
    - If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.
    - If one pair of opposite sides of a quadrilateral are both congruent and parallel, then the quadrilateral is a parallelogram.
    - If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.
    - If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.
  - If two lines are parallel, then all points on one line are equidistant from the other line
  - If three parallel lines cut off congruent segments on one transversal, then they cut off congruent segments on every transversal.
  - A line that contains the midpoint of one side of a triangle and is parallel to another side passes through the midpoint of the third side.
  - The segment that joins the midpoints of two sides of a triangle is parallel to the third side and is half as long as the third side.

#### **Skills:**

##### **Students will be able to...**

- identify polygons by number of sides.
- classify polygons as convex/concave and regular/irregular.
- determine the sum of the interior and exterior angles of polygons.
- determine the measure of one interior/exterior angle of a regular polygon.
- set up and solve algebraic equations relating to interior and exterior angles of regular and irregular polygons.
- verify that certain quadrilaterals are parallelograms.
- find missing angle measures and side lengths using the properties of all quadrilaterals.
- find missing angle measures and side/diagonal lengths using properties of parallelograms, including special parallelograms.
- use properties (markings) of special quadrilaterals to classify as parallelograms, rectangles, rhombuses, squares, trapezoids, and isosceles trapezoids.
- Calculate the area and perimeter of quadrilaterals.
- Calculate the area and perimeter of composite shapes.

#### **Standards:**

##### **Priority:**

CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.

CC.2.2.HS.A.14: Apply geometric concepts to model and solve real world problems.

##### **Supporting:**

CC.2.2.HS.D.2: Write expressions in equivalent forms to solve problems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

CC.2.2.HS.D.9: Use reasoning to solve equations and justify the solution method.

CC.2.1.HS.F.3: Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.

## Acceptable Evidence:

### Performance tasks -

- Spreadsheet Lab: Angles of Polygons (p. 432)
- Geometry Software Lab: Parallelograms (p. 442)
- Fashion Forward Chapter 6 Project (Online Textbook Teacher Edition, Chapter 6, Plan and Present tab, chapter projects)

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, Delta Math, IXL, etc.
- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

Assessment, Remediation, & Enrichment after section 6.3 and 6.6

#### Summative Assessment

- Unit 6 Quizzes and Exam
- Core 2

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- For verifying if a quadrilateral is a parallelogram, give the students a quadrilateral:
  - Then, ask them to determine whether they can say the quadrilateral is a parallelogram based on the markings of the figure (if they say yes, which of the main properties of a parallelogram is supported by the diagram? If they say no, why is this figure not a parallelogram?)
  - For this example, the answer would be “no, because the quadrilateral does not have two pairs of opposite sides congruent”.
- Activity: Students construct various convex polygons with one exterior angle drawn at each vertex. Students cut out the exterior angles and move them to observe that the sum of the exterior angles of any convex polygon is 360.
- See additional resources at:
  - [www.mathopenref.com/polygoninteriorangles.html](http://www.mathopenref.com/polygoninteriorangles.html)
  - [www.mathopenref.com/polygonexteriorangles.html](http://www.mathopenref.com/polygonexteriorangles.html) .
- Create a parallelogram using two congruent triangles and color code all corresponding parts. Students will line up the longest sides of the triangles in opposite directions. This will allow observations of the characteristics of parallelograms.
- Activity: Students review side and angle properties of polygons by playing Polygon Capture. (See <http://illuminations.nctm.org/LessonDetail.aspx?ID=L270> ).



- Activity: Students construct two congruent triangles and color code all corresponding parts. Students line up congruent triangles to create a parallelogram and discover the properties. (See p. 165c in McDougal Littell Geometry – High School Teacher’s Edition).
- Students can review their knowledge of side and angle characteristics of special quadrilaterals on p. 316 of the Larson, Geometry: An Integrated Approach – Middle School Text.
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL

#### Instructional Strategies:

- Derive the formula for the interior angle sum through exploring the number of triangles that can be created by drawing diagonals of a convex polygon from one vertex. Can be done either via Sketchpad or with construction paper.
- Use physical examples of different types of polygons in real life to emphasize understanding.
- Create a chart of the special properties of parallelograms, rectangles, rhombuses, and squares.
- Create Special Quadrilaterals Trifold to help students summarize properties, correctly mark, and identify various examples of parallelograms, rectangles, rhombi, squares, and/or trapezoids. See p. 187 in McDougal Littell Geometry – High School Text
- Use Venn Diagram and tree diagrams to visually relate special quadrilaterals.

#### Differentiation Options:

| Sections | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|----------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| 6-1      | X                            | X               | X                  | X                     | X                |
| 6-2      | X                            | X               | X                  | X                     | X                |
| 6-3      | X                            | X               | X                  | X                     | X                |
| 6-4      | X                            | X               | X                  | X                     | X                |
| 6-5      | X                            | X               | X                  | X                     | X                |
| 6-6      | X                            | X               | X                  | X                     | X                |
| 10-1     | X                            | X               | X                  | X                     | X                |
| 10-2     | X                            | X               | X                  | X                     | X                |

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

#### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

**For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 7 – Circles

### Desired Results:

#### Essential Questions:

- Why is it important to use consistent symbols and vocabulary to communicate?
- How will our prior knowledge help us understand rules in circles?
- How are angles and intercepted arcs of circles related?

#### Enduring Understandings:

##### Students will understand that...

- a relationship exists between points, lines, segments, angles, and arcs associated with circles.
- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- assumptions about figures cannot be made.

#### Knowledge:

##### Students will know...

- All radii in a circle are congruent.
- Vocabulary: Required: circle, center, radius, chord, diameter, circumference, inscribed, circumscribed, central angle, arc, minor arc, major arc, semicircle, congruent arcs, adjacent arcs, arc length, arc measure, inscribed angle, intercepted arc, tangent, point of tangency, secant, congruent circles, sector of a circle, concentric circles (optional), common tangent (optional)
- Postulate:
  - Arc Addition Postulate: The measure of the arc formed by two adjacent arcs is the sum of the measures of these two arcs.
- Formulas:
  - Radius:  $r = \frac{d}{2}$
  - Diameter:  $d = 2r$
  - Area of a Circle:  $A = \pi r^2$
  - Circumference of a Circle:  $C = 2\pi r$
  - Arc Length:  $\frac{x}{360} \cdot 2\pi r$
  - Sector Area:  $\frac{x}{360} \cdot \pi r^2$
- Additional knowledge, rules, properties, postulates, and theorems used for enrichment (optional):
  - Equation of a Circle:  $(x - h)^2 + (y - k)^2 = r^2$
  - If a quadrilateral is inscribed in a circle, then its opposite angles are supplementary.
  - In a plane, a line is tangent to a circle if and only if it is perpendicular to a radius drawn to the point of tangency.
  - If two segments from the same exterior point are tangent to a circle, then they are congruent.
  - If two secants or chords intersect in the interior of a circle, then the measure of an angle formed is one half the *sum* of the measure of the arcs intercepted by the angle and its vertical angle.
  - If a secant and a tangent intersect at the point of tangency, then the measure of each angle formed is one half the measure of its intercepted arc.
  - If two secants, a secant and a tangent, or two tangents intersect in the exterior of a circle, then the measure of the angle formed is one half the *difference* of the measures of the intercepted arcs.

- In the same circle or in congruent circles, two minor arcs are congruent if and only if their central angles are congruent.
- In the same circle or in congruent circles, two minor arcs are congruent if and only if their corresponding chords are congruent.
- If a diameter (or radius) of a circle is perpendicular to a chord, then it bisects the chord and its arc.
- The perpendicular bisector of a chord is a diameter (or radius) of the circle.
- In the same circle or in congruent circles, two chords are congruent if and only if they are equidistant from the center.
- Inscribed Angle Theorem: If an angle is inscribed in a circle, then the measure of the angle equals one-half of the measures of its intercepted arc.
- If two inscribed angles of a circle intercept the same arc (or congruent arcs), then the angles are congruent.
- An inscribed angle of a triangle intercepts a diameter or a semicircle if and only if the angle is a right angle.
- If the vertex of an angle is on the circle, then its measure is one half the measure of the intercepted arc.
- If the vertex of an angle is inside the circle, then its measure is one half of the sum of the measures of the intercepted arcs.
- If the vertex of an angle is outside the circle, then its measure is one half the difference of the measures of the intercepted arcs.

#### **Skills:**

##### **Students will be able to...**

- identify and use circle vocabulary and notation.
- identify and differentiate between major and minor arcs and semicircles using proper notation.
- apply Pythagorean Theorem and Special Right Triangles to find segment lengths in a circle.
- determine the area and circumference of a circle.
- solve problems by applying theorems involving angles and arcs formed by chords, radii, and tangents (optional).

#### **Standards:**

##### Priority:

CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.8: Apply geometric theorems to verify properties of circles.

##### Supporting:

CC.2.2.HS.D.2: Write expressions in equivalent forms to solve problems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

CC.2.2.HS.D.9: Use reasoning to solve equations and justify the solution method.

CC.2.3.HS.A.7: Apply trigonometric ratios to solve problems involving right triangles.

#### **Acceptable Evidence:**

##### **Performance tasks -**

- Chapter 9 – Performance Task – p. 718
- p. 650 #49
- Buffon's Needle: p. 649 #46
- Error Analysis: p. 659 #57
- Constructing Arguments: p. 659 #58-60

##### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups & Exit Slips



- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, IXL, Delta Math, etc.
- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

Assessment, Remediation, & Enrichment after section 10-3

Summative Assessment

- Unit 7 Quizzes and Exam

## **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Emphasize use of proper notation and vocabulary throughout course is critical
- Emphasize the application of the Pythagorean theorem, special right triangles, and trigonometry with circles
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL
- GeoGebra / Geometer's Sketchpad activities (the online textbook provides some of these)
- Desmos Activities - Example: Properties of Tangents to a Circle • Activity Builder by Desmos

Instructional Strategies:

- Emphasize the application of Pythagorean Theorem and Special Right Triangles in circles.

**Differentiation Options:**

| Sections | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|----------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| 9-1      | X                            | X               | X                  | X                     | X                |
| 9-2      | X                            | X               | X                  | X                     | X                |
| 10-3     | X                            | X               | X                  | X                     | X                |
| 9-4      | X                            | X               | X                  | X                     | X                |
| 9-5      | X                            | X               | X                  | X                     | X                |
| 9-6      | X                            | X               | X                  | X                     | X                |
| 9-7      | X                            | X               | X                  | X                     | X                |

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

### **For Language Development**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.

- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe “Get Ready” vocab in Spanish.

#### **For Advanced Learners**

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.
- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects

# Central Bucks School District – Course of Study – Geometry/Trig

## Unit 8 – Mixed Area, Surface Areas, & Volume

### Desired Results:

#### Essential Questions:

- Why is it important to use consistent symbols and vocabulary to communicate?
- How does changing the dimension(s) of a plane figure affect the area?
- How will our prior knowledge help us work with Area and Perimeter of Plane Figures and Surface Areas and Volumes of Solids?
- What does the surface area and volume of a solid represent?
- How does changing the dimension(s) of a solid affect the surface area and volume?
- When is the mathematical answer not a correct solution to a real-world application?
- When is it appropriate to adjust formulas for real world applications?
- When would you use surface area versus volume to solve a real-world application?

#### Enduring Understandings:

##### Students will understand that...

- mathematics is largely about communication. Using appropriate vocabulary and common symbols is essential for this communication.
- changing the dimensions of a plane figure affects the perimeter and area.
- sometimes the correct mathematical answer is not the best solution to real-world problems.
- there is a connection between three dimensional solids and two-dimensional figures.
- volume represents the space contained in the inside of a three dimensional solid, and surface area represents the sum of the areas of the solid's faces.
- changing the dimensions of a solid affects the volume and surface area.
- formulas and calculations are adjusted to correctly model real-world applications.
- geometry & mathematics is everywhere in the world. Skills from these disciplines can be used to solve problems.
- assumptions about figures cannot be made.

#### Knowledge:

##### Students will know...

- Vocabulary: polyhedra, prism, base, lateral face, lateral edge, lateral area, total area, surface area, volume, vertex, pyramid, slant height, cylinder, cone, hemisphere, sphere, composite figure, center of a regular polygon (optional), radius of a regular polygon (optional), apothem (optional), central angle of a regular polygon (optional),
- Other Rules:
  - Perimeter is measured in linear units.
  - Area is measured in square units.
  - Volume is measured in cubic units.
  - Base (b) and Height (h) in a plane figure are always perpendicular.
- Symbols:
  - b: base length of a plane figure
  - h: length of the height of a plane figure
  - s: side length of a square
  - $d_1$  &  $d_2$ : the lengths of the diagonals of a rhombus
  - L.A: lateral surface area
  - T.A: total surface area

- V: volume
- B: area of the base of a solid
- P: perimeter of the base of a solid
- l: slant height
- r: radius

- Formulas:

- Square
  - $A = s^2$
- Rectangle
  - $A = bh$
- Parallelogram
  - $A = bh$
- Triangle
  - $A = \frac{1}{2}bh$
- Rhombus
  - $A = \frac{1}{2}d_1d_2$  or  $A = bh$
- Trapezoid
  - $A = \frac{1}{2}h(b_1 + b_2)$
- Rectangular Solid/Right Prism:
  - Lateral Area:  $LA = ph$
  - Surface Area:  $TA = LA + 2lw$
  - Volume:  $V = lwh$
- Regular Pyramid:
  - Lateral Area:  $LA = \frac{1}{2}Pl$
  - Surface Area:  $TA = \frac{1}{2}Pl + B$
  - Volume:  $V = \frac{1}{3}Bh$
- Right Cylinder:
  - Lateral Area:  $LA = 2\pi rh$
  - Surface Area:  $TA = LA + 2\pi r^2$
  - Volume:  $V = \pi r^2 h$
- Right Cone:
  - Lateral Area:  $LA = \pi rl$
  - Surface Area:  $TA = \pi rl + \pi r^2$
  - Volume:  $V = \frac{1}{3}\pi r^2 h$
- Sphere:
  - Surface Area:  $TA = 4\pi r^2$
  - Volume:  $V = \frac{4}{3}\pi r^3$

**Skills:**

**Students will be able to...**

- calculate area and perimeter of plane figures.
- calculate lateral surface area, total surface area, and volume of solids.

- solve application problems using area and perimeter/circumference of plane figures and surface areas/volume of solids and interpret results to meet the requirements of the real-life application problem.
- identify plane figures and solids.
- apply knowledge from the rest of the course to figures and solids.
- Determine the area/perimeter of a composite figure/shaded region.
- State and apply properties of similar polygons (ratios of lengths, perimeters, and areas).
- Identify pieces of plane figures and solids (example: slant height, radius).

#### **Standards:**

##### Priority:

- CC.2.3.HS.A.3: Verify and apply geometric theorems as they relate to geometric figures.  
 CC.2.3.HS.A.12: Explain volume formulas and use them to solve problems.  
 CC.2.3.HS.A.13: Analyze relationships between two-dimensional and three-dimensional objects.  
 CC.2.3.HS.A.14: Apply geometric concepts to model and solve real world problems.

##### Supporting:

- CC.2.1.HS.F.3: Apply quantitative reasoning to choose and Interpret units and scales in formulas, graphs and data displays.  
 CC.2.2.HS.D.2: Write expressions in equivalent forms to solve problems.  
 CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

### **Acceptable Evidence:**

#### **Performance Tasks -**

- p. 852 – Chapter 11 Performance Task
- p. 833 – Extend 11-5 – Geometry Lab Navigational Coordinates
- p. 757 #20
- p. 808 #42

#### **Acceptable evidence of learning other than Performance Tasks:**

##### Formative Assessment

- Warm-ups & Exit Slips
- Check point assignments for each cycle
- Resources from textbook – remedial practice and enrichment opportunities
- Classwork
- Homework
- Online Applications: Quizizz, Kahoot, Forms, Canvas, IXL, Delta Math, etc.
- ConnectED.McGraw-Hill digital resources
  - Vocabulary
  - Self-check practice
  - Practice Sheet

Assessment, Remediation, & Enrichment as time allows/as needed.

##### Summative Assessment

- Unit 8 Quizzes and Exam

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- In online textbook – Geometry Tool 3-D Figures (Chapter 11)
- p. 795 – Introduce Volume formula with stacks of cards

- Use 3-D Models while introducing vocabulary and formulas
- Volume or Surface Area? • Activity Builder by Desmos
- Application Project: Students create a scale drawing of a room in their home and calculate various home improvement costs. Students write explanations of their problem-solving process.
- Application Project: Students complete application problems regarding maximizing area and minimizing cost.
- Jigsaw Application Activity: In groups of 3-4 students work on area and perimeter real world application problems. Students will present an explanation of their problem to the class. Students can use PowerPoint or a poster as a visual. Students take a quiz after the presentations to ensure understanding.
- Use vocabulary flashcards, online flashcards (quizlet), or webquests to reinforce vocabulary; Word Wall, H5P, [www.aplusmath.com](http://www.aplusmath.com) (flashcard section on left hand side).
- Personalized/Interactive Activities (with immediate feedback): Delta Math, IXL

#### Instructional Strategies:

- Emphasize the application of Pythagorean Theorem and Special Right Triangles in calculating area of plane figures.
- Use 3-D models while introducing formulas and vocabulary.
- Use physical examples of different types of solids in real life to emphasize understanding.

#### Differentiation Options:

| Sections           | Study Guide and Intervention | Skills Practice | Practice Worksheet | Word Problem Practice | Enrichment Sheet |
|--------------------|------------------------------|-----------------|--------------------|-----------------------|------------------|
| Various Chapter 10 | X                            | X               | X                  | X                     | X                |
| 10-4               | X                            | X               | X                  | X                     | X                |
| 1-8                | X                            | X               | X                  | X                     | X                |
| 10-6               | X                            | X               | X                  | X                     | X                |
| 11-2               | X                            | X               | X                  | X                     | X                |
| 11-3               | X                            | X               | X                  | X                     | X                |
| 11-4               | X                            | X               | X                  | X                     | X                |

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- Practice worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.

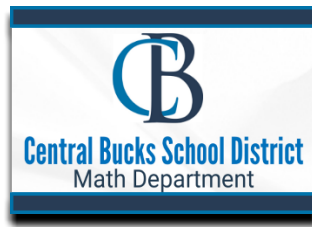
#### For Language Development

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Glencoe Personal Tutor (Spanish).
- Glencoe "Get Ready" vocab in Spanish.

#### For Advanced Learners

- Teach the optional topics for individual students or groups of students that are demonstrating understanding of the priority and supporting skills. When this course is taught in 8<sup>th</sup> or 9<sup>th</sup> grade, you will have an opportunity to teach many more of the optional topics with your students.

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  1. Practice sets from the textbook based on the readiness level to address their individual needs
  2. Application practice
  3. Enrichment projects



## Code and Create

Course Number: 2003

Course Level: Standard/College Bound

Grade: 9-12

Time/Credit: 83 minutes daily: Grades 9, 10, 11, and 12  
.5 credits

Development Date: June 2025 – August 2026

Board Approval Date: October 2014

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901



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## **Central Bucks School District**

### **K-12 Computer Science Teaching and Learning Principles**

1. Investigating, problem-solving, and communicating about computer science (speaking, reading, writing, representing, and listening) stimulates students' curiosity, builds confidence, and leads students toward deeper conceptual understanding.
2. Lessons should address students' strengths, interests, and learning styles through differentiated instruction.
3. All students can achieve excellence in computer science when:
  - instruction is appropriately paced
  - teachers set high expectations
  - students feel supported by their teachers, parents and administrators
4. Students must be actively engaged in learning experiences designed to connect to their prior knowledge.
5. For students to transfer and use knowledge meaningfully teachers need to:
  - present new ideas within rich and meaningful contexts
  - help students to make connections to their lives both within and outside of school
6. Computer Science instruction is more effective when teachers incorporate:
  - manipulatives
  - integrated development environments, both online and device based
7. Assessment should be ongoing, diagnostic, and aligned with instruction.

#### Documents Considered:

College Board (2019). AP Computer Science A: Course and Exam Description.  
Retrieved from <https://apcentral.collegeboard.org/courses>.

Computer Science Teachers Association (2017). CSTA K-12 Computer Science Standards, Revised 2017.  
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Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*.  
Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*.  
Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New Standards for Teaching and Learning in America's Schools*. Portsmouth, NH: Heinemann.

# **Central Bucks School District**

## **K-12 Computer Science Program Enduring Understandings**

**Students will understand that:**

### **Computing Systems**

- Abstractions hide the underlying implementation details of computing systems embedded in everyday objects.
- Levels of abstraction and interactions between application software, system software, and hardware layers can be compared.
- Guidelines that convey systematic troubleshooting strategies can be developed that others can use to identify and fix errors.

### **Networks and the Internet**

- There is scalability and reliability of networks, in which the relationship between routers, switches, servers, topology, and addressing can be described.
- Sensitive data can be affected by malware and other attacks.
- Security measures can address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.

### **Data and Analysis**

- There are different bit representations of real-world phenomena, such as characters, numbers, and images.
- There are tradeoffs in how data elements are organized and where data is stored.

### **Algorithms and Programming**

- Algorithms are used to solve computational problems by leveraging prior student knowledge and personal interests.
- Programmers must justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made.
- Problems can be decomposed into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- Documentation of design decisions using text, graphics, presentations, and/or demonstrations is an integral part in the development of complex programs.

### **Impacts of Computing**

- Computing affects personal, ethical, social, economic, and cultural practices.
- Computational artifacts must be tested and refined to reduce bias and equity deficits.

# **Central Bucks School District**

## **K-12 Computer Science Program Essential Questions**

### **Computing Systems**

- What is an abstraction?
- How does abstraction manage complexity?

### **Networks and the Internet**

- How do scalability and redundancy relate to reliability on the Internet?
- What is malware and how is sensitive data affected by it?
- How do efficiency, feasibility, and ethical impacts impact security measures?

### **Data and Analysis**

- What are the tradeoffs in how data elements are organized and where data is stored?
- How do we collect, visualize, and store large amounts of data?
- Why do we create computational models and how does the data we use affect those models?
- What is the purpose of creating prototypes to solve computational problems?

### **Algorithms and Programming**

- What is an algorithm?
- How do algorithms and programs differ?
- Why is the selection of specific control structures important when considering implementation, readability, and program performance?
- Why is the decomposition into smaller components in constructs such as procedures, modules, and/or objects important in the software development process?
- Why are documentation and design decisions an integral part in the development of complex programs?

### **Impacts of Computing**

- What is the purpose of collecting data?
- How is data used or abused?
- What are the ways that computing affects personal, ethical, social, economic, and cultural practices?
- Why must we test and refine computational artifacts to reduce bias and equity deficits?

## Central Bucks School District

### Code and Create Overview

#### Desired Results

Course Description: 2003 Code & Create (9 weeks, .5 credits)

Unlock your creativity with Code and Create, a dynamic course designed for high school students interested in block-based coding. Using an object-oriented programming language, students will learn to program virtual worlds in a 3D environment. This course emphasizes algorithmic thinking, abstraction, and problem-solving skills. Students will create movie-style animations, interactive games, and simulations, bringing their ideas to life. Up to one credit from Computer Science courses may be used to fulfill graduation requirements for mathematics.

Prerequisite: None

Committee Members: Dustin Frey, Aaron Fromal, Jason Matusek, Anthony Paglione, Jenn Robinson, Brian Novick, Math Supervisor

#### Acceptable Evidence

Final Project: In lieu of a final written exam, final project(s) will be required. The final project grade is 20% of the final course grade.

## Code and Create Pacing Guide

| Instructional Timeline                                                                                                                                                                                                                                                                                  | Blocks    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1: Getting to Know your IDE</b>                                                                                                                                                                                                                                                                 | <b>8</b>  |
| <ul style="list-style-type: none"> <li>Basics of your IDE (i.e. Alice, Snap, Scratch, etc.)</li> <li>Design Process (Scenarios, storyboards, etc.)</li> <li>Built-in Methods, Functions, and Expressions</li> <li>Simple Control Structures</li> <li>A First Program (i.e. a guided project)</li> </ul> | 7         |
| Unit 1 Summative Assessment                                                                                                                                                                                                                                                                             | 1         |
| <b>Unit 2: Programming Basics</b>                                                                                                                                                                                                                                                                       | <b>8</b>  |
| <ul style="list-style-type: none"> <li>Algorithms</li> <li>Primitive Methods/Procedures/Functions</li> <li>Properties</li> <li>Parameters</li> <li>Debugging</li> <li>Comments</li> <li>Project (Reteaching and Enrichment as necessary)</li> </ul>                                                     | 7         |
| Unit 2 Summative Assessment                                                                                                                                                                                                                                                                             | 1         |
| <b>Unit 3: Control Structures: Loops &amp; Conditionals</b>                                                                                                                                                                                                                                             | <b>8</b>  |
| <ul style="list-style-type: none"> <li>Execution Control with If/Else and Boolean Functions</li> <li>Operators (relational/logical)</li> <li>For Loops</li> <li>While Loops</li> <li>Project (Reteaching and Enrichment as necessary)</li> </ul>                                                        | 7         |
| Unit 3 Summative Assessment                                                                                                                                                                                                                                                                             | 1         |
| <b>Unit 4: Smart Structures: Methods &amp; Reuse</b>                                                                                                                                                                                                                                                    | <b>8</b>  |
| <ul style="list-style-type: none"> <li>User-Defined Methods</li> <li>Abstraction</li> <li>Modularity</li> <li>Re-use</li> <li>Project (Reteaching and Enrichment as necessary)</li> </ul>                                                                                                               | 7         |
| Unit 4 Summative Assessment                                                                                                                                                                                                                                                                             | 1         |
| <b>Unit 5: Events and Handling</b>                                                                                                                                                                                                                                                                      | <b>8</b>  |
| <ul style="list-style-type: none"> <li>Interactive Programming</li> <li>Parameters and Event Handling Methods</li> <li>Project (Reteaching and Enrichment as necessary)</li> </ul>                                                                                                                      | 7         |
| Unit 5 Summative Assessment                                                                                                                                                                                                                                                                             | 1         |
| <b>Final Project</b>                                                                                                                                                                                                                                                                                    | <b>5</b>  |
| <b>Total Days for Course:</b>                                                                                                                                                                                                                                                                           | <b>45</b> |

## Required and Supplementary Texts/Software

### Required Texts/Software

None. This course is taught with online materials. These sites provide free resources to schools to promote quality computer science instruction in K–12 education.

Suggested programming environments include, but are not limited to:

Alice 3.0 (preferred) <https://www.alice.org/get-alice/alice-3/> (through Carnegie Mellon University)

Scratch - <http://scratch.mit.edu> - [Scratch - Imagine, Program, Share](#) (through MIT)

Snap - <https://snap.berkeley.edu> [Snap! 11.0.8](#) (through Berkeley University)

MakeCode Arcade (free through Microsoft) [Microsoft MakeCode Arcade](#)

[www.Code.org](http://www.Code.org) (game lab)

[www.codehs.com](http://www.codehs.com)

### Technology

Computers: Student 1:1 Devices

Central Bucks School District – Course of Study  
**Unit 1: Getting to Know your IDE**

**Desired Results**

**Essential Questions:**

- How does an Integrated Development Environment (IDE) help programmers create, test, and refine their programs?
- What features of our IDE make programming more visual or beginner-friendly?
- Why is understanding your programming environment an important first step for learning to code?
- How can careful planning improve the quality and efficiency of a program?
- What role do storyboards or scenarios play in transforming an idea into a working program?
- How does the design process in programming compare to design processes in other creative fields?
- How do built-in functions and methods simplify the process of programming?
- What's the difference between a method, a function, and an expression—and why does it matter?
- How can we use existing programming tools effectively instead of creating everything from scratch?
- How do control structures (such as sequence, selection, and repetition) allow a program to make decisions and repeat actions?
- Why are control structures essential for creating dynamic and interactive programs?
- How can we trace or predict what a program will do based on its control flow?
- What steps are needed to turn a concept or design into a functional program?
- How do debugging and testing help ensure that a program behaves as intended?
- What did creating your first program teach you about how computers follow directions?

**Enduring Understandings:**

*Students will understand that...*

- They can navigate and use key features of an Integrated Development Environment (IDE) to create, edit, and run programs.
- The IDE's tools support problem-solving, creativity, and debugging in programming.
- Basic programming actions, such as adding objects, commands, or blocks, are used to build simple projects.
- The design process helps plan and organize a program before writing code.
- Storyboards and/or flowcharts can represent a program's logic and sequence.
- Designs can be refined and improved through feedback, testing, and reflection.
- Built-in methods and functions can perform common programming tasks efficiently.
- Expressions combine values, variables, and operations to produce results.
- Using appropriate built-in tools can simplify coding and reduce errors.
- Control structures (e.g., sequence, selection, and repetition) determine how a program flows.
- Control structures affect the behavior and outcome of a program.
- Logic and reasoning are essential for tracing and debugging simple control structures.
- Applying the full design and programming process leads to the creation of a simple, functional program.
- Testing, debugging, and revising are necessary to ensure a program meets design goals and user expectations.



- Reflecting on problem-solving strategies helps improve future programming projects.

### **Knowledge:**

*Students will know...*

- Definitions: IDE, interface, script, code, block, command, run, execute, debug, debugging, syntax, output, design process, storyboard, flowchart, scenario, algorithm, iteration, method, function, parameter, expression, operator, variable, sequence, selection, conditional, loop, repetition, Boolean, condition, event, program, testing, bug, algorithmic thinking, documentation

### **Skills:**

*Students will be able to...*

- Navigate and use features of an IDE (Alice, Snap, Scratch, etc.)
- Create, edit, and run simple programs
- Apply the design process to plan and organize a project
- Develop and interpret storyboards and flowcharts
- Write and follow basic algorithms
- Use built-in methods and functions effectively
- Utilize expressions, variables, and operators to produce results
- Apply simple control structures (sequence, selection, and loops)
- Trace and debug errors in a program
- Use events and conditions to make programs interactive
- Test and refine programs based on feedback and outcomes
- Document code and explain program logic
- Collaborate and share ideas in the design and coding process
- Reflect on how problem-solving and creativity apply to programming

### **Standards:**

Algorithms and Programming

#### Priority Standards

- |          |                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                       |
| 3A-AP-16 | Design and iteratively develop computational artifacts for practical intent, personal expression or to address a societal issue by using events to initiate instructions. |
| 3A-AP-18 | Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.                                     |
| 3B-AP-14 | Construct solutions to problems using student created components, such as procedures, modules and/or objects.                                                             |

#### Supporting Standards

- |          |                                                                                                                                       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. |
| 3B-AP-13 | Illustrate the flow of execution of recursive algorithms.                                                                             |

### **Acceptable Evidence**

**Acceptable evidence of learning other than Performance Tasks:**

**Formative Assessment**

- Warm-ups
- Checkpoint assignments
- Classwork
- Homework
- Exit slips
- Keep a notebook
- Programming assignments

**Summative Assessment**

- Unit Quiz
- Unit Project

**Suggested learning experiences and instruction**

**Learning Experiences:** Will vary based on the IDE used for the course.

**Instructional Strategies:**

- Demonstrate writing programs in the selected IDE.
- Use PowerPoint slides to present concepts and terminology.
- Emphasize the steps in problem solving and the use of algorithms.

**Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

**For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

**For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 2: Programming Basics

#### Desired Results

##### Essential Questions:

- How do algorithms help us break down and solve problems step by step?
- What makes one algorithm more efficient or effective than another?
- How can we translate real-world processes into algorithms that a computer can understand?
- How do methods, procedures, and functions help organize and simplify code?
- Why is it important to break a large program into smaller, reusable pieces?
- How do we decide when to create a new function versus using a built-in one?
- How do object properties affect how a program looks and behaves?
- What is the relationship between an object's properties and the code that controls them?
- How can changing a property help a program achieve a desired result?
- How do parameters make functions and methods more flexible and reusable?
- What happens when we pass different parameters to the same function or method?
- How do programmers find and fix errors in their code?
- What strategies or tools can make debugging more efficient?
- Why is debugging an essential part of the problem-solving process?
- How do programmers collaborate with others to debug programs?
- How do comments make code easier to understand, share, and maintain?
- Why is writing clear comments as important as writing functional code?
- How can comments be used to plan, explain, or document a program's logic?
- How can we apply what we've learned about algorithms, functions, and debugging to create an effective program?
- What steps should we take to evaluate and improve our own or others' code?
- How does the programming process reflect persistence, creativity, and attention to detail?

##### Enduring Understandings:

*Students will understand that...*

- Algorithms provide a clear, logical sequence of steps to solve problems effectively.
- Different algorithms can solve the same problem, but some are more efficient or easier to understand.
- Methods, procedures, and functions help organize programs into smaller, reusable parts that make code easier to manage.
- Properties define the characteristics and behavior of objects within a program.
- Changing object properties can control how a program looks, feels, and responds to user input.
- Parameters allow functions and methods to work flexibly with different inputs and situations.
- Debugging is an essential skill that requires patience, logic, and attention to detail.
- Errors in programming are opportunities to learn and improve both the code and the problem-solving process.
- Comments make code easier for others (and the programmer) to read, understand, and maintain over time.
- Writing clear, well-organized, and well-documented code is a mark of good programming practice.

- Effective programming involves designing, testing, and refining solutions through continuous improvement.
- Collaboration, communication, and reflection are key to improving both individual and group programming projects.

### **Knowledge:**

*Students will know...*

- Definitions: algorithm, method, procedure, function, property, parameter, variable, value, argument, object, debugging, error, bug, syntax, runtime, comment, documentation, input, output, sequence, selection, repetition, conditional, loop, logic, trace, test, program, code, IDE, project, iteration

### **Skills:**

*Students will be able to...*

- Design and follow algorithms to solve problems step by step
- Write, call, and organize code using methods, procedures, and functions
- Define and modify object properties to control program behavior
- Use parameters to make functions and methods flexible and reusable
- Identify, trace, and fix errors in programs through debugging
- Write clear comments to explain code logic and document programs
- Combine variables, expressions, and operations to produce desired outputs
- Apply sequence, selection, and repetition to control program flow
- Test and refine programs to ensure they meet design requirements
- Reflect on and improve programming approaches based on feedback and results
- Collaborate with others to plan, develop, and troubleshoot code
- Apply computational thinking to plan, analyze, and implement solutions

### **Standards:**

Algorithms and Programming

#### Priority Standards

- |          |                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                       |
| 3A-AP-16 | Design and iteratively develop computational artifacts for practical intent, personal expression or to address a societal issue by using events to initiate instructions. |
| 3A-AP-18 | Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.                                     |
| 3B-AP-14 | Construct solutions to problems using student created components, such as procedures, modules and/or objects.                                                             |

#### Supporting Standards

- |          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|          |                                                                                                                                       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. |
| 3A-AP-19 | Systematically design and develop programs for broad audiences by incorporating feedback from users.                                  |
| 3B-AP-10 | Use and adapt classic algorithms to solve computational problems.                                                                     |
| 3B-AP-12 | Compare and contrast fundamental data structures and their uses.                                                                      |
| 3B-AP-13 | Illustrate the flow of execution of recursive algorithms.                                                                             |

## Acceptable Evidence

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Warm-ups
- Checkpoint assignments
- Classwork
- Homework
- Exit slips
- Keep a notebook
- Programming assignments

#### Summative Assessment

- Unit Quiz
- Unit Project

## Suggested learning experiences and instruction

**Learning Experiences:** Will vary based on the IDE used for the course.

#### Instructional Strategies:

- Demonstrate writing programs in the selected IDE.
- Use PowerPoint slides to present concepts and terminology.
- Emphasize the steps in problem solving and the use of algorithms.

#### Differentiation:

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

#### For Language Development:

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

**For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 3: Control Structures: Loops & Conditionals

#### Desired Results

##### Essential Questions:

- How do if/else statements and Boolean functions allow a program to make decisions?
- How can relational and logical operators be used to test conditions and control program flow?
- What are the differences between for loops and while loops, and when should each be used?
- How can loops help automate repetitive tasks and simplify code?
- How do we combine conditional statements and loops to create more complex and dynamic programs?
- How can testing and debugging strategies ensure that control structures and loops work correctly in a program?

##### Enduring Understandings:

*Students will understand that...*

- If/else statements allow programs to make decisions based on conditions.
- Boolean functions evaluate to true or false and are essential for controlling program flow.
- Relational operators compare values, and logical operators combine conditions to guide decisions.
- For loops execute a block of code a predetermined number of times, simplifying repetitive tasks.
- While loops execute code repeatedly until a condition is no longer true, enabling flexible iteration.
- Combining conditional statements and loops allows programs to respond dynamically to different situations.
- Effective use of control structures and loops improves program efficiency, readability, and maintainability.
- Testing, debugging, and refining control structures ensures that programs behave as intended.
- Planning and applying loops and conditionals strategically supports the development of complete programming projects.

##### Knowledge:

*Students will know...*

- Definitions: if/else statement, Boolean, Boolean function, relational operator, logical operator, comparison, condition, true, false, for loop, while loop, iteration, loop control, nested loop, counter, accumulator, conditional statement, expression, program flow, control structure, debugging, test, trace, variable, logic, algorithm, project

##### Skills:

*Students will be able to...*

- Use if/else statements to control the flow of a program based on conditions
- Evaluate and apply Boolean functions to make decisions in code
- Use relational and logical operators to compare values and combine conditions
- Implement for loops to execute a block of code a predetermined number of times
- Implement while loops to repeat code until a specific condition is met
- Nest loops and conditional statements to solve more complex problems

- Trace the flow of a program to predict its behavior and identify errors
- Debug programs that use loops and conditional statements
- Plan and design solutions that use iteration and decision-making structures
- Optimize code by selecting appropriate loops and conditions for a task
- Apply control structures to complete projects efficiently and correctly
- Test and refine programs to ensure loops and conditionals work as intended

### **Standards:**

#### Priority Standards

- |          |                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                       |
| 3A-AP-16 | Design and iteratively develop computational artifacts for practical intent, personal expression or to address a societal issue by using events to initiate instructions. |
| 3A-AP-18 | Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.                                     |
| 3B-AP-14 | Construct solutions to problems using student created components, such as procedures, modules and/or objects.                                                             |

#### Supporting Standards

- |          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.                                                     |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                                                                      |
| 3B-AP-08 | Describe how artificial intelligence drives many software and physical systems                                                                                                            |
| 3B-AP-10 | Use and adapt classic algorithms to solve computational problems                                                                                                                          |
| 3B-AP-12 | Compare and contrast fundamental data structures and their uses.                                                                                                                          |
| 3B-AP-13 | Illustrate the flow of execution of recursive algorithms.                                                                                                                                 |

## **Acceptable Evidence**

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessment**

- Warm-ups
- Checkpoint assignments
- Classwork
- Exit slips
- Keep a notebook
- Programming assignments

#### **Summative Assessment**

- Unit Quiz
- Unit Project



## **Suggested learning experiences and instruction**

### **Instructional Strategies:**

- Demonstrate writing programs in the selected IDE.
- Use PowerPoint slides to present concepts and terminology.
- Emphasize the steps in problem solving and the use of algorithms.

### **Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

Central Bucks School District – Course of Study  
**Unit 4: Smart Structures: Methods & Reuse**

**Desired Results**

**Essential Questions:**

- How do user-defined methods allow programmers to simplify and organize code?
- How does abstraction help focus on essential features while ignoring unnecessary details?
- Why is modularity important for creating large, maintainable programs?
- How can reusing code improve efficiency and reduce errors in programming projects?
- How do user-defined methods, abstraction, and modularity work together to solve complex problems?
- How can testing, debugging, and refining individual modules improve the overall quality of a program?
- How can these concepts be applied to complete programming projects effectively and creatively?

**Enduring Understandings:**

*Students will understand that...*

- User-defined methods allow programmers to break down tasks into smaller, manageable pieces.
- Abstraction helps programmers focus on the essential behavior of a program without getting lost in details.
- Modularity organizes code into independent, reusable sections that improve readability and maintainability.
- Reusing methods and code components increases efficiency and reduces the likelihood of errors.
- Combining methods, abstraction, and modularity supports the development of more complex and flexible programs.
- Testing and debugging individual methods or modules ensures the program functions correctly as a whole.
- Applying these principles promotes good programming practices and effective problem-solving in projects.

**Knowledge:**

*Students will know...*

- Definitions: user-defined method, method, procedure, function, abstraction, modularity, module, reuse, parameter, argument, return value, variable, object, class, code block, procedure call, program structure, encapsulation, debugging, test, trace, program flow, project, algorithm

**Skills:**

*Students will be able to...*

- Create and call user-defined methods to organize code
- Pass parameters and use return values to make methods flexible
- Apply abstraction to focus on essential program features and hide unnecessary details
- Break programs into modular components for readability and maintainability
- Reuse methods and code blocks to improve efficiency and reduce errors
- Combine multiple methods to solve complex problems
- Trace the flow of a program that uses user-defined methods and modular design

- Debug programs that include methods and modular components
- Plan and design programs using modularity and abstraction principles
- Apply abstraction and modularity to complete programming projects successfully
- Evaluate and refine code for reusability, efficiency, and clarity

### **Standards:**

#### Algorithms and Programming

##### Priority Standards

- |          |                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                       |
| 3A-AP-16 | Design and iteratively develop computational artifacts for practical intent, personal expression or to address a societal issue by using events to initiate instructions. |
| 3A-AP-18 | Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.                                     |
| 3B-AP-14 | Construct solutions to problems using student created components, such as procedures, modules and/or objects.                                                             |

##### Supporting Standards

- |          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.                                                     |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                                                                      |
| 3B-AP-09 | Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem.                                                                                |
| 3B-AP-10 | Use and adapt classic algorithms to solve computational problems.                                                                                                                         |
| 3B-AP-12 | Compare and contrast fundamental data structures and their uses.                                                                                                                          |
| 3B-AP-13 | Illustrate the flow of execution of recursive algorithms.                                                                                                                                 |

### **Acceptable Evidence**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups
- Checkpoint assignments
- Classwork
- Homework
- Exit slips
- Keep a notebook
- Programming assignments

##### **Summative Assessment**

- Unit Quiz
- Unit Project

### **Suggested learning experiences and instruction**

**Instructional Strategies:**

- Demonstrate writing programs in the selected IDE.
- Use PowerPoint slides to present concepts and terminology.
- Emphasize the steps in problem solving and the use of algorithms.

**Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

**For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

**For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 5: Events & Handling

#### **Desired Results**

##### **Essential Questions:**

- How do events allow programs to respond to user interactions or other triggers?
- How can parameters be used with event-handling methods to create dynamic responses in a program?
- What are the differences between interactive programming and sequential programming?
- How can event-driven programming make programs more engaging and responsive?
- How do we design, test, and debug event-handling methods to ensure correct program behavior?
- How can events and event-handling methods be combined to create interactive projects efficiently?

##### **Enduring Understandings:**

*Students will understand that...*

- Events enable programs to respond to user actions, system signals, or other triggers.
- Event-handling methods allow programmers to define specific responses to events.
- Parameters passed to event-handling methods provide information needed to respond dynamically.
- Interactive programming makes programs more responsive and engaging for users.
- Combining events and event-handling methods allows for more flexible and modular program design.
- Debugging and testing event-driven programs ensures that all possible interactions are handled correctly.
- Applying event-driven principles supports the creation of complete and interactive programming projects.

##### **Knowledge:**

*Students will know...*

- Definitions: event, event handler, event-driven programming, interactive programming, parameter, argument, method, function, procedure, callback, trigger, user input, mouse click, key press, program response, listener, object, object property, debugging, test, trace, project, program flow, handler method

##### **Skills:**

*Students will be able to...*

- Identify events and define event-handling methods to respond to them
- Use parameters in event-handling methods to create dynamic responses
- Design programs that respond to user interactions and system events
- Implement interactive programming techniques using objects, properties, and event handlers
- Combine multiple event-handling methods to create complex, responsive behaviors
- Trace and debug programs that include interactive events and handlers
- Apply testing strategies to ensure all events are handled correctly in a program

- Plan, design, and complete projects that use interactive programming and event handling
- Evaluate and refine interactive programs for usability, functionality, and responsiveness

### **Standards:**

#### Algorithms and Programming

##### Priority Standards

- |          |                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                       |
| 3A-AP-14 | Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.                                                        |
| 3A-AP-16 | Design and iteratively develop computational artifacts for practical intent, personal expression or to address a societal issue by using events to initiate instructions. |
| 3A-AP-18 | Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.                                     |
| 3B-AP-14 | Construct solutions to problems using student created components, such as procedures, modules and/or objects.                                                             |

##### Supporting Standards

- |          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.                                                     |
| 3A-AP-19 | Systematically design and develop programs for broad audiences by incorporating feedback from users.                                                                                      |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                                                                      |
| 3B-AP-09 | Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem.                                                                                |
| 3B-AP-10 | Use and adapt classic algorithms to solve computational problems.                                                                                                                         |
| 3B-AP-11 | Evaluate algorithms in terms of their efficiency, correctness, and clarity.                                                                                                               |
| 3B-AP-12 | Compare and contrast fundamental data structures and their uses.                                                                                                                          |
| 3B-AP-13 | Illustrate the flow of execution of recursive algorithms.                                                                                                                                 |
| 3B-AP-22 | Modify an existing program to add functionality and discuss intended and unintended implications (e.g., breaking other functionality).                                                    |
| 3B-AP-23 | Evaluate key qualities of a program through a process such as a code review.                                                                                                              |

### **Acceptable Evidence**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups
- Checkpoint assignments
- Classwork
- Homework
- Exit slips
- Keep a notebook
- Programming assignments

**Summative Assessment**

- Unit Quiz
- Unit Project

**Suggested learning experiences and instruction****Instructional Strategies:**

- Demonstrate writing programs in the selected IDE.
- Use PowerPoint slides to present concepts and terminology.
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**Differentiation:**

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- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

# **K-12 Math Course of Study Updates and Approvals**

**August 2026**



# Introductions



**Brian Novick**

K-12 Mathematics Supervisor

# Goal of Presentation



- ✓ Share updated course of study documents for:
  - ✓ Elementary: Advanced Math 5
  - ✓ High School: Accelerated Algebra 1, Honors Geometry, Code and Create
- ✓ Seek approval for new course of study documents:
  - ✓ Middle School: Academic Math 6, Intervention Math 7, Intervention Math 8
  - ✓ High School: Introduction to Python, AP Cybersecurity, and Calculus 3



10-15 minutes

# Agenda



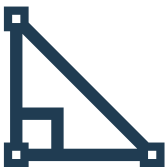
**Background**



**Elementary Courses**



**Middle School Courses**



**High School Courses**



# Background

## Secondary Mathematics Sequence

|                     | 5               | 6               | 7                  | 8                     | Credit 1              | Credit 2              | Credit 3                                 | Credit 4                                 |
|---------------------|-----------------|-----------------|--------------------|-----------------------|-----------------------|-----------------------|------------------------------------------|------------------------------------------|
| Academic            | Academic Math 5 | Academic Math 6 | Academic Math 7    | Academic Math 8       | Academic Algebra 1A   | Academic Algebra 1B   | Academic Geometry                        | Academic Algebra 2<br>Applied Math       |
|                     |                 |                 |                    |                       | Accelerated Algebra 1 | Accelerated Geometry  | Accelerated Algebra 2                    | Algebra 3/Trig<br>Precalculus/Trig       |
| Accelerated         |                 |                 | Accelerated Math 7 | Accelerated Algebra 1 | Accelerated Geometry  | Accelerated Algebra 2 | Algebra 3/Trig<br>Precalculus/Trig       | Stat and Data<br>Calculus 1              |
|                     |                 |                 |                    |                       | Honors Geometry       | Honors Algebra 2      | Honors Precalculus/Trig                  | AP Calculus AB<br>AP CS<br>AP Statistics |
| Honors/<br>Advanced | Advanced Math 5 | Advanced Math 6 | Advanced Algebra 1 | Advanced Geometry     | Honors Algebra 2      | Honors Precalculus    | AP Calculus AB<br>AP CS<br>AP Statistics | AP Calculus BC<br>AP CS<br>AP Statistics |

\*This chart does not represent all the options. Please talk with your math teacher if you are interested in pursuing an alternative.

# Advanced Math 5 – Update Only



## Course Content

- Chapter 1: Whole Numbers and the Four Operations
- Chapter 2: Fractions and Mixed Numbers
- Chapter 3: Multiplying and Dividing Fractions and Mixed Numbers
- Chapter 4: Decimals
- Chapter 5: Four Operations of Decimals
- Chapter 6: Volume
- Chapter 7: Line Plots and Coordinate Plane
- Chapter 8: Polygons
- Chapter 9: Ratio
- Chapter 10: Percent
- Chapter 11: Integers and Rational Numbers

## *Course Overview*

- ❑ Challenges students through both rigorous content and an accelerated pace
- ❑ Engages students in all Grade 5 mathematical standards, selected Grade 6 standards, and ongoing enrichment experiences that deepen understanding and reasoning
- ❑ Prepares students for the expectations and demands of the district's most advanced mathematics pathway
- ❑ Includes targeted updates in pacing, fluency, core enrichment, WIN, and assessment practices

*Next Course: Advanced Math 6*



# Academic Math 6 – Seeking Approval

## Course Content

- Unit 1: Number Systems and Operations
- Unit 2: Ratios and Rate Reasoning
- Unit 3: Expressions, Equations, and Inequalities
- Unit 4: Relationships in Geometry
- Unit 5: Data Collection and Analysis
- Unit 6: Rational Number Operations



## *Course Overview*

- ☐ Replaces the existing Math 6 course
- ☐ Supports a structured transition from the elementary division to middle school expectations
- ☐ Addresses all Grade 6 mathematical standards using the *Into Math* curriculum
- ☐ Provides instruction within a double-block model with embedded small-group instruction, intervention, and enrichment
- ☐ Reflects targeted professional learning, with teachers participating in June training and receiving ongoing support throughout the year

*Next Course: Academic Math 7 or Accelerated Math 7*



# Intervention Math 7 and Intervention Math 8 – Seeking Approval

## Grade 7

Unit 1: Number Systems and Operations

Unit 2: Rational Number Operations

Unit 3a: Model with Expressions, Equations

Unit 3b: Angle Relationships and Inequalities

Unit 4: Geometry

Unit 5: Sampling and Data Analysis

Unit 6: Probability

## Grade 8

Unit 1: Transformational Geometry

Unit 2: Linear Equations and Applications

Unit 3: Relationships and Functions

Unit 4: Statistics and Probability

Unit 5: Real Numbers and Pythagorean Theorem

Unit 6: Exponents, Scientific Notation, and Volume

## *Course Overview*

- ☐ Uses Zearn as the primary instructional resource
- ☐ Aligns to Academic Math 7 and Academic Math 8 course expectations
- ☐ Supports mid-year movement based on student progress and performance
- ☐ Integrates embedded assessments, including Progress Checks, Mid-Mission Assessments, and End-of-Mission Assessments
- ☐ Emphasizes growth and productivity as the primary components of grading, with progress monitoring incorporated
- ☐ Provides built-in flexible instructional days



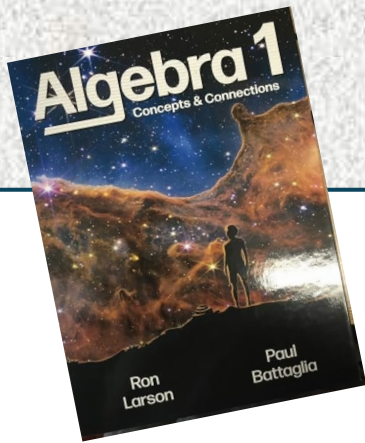




# Accelerated Algebra 1 – Update Only

## Course Content

- Chapter 1: Solving Linear Equations
- Chapter 2: Solving Linear Inequalities
- Chapter 3: Graphing Linear Functions
- Chapter 4: Writing Linear Functions
- Chapter 5: Solving Systems of Linear Equations
- Chapter 6: Exponents
- Chapter 7: Polynomial Equations and Factoring
- Chapter 9: Solving Quadratic Equations
- Chapter 11: Data Analysis and Displays
- Quadratics
- Radicals



## *Course Overview*

- ☐ Introduces a new offering at the high school
- ☐ Offers multiple pathways at the middle and high school levels
  - ☐ Advanced Algebra 1 – Algebra 1 + 7<sup>th</sup> Grade Standards
  - ☐ Accelerated Algebra 1 – Algebra 1 + 8<sup>th</sup> Grade Standards
  - ☐ Academic Algebra 1A – Algebra 1 Standards (Ch. 1-5)
  - ☐ Academic Algebra 1B – Algebra 1 Standards (Ch. 6-11)
  - ☐ **Accelerated Algebra HS – Algebra 1 Standards (Ch. 1-11)**
- ☐ Prepares students to take the Algebra 1 Keystone and the PSSA (Advanced and Accelerated)
- ☐ Includes built-in **retention** activities

*Next Course: Accelerated Geometry*





# Honors Geometry – Update Only

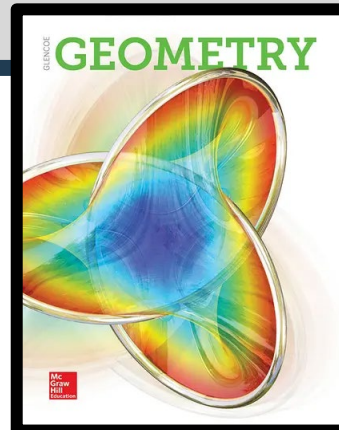
## Course Content

- Unit 1: Tools of Geometry
- Unit 2: Logical Arguments and Line Relationships
- Unit 3: Triangle Foundations and Similarity
- Unit 4: Right Triangles and Trigonometry
- Unit 5: Congruent Triangles
- Unit 6: Quadrilaterals and Polygons
- Unit 7: Circles
- Unit 8: Mixed Area, Surface Areas, and Volume

## *Course Overview*

- ☐ Updates Advanced Geometry to align with the high school schedule
- ☐ Undergoes a full rewrite in the 2026–27 school year
- ☐ Provides a rigorous, standards-aligned progression through geometric reasoning, proof, similarity, congruence, right-triangle trigonometry, polygons, circles, area, surface area, and volume, with continued emphasis on applying algebraic concepts to geometric situations

*Next Course: Honors Algebra 2*





# Code and Create – Update Only

## Course Content

- Unit 1: Getting to Know Your IDE
- Unit 2: Programming Basics
- Unit 3: Control Structures: Loops and Conditionals
- Unit 4: Smart Structures: Methods and Reuse
- Unit 5: Events and Handling

## **Course Overview**

- ☐ Renames and updates the former *Introduction to Computer Programming* course
- ☐ Offers an entry-level elective that requires no prior computer science experience
- ☐ Introduces computer science through accessible, block-based coding in an object-oriented programming environment
- ☐ Aligns with K–12 Computer Science standards



# Introduction to Python – Seeking Approval

## Course Content

- Unit 1: Introduction to Programming with Graphics
- Unit 2: Introduction to Python Basics
- Unit 3: Conditionals
- Unit 4: Loops
- Unit 5: Functions
- Unit 6: Strings
- Unit 7: Data Structures

## *Course Overview*

- ☐ Provides a new elective course in computer science
- ☐ Introduces students to the fundamentals of computer programming
- ☐ Requires no prerequisites, making computer science accessible to a broader range of students
- ☐ Develops logical thinking and problem-solving skills through designing, coding, testing, debugging, and refining Python programs
- ☐ Aligns with K–12 Computer Science standards

*Next Course: AP Computer Science A*



# AP Cybersecurity – Seeking Approval

## Course Content

- Unit 1: Introduction to Security
- Unit 2: Securing Spaces
- Unit 3: Securing Networks
- Unit 4: Securing Devices
- Unit 5: Securing Applications and Data

## *Course Overview*

- ❑ Provides a new Advanced Placement course in computer science
- ❑ Introduces students to the principles, practices, and tools used to secure digital systems
- ❑ Emphasizes applied, hands-on learning through AP Classroom labs, real-world cybersecurity scenarios, formative assessments, and project-based experiences
- ❑ Develops both technical understanding and risk-based decision-making as students analyze vulnerabilities, threats, security controls, encryption, authentication, access control, and attack detection
- ❑ Connects cybersecurity to ethical, personal, and societal issues

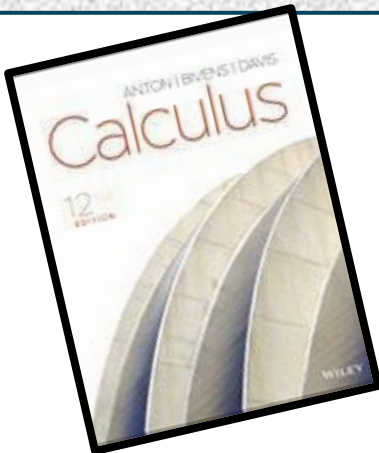
*Next Course: N/A*



# Calculus 3 – Seeking Approval

## Course Content

- Unit 1: Review of Single Variable Calculus
- Unit 2: Three-Dimensional Space
- Unit 3: Vector-Valued Functions
- Unit 4: Partial Derivatives
- Unit 5: Multiple Integrals
- Unit 6: Topics in Vector Calculus
- Unit 7: Second Order Differential Equations



## *Course Overview*

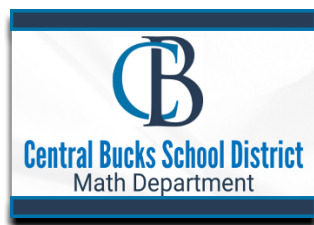
- ☐ Introduces a new course that parallels a third-semester college course
- ☐ Launches in a hybrid format in 2026–27
- ☐ Engages students in inquiry-based exploration of multivariable concepts
- ☐ Uses multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- ☐ Promotes mathematical discourse by requiring students to justify their reasoning, critique peers, and explain interpretations

*Next Course: N/A*



# Next Steps

- Seeking Approval for New Course of Study Documents
- Implementation
- Common Assessments
- Data Review



## Academic Math 6

Course Number: 2625

Course Level: Academic Math 6

Grade: 6

Time/Credit: 1 year/ 94 minutes daily

Development Date: Fall 2025 – Spring 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901



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## K – 12 Mathematics Program Learning Principles

### Teaching and Learning Principles:

1. Teaching mathematics for understanding requires providing experiences that stimulate students' curiosity and build confidence in investigating, problem solving, and communicating (speaking, reading, writing, representing, and listening).
2. Differentiated instruction addresses student strengths, interests, and learning styles.
3. Instruction should be appropriately paced to make the curriculum accessible to all students.
4. High expectations with strong support from teachers, parents and administrators motivate all students to achieve excellence in mathematics.
5. To create new understanding, students must be actively engaged in learning experiences designed to connect to their prior knowledge.
6. Presenting new ideas within rich and meaningful contexts helps learners to transfer and use knowledge meaningfully.
7. Making connections both within and outside of school helps learners to transfer and use knowledge meaningfully.
8. The learning process is enhanced when new ideas are presented using manipulatives, computers, calculators, and real-time data collection devices.
9. Teacher collaboration and reflection enrich learning experiences for students.
10. Assessment is an ongoing process that guides instruction and monitors student progress to include mastery of mathematics content and higher-level thinking skills.

### Documents Considered:

(2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

## K-12 Mathematics Program Enduring Understandings

### Students will understand that:

#### The Nature of Mathematics

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.

#### Numbers and Operations

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.
- Estimates help determine the reasonableness of an answer.
- Expressions are simplified using a predetermined order of operations.

#### Measurement

- Measurements collected using any tools (except for counting) are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing one linear dimension in a figure with two or three dimensions will have a different effect on the figure's perimeter, circumference, area, or volume.

#### Geometry

- Points, lines, and planes are the building blocks of geometry.
- Each geometric figure has a specific naming convention.
- Postulates, theorems, definitions, and properties are used to:
  - justify reasoning in a direct proof.
  - establish relationships involving two and three-dimensional figures.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter, and volume) are used for identification.
- The Pythagorean Theorem and trigonometric ratios are used to find missing quantities in right triangles.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.

#### Algebraic Concepts

- Algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems involving a constant rate of change can be modeled using proportional reasoning.
- Algebraic expressions, equations, inequalities, and functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic) are used to model relationships between quantities in real-world situations.
- Patterns and functions can be generalized and represented using verbal models, tables, equations, and graphs.

- Systems of equations are solved both graphically and algebraically and are used to model real-life problems.

### **Data Analysis and Probability**

- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Probability is used to make informed predictions and inferences.

## K-12 Mathematics Program Essential Questions

### The Nature of Mathematics

- What characteristics make mathematics a language?
- When is the correct solution not the answer to a problem?

### Numbers and Operations

- How do you know that an answer is reasonable?
- Why are there different number systems?
- How do you determine when to calculate with pencil and paper, find an estimate, or use a calculator?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

### Measurement

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension affect a figure's length, area, and volume?

### Geometry

- Why do all statements need justification?
- What is the logical progression of statements in a proof?
- How are figures classified?
- How do you name a geometric figure and why are standard naming conventions important?
- Why are points, lines, and planes so important in Euclidean geometry?
- How and when is the Pythagorean Theorem used?
- What do similarity and congruency statements tell you about polygons?

### Algebraic Concepts

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a pattern/function in different ways?

### Data Analysis and Probability

- What is the purpose of collecting data?
- How is data used or abused?
- How do we make predictions based on probability?

# Academic Math 6 Overview

## Desired Results

Course Description: This course is designed for students who are on track with grade-level content and material. This course will cover all sixth-grade standards preparing students for Academic Math 7 in seventh grade. Topics covered will include number systems and operations, ratio and rate, expressions, equations, inequalities, geometry, and data analysis.

The course structure also allows students who require support to receive targeted intervention within the 94-minute instructional block. The sixth-grade mathematics teacher will provide differentiated levels of support through the daily instructional model found in the appendix at the end of the document.

Prerequisite: Academic Math 5

Committee Members: Katie Marttila, Mike Lechniak, Jaime Lemon, Megan Milroy, Stacy Cunningham, Rachel Lodwig, Brian Yannarella, Amanda Higgins, Casey McCullion, Brian Novick, Math Supervisor

## Pacing Guide

### Academic Math 6 Pacing Guide

| Course Overview                                                                    | Days       |
|------------------------------------------------------------------------------------|------------|
| Unit 1: Number Systems and Operations                                              | 35         |
| Unit 2: Ratio and Rate Reasoning                                                   | 27         |
| Unit 3: Expressions, Equations, and Inequalities                                   | 31         |
| Unit 4: Relationships in Geometry                                                  | 26         |
| Unit 5: Data Collection and Analysis                                               | 21         |
| Standards Based Practice Review                                                    | 2          |
| Total Prior to PSSA Testing                                                        | <b>142</b> |
| Unit 6: Module 3, 4, 5 from Into Math Grade 7                                      | 23         |
| Beginning of Year Activities/Review/Remediation                                    | 2          |
| Flex Days – Field Trips, Snow Days, Half Days, Assemblies, School Activities, etc. | 8          |
| PSSA Testing – 1 Day for ELA, 2 Days for Math                                      | 3          |
| Final Exam/EOY Test and Review                                                     | 2          |
| <b>Total Days</b>                                                                  | <b>180</b> |

| Unit 1 – Number Systems and Operations (No Calculator)<br>35 days            |           |
|------------------------------------------------------------------------------|-----------|
| <b>Module 1: Integer Concepts (No Calculator)</b>                            | <b>6</b>  |
| Lesson 1.0 Are you Ready, Prerequisite Skill Review                          | 1         |
| Lesson 1.1 Identify and Interpret Integers                                   | 1         |
| Lesson 1.2 Compare and Order Integers on a Number Line                       | 1         |
| Lesson 1.3 Find and Apply Absolute Value                                     | 1         |
| Intervention and Enrichment; Review                                          | 1         |
| Module 1 Summative Test                                                      | 1         |
| <b>Module 2: Rational Number Concepts (No Calculator)</b>                    | <b>8</b>  |
| Lesson 2.0 Are you Ready, Prerequisite Skill Review                          | 1         |
| Lesson 2.1 Interpret Rational Numbers                                        | 1         |
| Lesson 2.2 Compare Rational Numbers on a Number Line                         | 1         |
| Summative Quiz                                                               | 0.5       |
| Lesson 2.3 Find and Apply LCM and GCF                                        | 1.5       |
| Lesson 2.4 Order Rational Numbers                                            | 1         |
| Intervention and Enrichment; Review                                          | 1         |
| Module 2 Summative Assessment                                                | 1         |
| <b>Module 3: Fraction Division (No Calculator)</b>                           | <b>12</b> |
| Lesson 3.0 Are you Ready, Prerequisite Skill Review                          | 1         |
| Lesson 3.1 Understand Fraction Division                                      | 1         |
| Lesson 3.2 Explore Division of Fractions with Unlike Denominators            | 2         |
| Lesson 3.3 Explore Division of Mixed Numbers                                 | 2         |
| Summative Quiz                                                               | 0.5       |
| Lesson 3.4 Practice and Apply Division of Fractions and Mixed Numbers        | 1.5       |
| Lesson 3.5 Practice Fraction Operations                                      | 2         |
| Intervention and Enrichment; Review                                          | 1         |
| Module 3 Summative Assessment                                                | 1         |
| <b>Module 4: Fluency with Multi-Digit Decimal Operations (No Calculator)</b> | <b>8</b>  |
| Lesson 4.0 Are you Ready, Prerequisite Skill Review                          | 1         |
| Lesson 4.1 Add and Subtract Multi-Digit Decimals                             | 1         |
| Lesson 4.2 Multiply Multi-Digit Decimals                                     | 1         |
| Lesson 4.3 Divide Multi-Digit Whole Numbers                                  | 1         |
| Lesson 4.4 Divide Multi-Digit Decimals                                       | 1         |
| Lesson 4.5 Apply Operations with Multi-Digit Decimals                        | 1         |
| Intervention and Enrichment; Review                                          | 1         |
| Module 4 Summative Assessment                                                | 1         |
| Unit 1                                                                       | 1         |
| • Retrieval Activity                                                         |           |
| • Performance Task                                                           |           |
| • Project                                                                    |           |
| • Intervention and Enrichment                                                |           |

| Unit 2 – Ratio and Rate Reasoning<br>27 Days                          |           |
|-----------------------------------------------------------------------|-----------|
| <b>Module 5: Ratios and Rates</b>                                     | <b>11</b> |
| Lesson 5.0 Are you Ready, Prerequisite Skill Review                   | 1         |
| Lesson 5.1 Understand the Concept and Language of Ratios              | 1         |
| Lesson 5.2 Represent Ratios and Rates with Tables and Graphs          | 2         |
| Lesson 5.3 Compare Ratios and Rates                                   | 1         |
| Summative Quiz                                                        | 0.5       |
| Lesson 5.4 Find and Apply Unit Rates                                  | 1.5       |
| Lesson 5.5 Solve Ratio and Rate Problems Using Proportional Reasoning | 2         |
| Intervention and Enrichment; Review                                   | 1         |
| Module 5 Summative Assessment                                         | 1         |
| <b>Module 6: Apply Ratios and Rates to Measurement</b>                | <b>7</b>  |
| Lesson 6.0 Are you Ready, Prerequisite Skill Review                   | 1         |
| Lesson 6.1 Use Ratio Reasoning with Circle Graphs                     | 1         |
| Lesson 6.2 Use Rate Reasoning to Convert Within Measurement Systems   | 1         |
| Lesson 6.3 Use Rate Reasoning to Convert Between Measurement Systems  | 2         |
| Intervention and Enrichment; Review                                   | 1         |
| Module 6 Summative Assessment                                         | 1         |
| <b>Module 7: Understand and Apply Percent</b>                         | <b>8</b>  |
| Lesson 7.0 Are you Ready, Prerequisite Skill Review                   | 1         |
| Lesson 7.1 Understand, Express, and Compare Percent Ratios            | 2         |
| Lesson 7.2 Use Strategies to Find a Percent of a Quantity             | 2         |
| Lesson 7.3 Solve a Variety of Percent Problems                        | 1         |
| Intervention and Enrichment; Review                                   | 1         |
| Module 7 Summative Assessment                                         | 1         |
| Unit 2                                                                | 1         |
| • Retrieval Activity                                                  |           |
| • Performance Task                                                    |           |
| • Project                                                             |           |
| • Intervention and Enrichment                                         |           |

| Unit 3: Expressions, Equations, and Inequalities<br>31 days        |           |
|--------------------------------------------------------------------|-----------|
| <b>Module 8: Numerical and Algebraic Expressions</b>               | <b>10</b> |
| Lesson 8.0 Are you Ready, Prerequisite Skill Review                | 0.5       |
| Lesson 8.1 Understand and Apply Exponents                          | 0.5       |
| Lesson 8.2 Write and Evaluate Numerical Expressions for Situations | 2         |
| Lesson 8.3 Write Algebraic Expressions to Model Situations         | 1         |
| Summative Quiz                                                     | 0.5       |
| Lesson 8.4 Interpret and Evaluate Algebraic Expressions            | 1.5       |
| Lesson 8.5 Identify and Generate Equivalent Algebraic Expressions  | 2         |



|                                                                        |           |
|------------------------------------------------------------------------|-----------|
| Intervention and Enrichment; Review                                    | 1         |
| Module 8 Summative Assessment                                          | 1         |
| <b>Module 9: Solve Problems Using Equations and Inequalities</b>       | <b>12</b> |
| Lesson 9.0 Are you Ready, Prerequisite Skill Review                    | 1         |
| Lesson 9.1 Write Equations to Represent Situations                     | 1         |
| Lesson 9.2 Use Addition and Subtraction Equations to Solve Problems    | 2         |
| Lesson 9.3 Use Multiplication and Division Equations to Solve Problems | 2         |
| Summative Quiz                                                         | 0.5       |
| Lesson 9.4 Use One-Step Equations to Solve a Variety of Problems       | 2.5       |
| Lesson 9.5 Write and Graph Inequalities                                | 1         |
| Intervention and Enrichment; Review                                    | 1         |
| Module 9 Summative Assessment                                          | 1         |
| <b>Module 10: Real-World Relationships Between Variables</b>           | <b>8</b>  |
| Lesson 10.0 Are you Ready, Prerequisite Skill Review                   | 1         |
| Lesson 10.1 Represent Equations in Tables and Graphs                   | 2         |
| Lesson 10.2 Write Equations from Verbal Descriptions                   | 1         |
| Lesson 10.3 Write Equations from Tables and Graphs                     | 2         |
| Intervention and Enrichment; Review                                    | 1         |
| Module 10 Summative Assessment                                         | 1         |
| Unit 3                                                                 | 1         |
| • Retrieval Activity                                                   |           |
| • Performance Task                                                     |           |
| • Project                                                              |           |
| • Intervention and Enrichment                                          |           |

|                                                                    |           |
|--------------------------------------------------------------------|-----------|
| <b>Unit 4: Relationships in Geometry</b>                           |           |
| <b>26 days</b>                                                     |           |
| <b>Module 11: Polygons on the Coordinate Plane</b>                 | <b>10</b> |
| Lesson 11.0 Are you Ready, Prerequisite Skill Review               | 1         |
| Lesson 11.1 Graph Rational Numbers on the Coordinate Plane         | 2         |
| Lesson 11.2 Graph Polygons on the Coordinate Plane                 | 1         |
| Lesson 11.3 Find Distance on the Coordinate Plane                  | 2         |
| Lesson 11.4 Find Perimeter and Area on the Coordinate Plane        | 2         |
| Intervention and Enrichment; Review                                | 1         |
| Module 11 Summative Assessment                                     | 1         |
| <b>Module 12: Area of Triangles and Special Quadrilaterals</b>     | <b>8</b>  |
| Lesson 12.0 Are you Ready, Prerequisite Skill Review               | 1         |
| Lesson 12.1 Develop and Use the Formula for Area of Parallelograms | 1         |
| Lesson 12.2 Develop and Use the Formula for Area of Triangles      | 1         |
| Lesson 12.3 Develop and Use the Formula for Area of Trapezoids     | 1.5       |
| Lesson 12.4 Find Area of Composite Figures                         | 1.5       |
| Intervention and Enrichment; Review                                | 1         |

|                                                      |          |
|------------------------------------------------------|----------|
| Module 12 Summative Assessment                       | 1        |
| <b>Module 13: Surface Area and Volume</b>            | <b>7</b> |
| Lesson 13.0 Are you Ready, Prerequisite Skill Review | 1        |
| Lesson 13.1 Explore Nets and Surface Area            | 2        |
| Lesson 13.2 Find Volume of Rectangular Prisms        | 1        |
| Lesson 13.3 Solve Volume Problems                    | 1        |
| Intervention and Enrichment; Review                  | 1        |
| Module 13 Summative Assessment                       | 1        |
| Unit 4                                               | 1        |
| • Retrieval Activity                                 |          |
| • Performance Task                                   |          |
| • Project                                            |          |
| • Intervention and Enrichment                        |          |

| Unit 5: Data Collection and Analysis<br>21 days      |          |
|------------------------------------------------------|----------|
| <b>Module 14: Data Collection and Displays</b>       | <b>6</b> |
| Lesson 14.0 Are you Ready, Prerequisite Skill Review | 0.5      |
| Lesson 14.1 Explore Statistical Data Collection      | 1        |
| Lesson 14.2 Display Data in Dot Plots                | 1        |
| Lesson 14.3 Make Histograms and Frequency Tables     | 1.5      |
| Intervention and Enrichment; Review                  | 1        |
| Module 14 Summative Assessment                       | 1        |
| <b>Module 15: Measures of Center</b>                 | <b>6</b> |
| Lesson 15.0 Are you Ready, Prerequisite Skill Review | 1        |
| Lesson 15.1 Explore Mean as Fair Share               | 1        |
| Lesson 15.2 Find Measures of Center                  | 1        |
| Lesson 15.3 Choose a Measure of Center               | 1        |
| Intervention and Enrichment; Review                  | 1        |
| Module 15 Summative Assessment                       | 1        |
| <b>Module 16: Variability and Data Distribution</b>  | <b>8</b> |
| Lesson 16.0 Are you Ready, Prerequisite Skill Review | 0.5      |
| Lesson 16.1 Explore Patterns of Data                 | 0.5      |
| Lesson 16.2 Display Data in Box Plots                | 1.5      |
| Lesson 16.3 Find Mean Absolute Deviation             | 1.5      |
| Lesson 16.4 Explore Measures of Variability          | 1        |
| Lesson 16.5 Describe Distributions                   | 1        |
| Intervention and Enrichment; Review                  | 1        |
| Module 16 Summative Assessment                       | 1        |

|                                                                                                                                                              |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit 5                                                                                                                                                       |   |
| <ul style="list-style-type: none"> <li>• Retrieval Activity</li> <li>• Performance Task</li> <li>• Project</li> <li>• Intervention and Enrichment</li> </ul> | 1 |

All material for Academic 6 is covered prior to PSSA.

The following modules are 7<sup>th</sup> grade standards

| Unit 6 – Rational Number Operations                                                      |           |
|------------------------------------------------------------------------------------------|-----------|
| 23 Days                                                                                  |           |
| <b>Module 3: Understand Addition and Subtraction of Rational Numbers (No Calculator)</b> |           |
| <b>Module 4: Add and Subtract Rational Numbers (No Calculator)</b>                       | <b>14</b> |
| Lesson 3.0 and 4.0 Are you Ready, Prerequisite Skill Review                              | 1         |
| Lesson 3.1 Add or Subtract a Positive Integer on a Number Line                           | 2         |
| Lesson 3.2 Add or Subtract a Negative Integer on a Number Line                           |           |
| Supplement: Adding and Subtracting Rational Numbers using a calculator                   |           |
| Lesson 4.1 Compute Sums of Integers                                                      | 2         |
| Lesson 4.2 Compute Differences of Integers                                               | 2         |
| Intervention and Enrichment; Review                                                      | 1         |
| Summative Quiz (Include 3.1, 3.2, 4.1, 4.2)                                              | 1         |
| Lesson 4.3 Compute Sums and Differences of Rational Numbers                              | 2         |
| Lesson 4.4 Apply Properties to Multi-Step Addition and Subtraction Problems              | 1         |
| Intervention and Enrichment; Review                                                      | 1         |
| Module 3 & 4 Summative Assessment (No Calculator)                                        | 1         |
| <b>Module 5: Multiply and Divide Rational Numbers</b>                                    | <b>9</b>  |
| Day 0                                                                                    | 1         |
| Lesson 5.0 Are you Ready, Prerequisite Skill Review                                      | 1         |
| Lesson 5.1 Understand Multiplication and Division of Rational Numbers                    | 2         |
| Lesson 5.2 Multiply Rational Numbers                                                     | 2         |
| Lesson 5.3 Write Fractions as Decimals and Divide Integers Lesson                        | 1         |
| Lesson 5.4 Multiply and Divide Rational Numbers in Context                               | 1         |
| Intervention and Enrichment; Review                                                      | 1         |
| Module 5 Summative Assessment                                                            | 1         |

|                         |          |
|-------------------------|----------|
| <b>End of Year Test</b> | <b>2</b> |
| Review                  | 1        |
| Final Exam/EOY Test     | 1        |

## Acceptable Evidence

Common Summative Assessments: There is a common summative assessment for each module.

Final Exam Grade: Final exam counts for 10% of the students' course grade.

**Course Grading:** The final course grade is calculated as follows:

- Each marking period grade counts for 22.5% of the students' course grade.
- The final exam counts for 10% of the students' course grade.

Additional remediation in standards/content from the grade level (or previous grade level) where the student completes this course will be provided for students when the teacher determines a student has not yet mastered that content. Enrichment opportunities will also be provided to meet the needs of students that acquire an understanding of the content faster than their class peers.

## Required and Supplementary Texts/Software

HMH Into Math – Grade 6

ISBN: 978-0-358-11581-6

Burger, E. B., Dixon, J. K., Kanold, T. D., Larson, M. R., Leinwand, S., & Houghton Mifflin Harcourt Publishing Company. (2020). Into math. Grade 6. Orlando, Florida: Houghton Mifflin Harcourt.

Zearn Math

- Sharma, S. (2025). *Zearn Math*. Zearn.

IXL Math

## Calculator Recommendation

The secondary mathematics department of Central Bucks School district recognizes the use of Calculators are valuable tools for learning in the mathematics classroom. In certain advanced courses, graphing calculators with specific capabilities are important for daily classroom performance and are required for advanced placement tests. While no specific brands are endorsed, there are restrictions on the types of calculators allowed on certain classroom tests and final exams. Calculators that perform operations with variables, such as the TI-89, TI-92, and HP49G, will not be permitted on district assessments and final exams, even though they may be used on some nationwide tests. Teachers have discretion as to whether these types may be used for classroom-related purposes.

Background: Fact fluency is a major emphasis in the elementary program. The math department believes in maintaining these foundational skills while teaching calculator

proficiency. Students are permitted to use a calculator on the majority of standardized tests (PSSA, Keystone Algebra 1, SAT, etc.).

*With this background in mind, students are always allowed to use a calculator on summative assessments unless it is indicated that calculators are not permitted for specific assessments and/or questions.*

## Central Bucks School District – Course of Study

### **Unit 1: Number Systems and Operations**

Module 1: Integer Concepts

Module 2: Rational Number Concepts

Module 3: Fraction Division

Module 4: Decimal Operations

### **Desired Results**

#### **Essential Questions:**

- How do integers and their positions on a number line help us represent real-world situations involving direction, change, and magnitude?
- How does absolute value help us interpret the distance of a number from zero in meaningful contexts?
- How can rational numbers (fractions and decimals, positive and negative) be compared and ordered to make sense of real-world situations?
- What does it mean for two rational numbers to be opposites, and how does that relationship help us understand quantities and change?
- What does it mean to divide a fraction by a fraction, and how do models help us understand this process?
- How can division of fractions be applied to solve real-world problems efficiently and accurately?
- How does understanding place value help us add, subtract, multiply, and divide decimals precisely?
- How can estimation and reasoning help us determine whether a decimal answer is reasonable in a real-world context?

#### **Enduring Understandings:**

*Students will understand how to...*

Module 1:

- Identify and Interpret Integers
- Compare and Order Integers on a Number Line
- Find and Apply Absolute Value

Module 2:

- Interpret Rational Numbers
- Compare Rational Numbers on a Number Line
- Find and Apply LCM and GCF
- Order Rational Numbers

#### Module 3:

- Understand Fraction Division
- Explore Division of Fractions with Unlike Denominators
- Explore Division of Mixed Numbers
- Practice and Apply Division of Fractions and Mixed Numbers
- Practice Fraction Operations

#### Module 4:

- Add and subtract multi-digit decimals
- Multiply multi-digit decimals
- Divide multi-digit whole numbers
- Divide multi-digit decimals
- Apply operations with multi-digit decimals

### Knowledge:

#### *Unit 1 Vocabulary*

Integers, negative number, opposites, positive number, inequality, absolute value, rational number, greatest common factor, least common multiple, dividend, divisor, expression, quotient, denominator, numerator, multiplicative inverse, reciprocal, rectangle, simplify, simplest form, remainder, equivalent

### Skills:

#### Module 1:

- Identify and interpret integers using a number line.
- Use number lines to compare and order integers.
- Find and use absolute value in real-world situations.

#### Module 2:

- Graph rational numbers on vertical and horizontal number lines.
- Compare rational numbers using a number line.
- Compare rational numbers using the GCF and LCM.
- Use strategies to order rational numbers.

#### Module 3

- Divide fractions with the same denominators.
- Divide fractions with unlike denominators.
- Divide mixed numbers.
- Divide fractions and mixed numbers.
- Use LCM and GCF to add, subtract, multiply and divide fractions.

#### Module 4

- Add and subtract multi-digit decimals.
- Multiply multi-digit decimals.
- Divide multi-digit whole numbers using the standard algorithm.
- Divide multi-digit decimals using the standard algorithm.
- Solve real-world problems involving operations with multi-digit decimals.

## Standards:

### Priority Standards:

- **CC.2.1.6.E.1:** Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- **CC.2.1.6.E.2:** Identify and choose appropriate processes to compute fluently with multi-digit numbers.
- **CC.2.1.6.E.3:** Develop and/or apply number theory concepts to find common factors and multiples.
- **CC.2.1.6.E.4:** Apply and extend previous understandings of numbers to the system of rational numbers.

### Eligible Content:

- **M06.A-N.1.1.1:** Interpret and compute quotients of fractions (including mixed numbers), and solve word problems involving division of fractions by fractions.
- **M06.A-N.2.1.1:** Solve problems involving operations (+, −, ×, ÷) with whole numbers, decimals (through thousandths), straight computation, or word problem.
- **M06.A-N.2.2.1:** Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12.
- **M06.A-N.2.2.2:** Apply the distributive property to express a sum of two whole numbers, 1 through 100, with a common factor as a multiple of a sum of two whole numbers with no common factor.
- **M06.A-N.3.1.1:** Represent quantities in real-world contexts using positive and negative numbers, explaining the meaning of 0 in each situation (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge).
- **M06.A-N.3.1.2:** Determine the opposite of a number and recognize that the opposite of the opposite of a number is the number itself (e.g.,  $-(-3) = 3$ ; 0 is its own opposite).
- **M06.A-N.3.1.3:** Locate and plot integers and other rational numbers on a horizontal or vertical number line; locate and plot pairs of integers and other rational numbers on a coordinate plane.
- **M06.A-N.3.2.1:** Write, interpret, and explain statements of order for rational numbers in real-world contexts.
- **M06.A-N.3.2.2:** Interpret the absolute value of a rational number as its distance from 0 on the number line and as a magnitude for a positive or negative quantity in a real-world situation.



## Acceptable Evidence

### Problem Solving Tasks:

- Unit 1 Project: Cocoa Costs (Use after 4.3)
- Event Organizer STEM Task (pg. 1)
- Unit 1 Performance Task (use after Module 4)

### Acceptable evidence of learning other than Problem Solving Tasks:

#### Formative Assessments

- Spark your learning
- Learn Together Tasks
- Spiral Review
- Test Prep
- Warm-up
- Keep a notebook with pencil/paper or Microsoft OneNote
- Exit Slips
- More Practice/Homework
- Fluency Practice

#### Summative Assessment:

- Module 1:
  - Module 1 Assessment
- Module 2:
  - Module 2: 2.1 – 2.2 Summative Quiz
  - Module 2 Assessment
- Module 3:
  - Module 3: 3.1 – 3.3 Summative Quiz
  - Module 3 Assessment
- Module 4 Test
  - Module 4 Assessment

## Suggested Learning Experiences and Instruction

- The student will identify that a number and its opposite are the same distance from 0 on a number line but lie on opposite sides (e.g., 3 and -3).
- The student will understand that a negative sign can mean “negative” or “the opposite of,” such as -3 meaning negative 3 and  $-(-3)$  meaning the opposite of -3.
- The student will recognize that the opposite of the opposite of a number is the number itself, expressed as  $-(-a) = a$ .
- The student will describe integers as all whole numbers and their opposites (... , -3, -2, -1, 0, 1, 2, 3, ...).
- The student will explain that integers are symmetric about 0 on the number line, and folding at 0 pairs each integer with its opposite.

- The student will apply the rule that dividing by a fraction is the same as multiplying by its reciprocal:  $a/b \div c/d = a/b \times d/c$  (with nonzero denominators).
- The student will connect division and multiplication using models, such as grouping to solve problems like  $2 \div 1/4 = 8$ .
- The student will explain that the reciprocal represents how many of the divisor-sized groups fit in one whole, and multiplying by it gives the same result as the original division.

### Differentiation/Intervention/Enrichment Options:

- Utilize study guide and intervention for students who need more reteaching.
- Use the skills practice as extra practice for students who need more entry level practice to master the concept.
- Use the More Practice / Homework worksheet as a standard practice sheet.
- Leverage the Word problem practice to provide additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- Use the enrichment sheet to provide higher-level practice opportunities for students.
- Utilize Reteach, Challenge, Tier 2, and Tier 3 practice sheets for varying levels of student understanding.

### For Language Development:

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Encourage students to use the chapter vocabulary.
- Multilingual Glossaries

### For Advanced Learners:

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper into the same skills.
- Provide more rigorous opportunities for mathematical proof.
- Leverage the resources available throughout the textbook and digital resources.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Unit 2: Ratios and Rate Reasoning

### Module 5: Ratios and Rates

### Module 6: Apply Ratios and Rates to Measurement

### Module 7: Understand and Apply Percent

## Desired Results

### Essential Questions:

- How can ratios and rates be used to describe and compare relationships between quantities?
- How do models and unit rates help represent, analyze, and solve ratio and rate problems?
- How can ratio and rate reasoning be applied to measurement and unit conversion problems?
- How do proportional relationships help solve real-world measurement situations?
- How is percent connected to fractions, decimals, and ratios?
- How can percent be used to solve real-world problems involving comparisons and change?

### Enduring Understandings:

*Students will understand how to...*

Module 5:

- Understand the Concept and Language of Ratios
- Represent Ratios and Rates with Tables and Graphs
- Compare Ratios and Rates
- Find and Apply Unit Rates
- Solve Ratio and Rate Problems Using Proportional Reasoning

Module 6:

- Use Ratio Reasoning with Circle Graphs
- Use Rate Reasoning to Convert Within Measurement Systems
- Use Rate Reasoning to Convert Between Measurement Systems

Module 7:

- Understand, Express, and Compare Percent Ratios
- Use Strategies to Find a Percent of a Quantity
- Solve a Variety of Percent Problems

### Knowledge:

*Unit 2 Vocabulary*

Ratio, point, equivalent ratios, rate, unit rate, circle, circle graph, conversion factor, customary system, metric system, percent

## Skills:

### Module 5:

- Understand and write ratios.
- Learn to use tables and graphs to represent ratios and rates.
- Use a table or double number lines to compare ratios and rates.
- Find and use unit rates to solve problems.
- Use equivalent ratios to solve real-world problems.

### Module 6:

- Apply ratio reasoning to make and interpret circle graphs.
- Convert units within a measurement system.
- Use equivalent ratios to convert measurements between measurement systems.

### Module 7:

- Write a ratio as a percent.
- Find a percent of a quantity.
- Use percents to solve real-world problems.

## Standards:

### Priority Standards:

- **CC.2.1.6.D.1** Students acquire the knowledge and skills needed to: Understand ratio concepts and use ratio reasoning to solve problems.

### Eligible Content:

- **M06.A-R.1.1.1** Use ratio language and notation (such as 3 to 4, 3:4,  $\frac{3}{4}$ ) to describe a ratio relationship between two quantities.
- **M06.A-R.1.1.2** Find the unit rate  $a/b$  associated with a ratio  $a:b$  (with  $b \neq 0$ ) and use rate language in the context of a ratio relationship.
- **M06.A-R.1.1.3** Construct tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and/or plot the pairs of values on the coordinate plane. Use tables to compare ratios.
- **M06.A-R.1.1.4** Solve unit rate problems including those involving unit pricing and constant speed.
- **M06.A-R.1.1.5** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means  $30/100$  times the quantity); solve problems involving finding the whole, given a part and the percentage.

## Acceptable Evidence

### Problem Solving Tasks:

- Unit 2 Project- Record-Deal Ratios (Use after 7.2)
- Music Producer STEM Task (pg. 135)
- Unit 2 Performance Task (after Module 7)

**Acceptable evidence of learning other than Problem Solving Tasks:****Formative Assessments**

- Spark your learning
- Learn Together Tasks
- Spiral Review
- Test Prep
- Warm-up
- Keep a notebook with pencil/paper or Microsoft OneNote
- Exit Slips
- More Practice/Homework
- Fluency Practice
- Quizzes

**Summative Assessment:**

- Module 5:
  - Module 5: 5.1-5.3 Summative Quiz
  - Module 5 Assessment
- Module 6:
  - Module 6 Assessment
- Module 7:
  - Module 7 Assessment

**Suggested Learning Experiences and Instruction**

- The student will compare two quantities using a ratio and represent the comparison in words, colon form, or fraction form.
- The student will identify and generate equivalent ratios by multiplying or dividing both terms by the same nonzero number.
- The student will describe ratios in context to interpret their meaning in real-world situations.
- The student will use visual models, such as grouped pictures or dot diagrams, to understand ratios and create equivalent ratios.
- The student will build equivalent ratios by repeating a known ratio model until reaching the desired terms.
- The student will apply conversion factors to relate equivalent measures using fractions equal to 1.
- The student will understand that percent means “per hundred” and write percents as fractions over 100.
- The student will model percents visually using a 100-square grid to represent the portion indicated.

**Differentiation/Intervention/Enrichment Options:**

- Utilize study guide and intervention for students who need more reteaching.
- Use the skills practice as extra practice for students who need more entry-level practice to master the concept.
- Use the More Practice / Homework worksheet as a standard practice sheet.
- Leverage the Word problem practice to provide additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- Using the enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.
- Utilize Reteach, Challenge, Tier 2, and Tier 3 practice sheets for varying levels of student understanding.

### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Encourage students to use the chapter vocabulary.
- Multilingual Glossaries

### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- Leverage the resources available throughout the textbook and digital resources.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

### **Unit 3: Expressions, Equations, and Inequalities**

Module 8: Numerical and Algebraic Expressions

Module 9: Solve Problems Using Equations and Inequalities

Module 10: Real – World Relationships Between Variables

#### **Desired Results**

#### **Essential Questions:**

- How can variables and expressions represent real-world situations?
- How do the properties of operations help us simplify and evaluate expressions?
- How can equations and inequalities help solve real-life problems?
- What strategies help us determine and verify solutions to equations and inequalities?
- How can tables, graphs, and equations represent relationships between variables?
- How do changes in one quantity affect another, and how can we use this to make predictions?

#### **Enduring Understandings:**

*Students will understand how to...*

Module 8:

- Understand and Apply Exponents
- Write and Evaluate Numerical Expressions for Situations
- Write Algebraic Expressions to Model Situations
- Interpret and Evaluate Algebraic Expressions
- Identify and Generate Equivalent Algebraic Expressions

Module 9:

- Write Equations to Represent Situations
- Use Addition and Subtraction Equations to Solve Problems
- Use Multiplication and Division Equations to Solve Problems
- Use One-Step Equations to Solve a Variety of Problems
- Write and Graph Inequalities

Module 10:

- Represent Equations in Tables and Graphs
- Write Equations from Verbal Descriptions
- Write Equations from Tables and Graphs

## Knowledge:

### *Unit 3 Vocabulary:*

Factor, base, exponent, Distributive Property, order of operations, evaluate, numerical expression, term, algebraic expression, coefficient, constant, variable, perimeter, Associative Property of Addition, Associative Property of Multiplication, Commutative Property of Addition, Commutative Property of Multiplication, equivalent expression, like term, triangle, equation, solution of an equation, Addition Property of Equality, Subtraction Property of Equality, Division Property of Equality, Multiplication Property of Equality, angle, degree, constraint, inequality, solution of an inequality, dependent variable, independent variable

## Skills:

### Module 8:

- Write and find the value of expressions involving exponents.
- Write and evaluate numerical expressions.
- Write an algebraic expression to represent a situation.
- Interpret and evaluate an algebraic expression.
- Identify and generate equivalent expressions.

### Module 9:

- Model and write an equation to represent a situation.
- Solve equations that contain addition and subtraction.
- Solve equations that contain multiplication and division.
- Write and use equations to represent situations and solve problems.
- Write and graph inequalities to represent real-world situations.

### Module 10:

- Represent an equation in a table or graph.
- Write an equation given a verbal description of a relationship.
- Write an equation using a table or graph.

## Standards:

### Priority Standards:

- **CC.2.2.6.B.1** Apply and extend previous understandings of arithmetic to algebraic expressions
- **CC.2.2.6.B.2** Understand the process of solving a one-variable equation or inequality and apply it to real-world and mathematical problems.
- **CC.2.2.6.B.3** Represent and analyze quantitative relationships between dependent and independent variables.



Eligible Content:

- **M06.B-E.1.1.1** – Write and evaluate numerical expressions with whole-number exponents
- **M06.B-E.1.1.2** – Write algebraic expressions from verbal descriptions
- **M06.B-E.1.1.3** – Identify parts of an expression (sum, term, product, factor, quotient, coefficient, quantity)
- **M06.B-E.1.1.4** – Evaluate expressions at specific variable values, including real-world formulas
- **M06.B-E.1.1.5** – Apply properties of operations to generate equivalent expressions
- **M06.B-E.2.1.1** – Use substitution to test whether a number makes an equation or inequality true
- **M06.B-E.2.1.2** – Write algebraic expressions to represent real-world or mathematical problems
- **M06.B-E.2.1.3** – Solve real-world and mathematical problems using  $x + p = q$  and  $px = q$  (non-negative rational numbers)
- **M06.B-E.3.1.1** – Write equations expressing the relationship between dependent and independent variables
- **M06.B-E.3.1.2** – Analyze relationships using graphs and tables and relate them to equations

## Acceptable Evidence

### Problem Solving Tasks:

- Unit 3 Project Card: Art in the Expression (use after 9.1)
- Visual Artist STEM Task (pg. 229)
- Unit 3 Performance Task (after Module 10)

### Acceptable evidence of learning other than Problem Solving Tasks:

#### Formative Assessments

- Spark your learning
- Learn Together Tasks
- Spiral Review
- Test Prep
- Warm-up
- Keep a notebook with pencil/paper or Microsoft OneNote
- Exit Slips
- More Practice/Homework
- Fluency Practice
- Quizzes

#### Summative Assessment:

- Module 8:
  - Module 8: 8.1-8.3 Summative Quiz
  - Module 8 Assessment
- Module 9:
  - Module 9: 9.1-9.3 Summative Quiz
  - Module 9 Assessment
- Module 10:
  - Module 10 Assessment

#### Suggested Learning Experiences and Instruction

- The student will represent and explain the distributive property as multiplying a factor by a sum, distributing the factor to each addend.
- The student will illustrate the distributive property using area models, showing how the total area equals the sum of individual rectangular areas.
- The student will make connections between numerical expressions and real-world situations by translating words and phrases into equations or inequalities.
- The student will use variables to represent unknown numbers and understand how equations model real-world problems.
- The student will determine whether equations have solutions that make them true and use models to organize information before writing equations.
- The student will distinguish between dependent and independent variables in real-world contexts.
- The student will analyze situations to identify which variable depends on the other and explain how changes in the independent variable affect the dependent variable.

#### Differentiation/Intervention/Enrichment Options:

- Utilize study guide and intervention for students who need more reteaching.
- Use the skills practice as extra practice for students who need more entry level practice to master the concept.
- Use the More Practice / Homework worksheet as a standard practice sheet.
- Leverage the word problem practice to provide additional opportunities for students to engage in solving problems using the skill from the lesson.
- Use the enrichment sheet to provide higher-level practice opportunities for students.
- Utilize Reteach, Challenge, Tier 2, and Tier 3 practice sheets for varying levels of student understanding.

### For Language Development:

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Encourage students to use the chapter vocabulary.
- Multilingual Glossaries

### For Advanced Learners:

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- Leverage the resources available throughout the textbook and digital resources.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Unit 4: Relationships in Geometry

Module 11: Polygons on the Coordinate Plane

Module 12: Area of Triangles and Special Quadrilaterals

Module 13: Surface Area and Volume

### Desired Results

#### Essential Questions:

- How can coordinates be used to describe and analyze polygons on the coordinate plane?
- How can we use the coordinate plane to determine distances, side lengths, and shapes of polygons?
- How can we calculate the area of triangles and special quadrilaterals using formulas and reasoning?
- How does understanding shapes and their properties help solve real-world area problems?
- How can we determine the surface area and volume of three-dimensional figures using formulas?
- How does applying surface area and volume concepts help solve practical, real-world problems?

#### Enduring Understandings:

*Students will understand how to...*

Module 11:

- Graph Rational Numbers on the Coordinate Plane
- Graph Polygons on the Coordinate Plane
- Find Distance on the Coordinate Plane
- Find Perimeter and Area on the Coordinate Plane

Module 12:

- Develop and Use the Formula for Area of Parallelograms
- Develop and Use the Formula for Area of Triangles
- Develop and Use the Formula for Area of Trapezoids
- Find Area of Composite Figures

Module 13:

- Explore Nets and Surface Area
- Find Volume of Rectangular Prisms
- Solve Volume Problems

## Knowledge:

### *Unit 4 Vocabulary:*

Axes, coordinates, rectangle, x-coordinate, y-coordinate, hexagon, isosceles triangle, pentagon, quadrilateral, right angle, right triangle, transformation, area, base, height, coordinate plane, ordered pair, origin, quadrant, x-axis, y-axis, polygon, vertex, reflection, base of a parallelogram, height of a parallelogram, parallelogram, base of a triangle, diagonal, height of a triangle, base of a trapezoid, height of a trapezoid, trapezoid, composite figure, solid figure, volume, net, pyramid, surface area

## Skills:

### Module 11:

- Locate rational ordered pairs on the coordinate plane.
- Solve problems by graphing and identifying polygons in the coordinate plane.
- Use absolute value to find the distance between two points with the same x- or y-coordinate.
- Find the perimeter and area of polygons on the coordinate plane.

### Module 12:

- Find the areas of parallelograms.
- Find the area of triangles.
- Find the areas of trapezoids.
- Find the area of composite figures.

### Module 13:

- Use nets to find surface area.
- Find the volume of a rectangular prism.
- Write equations to solve problems involving the volume of rectangular prisms.

## Standards:

### Priority Standards:

- **CC.2.2.6.B.1** – Students acquire the knowledge and skills needed to: Apply and extend previous understandings of arithmetic to algebraic expressions.
- **CC.2.3.6.A.1** – Students acquire the knowledge and skills needed to: Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

Eligible Content:

- **M06.A-N.3.1.3** – Locate and plot integers and other rational numbers on a horizontal or vertical number line; locate and plot pairs of integers and other rational numbers on a coordinate plane.
- **M06.A-N.3.2.3** – Solve real-world and mathematical problems by plotting points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
- **M06.B-E.1.1.4** – Evaluate expressions at specific values of their variables, including expressions that arise from formulas used in real-world problems.
- **M06.C-G.1.1.1** – Determine the area of triangles and special quadrilaterals (i.e., square, rectangle, parallelogram, rhombus, and trapezoid). Formulas will be provided.
- **M06.C-G.1.1.2** – Determine the area of irregular or compound polygons.
- **M06.C-G.1.1.3** – Determine the volume of right rectangular prisms with fractional edge lengths. Formulas will be provided.
- **M06.C-G.1.1.4** – Given coordinates for the vertices of a polygon in the plane, use the coordinates to find side lengths and area of the polygon (limited to triangles and special quadrilaterals). Formulas will be provided.
- **M06.C-G.1.1.5** – Represent three-dimensional figures using nets made of rectangles and triangles.
- **M06.C-G.1.1.6** – Determine the surface area of triangular and rectangular prisms (including cubes). Formulas will be provided.

## Acceptable Evidence

### Problem Solving Tasks:

- Unit 4 Project Card: Think Outside the Box
- Marketing Manager STEM Task (pg. 337)
- Unit 4 Performance Task (after Module 13)

### Acceptable evidence of learning other than Problem Solving Tasks:

#### Formative Assessments

- Spark your learning
- Learn Together Tasks
- Spiral Review
- Test Prep
- Warm-up
- Keep a notebook with pencil/paper or Microsoft OneNote
- Exit Slips
- More Practice/Homework
- Fluency Practice
- Quizzes

#### Summative Assessment:

- Module 11 Assessment
- Module 12 Assessment
- Module 13 Assessment

### Suggested Learning Experiences and Instruction

- The student will make connections between number lines and coordinate planes to find lengths of horizontal and vertical segments using absolute value.
- The student will calculate distances between points on a coordinate plane, understanding that distance is always positive.
- The student will apply segment lengths to solve problems involving perimeter and area of figures on a coordinate plane.
- The student will understand that area is measured in unit squares and that a unit square has sides of 1 unit and an area of 1 square unit.
- The student will calculate areas of rectangles, parallelograms, triangles, and trapezoids, recognizing that length and width may also be called base and height.
- The student will explore models of rectangular prisms using real-world objects like cereal boxes to understand three-dimensional shapes.
- The student will create and analyze nets of rectangular prisms to determine surface area and understand that different nets for the same prism yield the same surface area.

### Differentiation/Intervention/Enrichment Options:

- Utilize study guide and intervention for students who need more reteaching.
- Use the skills practice as extra practice for students who need more entry level practice to master the concept.
- Use the More Practice / Homework worksheet as a standard practice sheet.
- Leverage the Word problem practice to provide additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- Use the enrichment sheet to provide higher-level practice opportunities for students.
- Utilize Reteach, Challenge, Tier 2, and Tier 3 practice sheets for varying levels of student understanding.

### For Language Development:

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Encourage students to use the chapter vocabulary.
- Multilingual Glossaries

### For Advanced Learners:

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- Use the enrichment sheet to provide higher-level practice opportunities for students.
- Leverage the resources available throughout the textbook and digital resources.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects



## **Unit 5: Data Collection and Analysis**

Module 14: Data Collection and Displays

Module 15: Measures of Center

Module 16: Variability and Data Distribution

### **Desired Results**

#### **Essential Questions:**

- How can we collect and organize data so it clearly communicates information?
- How do different types of graphs help us identify patterns and relationships in data?
- How do we find the mean, median, and mode of a data set, and when is each most useful?
- How can measures of center help us compare and interpret different sets of data?
- How can we describe the spread or variability of a data set?
- What does the shape of a data distribution tell us about the data and what we can predict from it?

#### **Enduring Understandings:**

*Students will understand how to...*

Module 14:

- Explore Statistical Data Collection
- Display Data in Dot Plots
- Make Histograms and Frequency Tables

Module 15:

- Explore Mean as Fair Share
- Find Measures of Center
- Choose a Measure of Center

Module 16:

- Explore Patterns of Data
- Display Data in Box Plots
- Find Mean Absolute Deviation
- Explore Measures of Variability
- Describe Distributions

## Knowledge:

### *Unit 5 Vocabulary:*

Set, data, statistical question, line plot, dot plot, frequency, bar graph, interval, frequency table, histogram, average, mean, measure of center, median, mode, outlier, box plot, lower quartile, upper quartile, mean absolute deviation (MAD), interquartile range (IQR), measure of variability, range

## Skills:

### Module 14:

- Identify a statistical question and describe data.
- Use dot plots to display data.
- Make histograms and frequency tables to display data.

### Module 15:

- Understand how fair share and balance point are related to the mean.
- Describe a set of data using mean, median, and mode.
- Choose an appropriate measure of center to describe a data set.

### Module 16:

- Describe overall patterns in a data set.
- Use box plots to display data.
- Determine and use the mean absolute deviation of a set of data points.
- Summarize a set of data by using range, interquartile range, and mean absolute deviation.
- Describe the distribution of a data set collected to answer a statistical question.

## Standards:

### Priority Standards:

- **CC.2.4.6.B.1** Students acquire the knowledge and skills needed to: Demonstrate an understanding of statistical variability by displaying, analyzing, and summarizing distributions.

### Eligible Content:

- **M06.D-S.1.1.1** Display numerical data in plots on a number line, including line plots, histograms, and box-and-whisker plots.
- **M06.D-S.1.1.2** Determine quantitative measures of center (e.g., median, mean, mode) and variability (e.g., range, interquartile range, mean absolute deviation).
- **M06.D-S.1.1.3** Describe any overall pattern and any deviations from the overall pattern with reference to the context in which the data were gathered.
- **M06.D-S.1.1.4** Relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

## Acceptable Evidence

### Problem Solving Tasks:

- Unit 5 Project Card: The Right Price
- Sales Director STEM Task (pg. 435)
- Unit 5 Performance Task (after Module 16)

### Acceptable evidence of learning other than Problem Solving Tasks:

#### Formative Assessments

- Spark your learning
- Learn Together Tasks
- Spiral Review
- Test Prep
- Warm-up
- Keep a notebook with pencil/paper or Microsoft OneNote
- Exit Slips
- More Practice/Homework
- Fluency Practice
- Quizzes

#### Summative Assessment:

- Module 14 Assessment
- Module 15 Assessment
- Module 16 Assessment

## Suggested Learning Experiences and Instruction

- The student will identify statistical questions as those that require a set of data to answer and have varying responses, distinguishing them from non-statistical questions.
- The student will recognize that statistical questions can involve non-numerical data, such as colors or categories, by recording frequencies of outcomes.
- The student will calculate the mean of a data set by adding all values and dividing by the number of values.
- The student will use a dot plot to verify that the mean acts as a balance point for a data distribution.
- The student will understand that for the mean to be a balance point, the sum of distances from data points on either side of the mean must be equal.
- The student will determine the distance between each data value and the mean using either counting units on a number line or subtraction to ensure positive distances.
- The student will calculate the mean absolute deviation (MAD) as the average distance of data values from the mean, preparing to use absolute value in future lessons.

### **Differentiation/Intervention/Enrichment Options:**

- Utilize study guide and intervention for students who need more reteaching.
- Use the skills practice as extra practice for students who need more entry level practice to master the concept.
- Use the More Practice / Homework worksheet as a standard practice sheet.
- Leverage the Word problem practice to provide additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- Using the enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.
- Utilize Reteach, Challenge, Tier 2, and Tier 3 practice sheets for varying levels of student understanding.

### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Encourage students to use the chapter vocabulary.
- Multilingual Glossaries

### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- Leverage the resources available throughout the textbook and digital resources.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects

## Unit 6: Rational Number Operations

Module 3 (Grade 7): Understand Addition and Subtraction of Rational Numbers

Module 4 (Grade 7): Add and Subtract Rational Numbers

Module 5 (Grade 7): Multiply and Divide Rational Numbers

### Desired Results

#### Essential Questions:

- How can you explain an understanding of adding and subtracting rational numbers?
- What strategies and methods can we use to add and subtract rational numbers in different mathematical problems?
- How do the rules of multiplication and division apply to rational numbers, and how can we use these operations to solve complex problems?
- In what ways can we apply our understanding of rational number operations to systematically solve multi-step real-world and mathematical problems?

#### Enduring Understandings:

*Students will understand how to...*

Module 3:

- Add or subtract a positive integer on a number line.
- Add or subtract a negative integer on a number line.
- Use a number line to add and subtract rational numbers.

Module 4:

- Compute sums of integers
- Compute differences of integers
- Compute sums and differences of rational numbers.
- Apply properties to multi-step addition and subtraction problems.

Module 5:

- Understand multiplication and division of rational numbers.
- Multiply rational numbers
- Write fractions as decimals and divide integers.
- Multiply and divide rational numbers in context.

#### Knowledge:

*Unit 2 Vocabulary*

Absolute value, addend, Addition property of opposites, additive inverse, Associative property of multiplication, Commutative property of multiplication, Compatible numbers, denominator, distributive property, Dividend, divisor, factor, identity property of addition, identity property of multiplication, integers, inverse operations, Inverse property of multiplication, mixed number, numerator, order of operations, percent error, product, quotient, rational number

## Skills:

### Module 3:

- Use a number line to add and subtract positive integers.
- Use a number line to add or subtract a negative integer and then assess their results for reasonableness.
- Use a number line to add and subtract rational numbers.

### Module 4:

- Calculate the sum of two integers.
- Calculate the difference of two integers without using a number line.
- Fluently add and subtract rational numbers without a number line.
- Use properties to solve multi-step problems involving sums and differences of positive and negative rational numbers.

### Module 5:

- Develop rules to find the product or quotient of two integers.
- Find the product of three or more signed rational numbers.
- Express quotients in different forms
- Use products and quotients of rational numbers to solve problems.

## Standards:

### Priority Standards:

- **CC.2.1.7.E.1** Students acquire the knowledge and skills needed to: Apply and extend previous understandings of operations with fractions to operations with rational numbers.
- **CC.2.1.7.D.1** Students acquire the knowledge and skills needed to: Analyze proportional relationships and use them to model and solve real-world and mathematical problems.
- **CC.2.2.7.B.1** Students acquire the knowledge and skills needed to: Apply properties of operations to generate equivalent expressions.
- **CC.2.2.7.B.3** Students acquire the knowledge and skills needed to: Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.

### Eligible Content:

- **M07.A-N.1.1.1** Apply properties of operations to add and subtract rational numbers, including real-world contexts.
- **M07.A-N.1.1.2** Represent addition and subtraction on a horizontal or vertical number line.
- **M07.A-N.1.1.3** Apply properties of operations to multiply and divide rational numbers, including real-world contexts; demonstrate that the decimal form of a rational number terminates or eventually repeat.
- **M07.B-E.2.1.1** Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate.
- **M07.B-E.2.3.1** Determine the reasonableness of answer(s) or interpret the solution(s) in the context of the problem.
- **M07.A-R.1.1.6** Use proportional relationships to solve multi-step ratio and percent problems.

## Acceptable Evidence

### Problem Solving Tasks:

- Unit 2 Project Card (use after 4.3)
- Film Director STEM Task (pg. 97)

### Acceptable evidence of learning other than Problem Solving Tasks:

#### Formative Assessments

- Spark your learning
- Learn Together Tasks
- Spiral Review
- Test Prep
- Warm-up
- Keep a notebook with pencil/paper or Microsoft OneNote
- Exit Slips
- More Practice/Homework
- Fluency Practice
- Quizzes

#### Summative Assessment:

- Summative Quiz (3.1, 3.2, 4.1, 4.2)
- Module 3 and 4 Test
- Module 5 Test

## Suggested Learning Experiences and Instruction

- Students are often taught to add two negative integers by finding the sum of the absolute values of the integers and taking the opposite of the result.
- Use a number line to add and subtract positive negative integers and rational numbers.
- It is important that students are able to apply the correct integer addition or subtraction rule at the appropriate time.
- Students should learn to distinguish among the different types of addition and subtraction problems.
- Students need to apply their prior knowledge of rational numbers to multiply and divide with rational numbers.
- Make students aware of the alternate names for the following properties identity: property of addition, identity property of multiplication, inverse property of addition, inverse property of multiplication.

## Differentiation/Intervention/Enrichment Options:

- Utilize study guide and intervention for students who need more reteaching.
- Skills practice is extra practice for students who need more entry level practice to master the concept.
- More Practice / Homework worksheet is a standard practice sheet.
- Word problem practice provides additional opportunities for students to engage in solving problems utilizing the skill from the lesson.
- The enrichment sheet provides a higher-level practice opportunity for students demonstrating faster understanding of the concept.
- Utilize Reteach, Challenge, Tier 2, and Tier 3 practice sheets for varying levels of student understanding.

## For Language Development:

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Use the study guide document with clear definitions and vocabulary development opportunities.
- Discuss the Chapter Wrap-Up, encouraging students to use the chapter vocabulary.
- Multilingual Glossaries

## For Advanced Learners:

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for mathematical proof.
- There are many resources available throughout our textbook and digital resources to draw upon for enrichment.
  - Practice sets from the textbook based on the readiness level to address individual needs.
  - Application practice
  - Enrichment projects



## Appendix – Sixth Grade Mathematics Instructional Routine

| Academic Math<br>6 Instructional<br>Model                                                        | Core Instruction                                                                                                                                                                                                                                                                                             | Small Group Instruction (SGI)                                                                                                                                                                                                        |                                                                                                                                              |                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                  | 60 - 65<br>minutes/day                                                                                                                                                                                                                                                                                       | 30 - 35 minutes/day                                                                                                                                                                                                                  |                                                                                                                                              |                                                                                                                                                                                                                          |
|                                                                                                  |                                                                                                                                                                                                                                                                                                              | Tier 2: 12 – 15 minutes 2 times/week (Total: 24 – 30 minutes/week)<br>Tier 3: 12 – 15 minutes 3 times/week (Total: 36 – 45 minutes/week)                                                                                             |                                                                                                                                              |                                                                                                                                                                                                                          |
|                                                                                                  |                                                                                                                                                                                                                                                                                                              | Tier 1                                                                                                                                                                                                                               | Tier 2                                                                                                                                       | Tier 3                                                                                                                                                                                                                   |
| Monday                                                                                           | INTO MATH<br>(with teacher)<br>Spark, Build Understanding, Step it Out, Check Understanding, On Your Own                                                                                                                                                                                                     | INTO MATH<br>(with teacher or independent)<br>Standards – Based Practice, Reteach/Challenge Pages, Test Prep/Spiral Review, Additional Practice, Fluency Maintenance/Builders<br><br>SUPPLEMENTAL<br>PSSA Practice<br>IXL<br>Quizlet | INTO MATH<br>(with teacher or independent)<br>Standards – Based Practice, Tier 2 Lesson, Math Language Routine, Fluency Maintenance/Builders | INTERVENTION LESSON<br>(with teacher)<br>Zearn                                                                                                                                                                           |
| Tuesday                                                                                          |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                      | SUPPLEMENTAL<br>PSSA Practice<br>IXL<br>Quizlet                                                                                              | INTERVENTION LESSON<br>(with teacher)<br>Zearn                                                                                                                                                                           |
| Wednesday                                                                                        |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                      | INTERVENTION LESSON<br>(with teacher)<br>Into Math                                                                                           | INTERVENTION LESSON<br>(with teacher)<br>Zearn                                                                                                                                                                           |
| Thursday                                                                                         |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                      | INTERVENTION LESSON<br>(with teacher)<br>Into Math                                                                                           | INTERVENTION LESSON<br>(with teacher or independent)<br>Zearn<br>OR<br>INTO MATH<br>(with teacher or independent)<br>Standards – Based Practice, Tier 3 Lesson, Math Language Routine, Fluency Maintenance/Builders, IXL |
| Friday                                                                                           |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                      | Interleaving Practice Format (Retrieval)                                                                                                     |                                                                                                                                                                                                                          |
| To maximize instructional time and prepare students for 7 <sup>th</sup> & 8 <sup>th</sup> grade: |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                      |                                                                                                                                              |                                                                                                                                                                                                                          |
| Assessment                                                                                       | End of Module Assessments (Common Summatives) should be limited to 47 – 60 minutes with a goal of students finishing in 47 minutes to prepare for seventh grade.<br>Module Quizzes (Teacher Created) should be limited to 20 – 25 minutes.<br>SGI/IPF should still occur on days when assessments are given. |                                                                                                                                                                                                                                      |                                                                                                                                              |                                                                                                                                                                                                                          |
| Homework                                                                                         | More Practice/Homework Pages (Approx. 15 minutes)<br>(In addition to the above instructional time, outside of the math block)                                                                                                                                                                                |                                                                                                                                                                                                                                      |                                                                                                                                              |                                                                                                                                                                                                                          |

# CENTRAL BUCKS SCHOOL DISTRICT

## Course of Study Recommendation for Adoption

**Course:** Academic Math 6

**Date:** August 6, 2026

**Student Level:** Middle School

**Grade Level:** 6

### **Characterization of Course of Study:**

This course is designed for students who are progressing through grade-level mathematics content. Academic Math 6 addresses all sixth-grade mathematics standards and prepares students for Academic Math 7 in seventh grade. Major areas of study include number systems and operations, ratios and rates, expressions, equations, inequalities, geometry, and data analysis.

The course structure also allows students who require Tier 2 or Tier 3 support to receive targeted intervention within the 94-minute instructional block. The sixth-grade mathematics teacher will provide differentiated levels of support through the daily instructional model.

### **Reasons for Proposed Adoption:**

During the 2023-24 curriculum review cycle, Pre-Algebra 6, Math 7, Pre-Algebra 7, and Pre-Algebra 8 were reviewed. The previously used Glencoe program for sixth-grade Pre-Algebra and middle school mathematics had been discontinued, creating the need to identify a new instructional resource aligned to the district's curriculum and instructional goals. In anticipation of district realignment, a committee was formed that included mathematics teachers from all five middle schools, two special education teachers, three elementary teachers, one high school teacher, mathematics coaches, and the district mathematics supervisor. The committee reviewed available programs, identified six finalists for further consideration, and, following a thorough evaluation process, recommended *Into Math* as the strongest instructional resource for students.

The selection process was guided by a four-phase timeline: **research, recommendation, feedback, and implementation.**

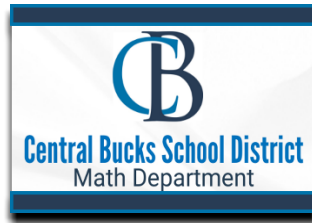
- **Research Phase:** Teacher input was collected, instructional resources were reviewed, and practices in high-performing districts across the state were examined.
- **Recommendation Phase:** Updated course pathways were developed, a core instructional resource was selected, and the proposed course of study was drafted.
- **Feedback Phase:** Feedback was gathered from mathematics coordinators, department teachers, and special education teachers to refine the course recommendation.
- **Implementation Phase:** A transition plan was developed, supporting resources were created, and professional development planning was initiated.

*Into Math* was piloted at Tamanend Middle School, where ongoing teacher feedback was collected to assess implementation, identify strengths, and determine areas for continued support. In response to this feedback, professional development opportunities were introduced to help teachers implement the program with fidelity. These efforts are intended to support consistent instructional practices, strengthen alignment with the program's framework, and promote successful implementation across the middle school mathematics program.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## **Intervention Math 7**

Course Number: 2745

Course Level: Intervention

Grade: 7

Time/Credit: 1 year/ 47 minutes daily

Development Date: Fall 2025 - Summer 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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# K – 12 Mathematics Program Learning Principles

## Teaching and Learning Principles:

1. Teaching mathematics for understanding requires providing experiences that stimulate students' curiosity and build confidence in investigating, problem solving, and communicating (speaking, reading, writing, representing, and listening).
2. Differentiated instruction addresses student strengths, interests, and learning styles.
3. Instruction should be appropriately paced to make the curriculum accessible to all students.
4. High expectations with strong support from teachers, parents and administrators motivate all students to achieve excellence in mathematics.
5. To create new understanding, students must be actively engaged in learning experiences designed to connect to their prior knowledge.
6. Presenting new ideas within rich and meaningful contexts helps learners to transfer and use knowledge meaningfully.
7. Making connections both within and outside of school helps learners to transfer and use knowledge meaningfully.
8. The learning process is enhanced when new ideas are presented using manipulatives, computers, calculators, and real-time data collection devices.
9. Teacher collaboration and reflection enrich learning experiences for students.
10. Assessment is an ongoing process that guides instruction and monitors student progress to include mastery of mathematics content and higher-level thinking skills.

## Documents Considered:

(2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

# Mathematics Program Enduring Understandings

**Students will understand that:**

## The Nature of Mathematics

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.

## Numbers and Operations

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.
- Estimates help determine the reasonableness of an answer.
- Expressions are simplified using a predetermined order of operations.

## Measurement

- Measurements collected using any tools (except for counting) are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing one linear dimension in a figure with two or three dimensions will have a different effect on the figure's perimeter, circumference, area, or volume.

## Geometry

- Points, lines, and planes are the building blocks of geometry.
- Each geometric figure has a specific naming convention.
- Postulates, theorems, definitions, and properties are used to:
  - justify reasoning in a direct proof.
  - establish relationships involving two and three-dimensional figures.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter, and volume) are used for identification.
- The Pythagorean Theorem and trigonometric ratios are used to find missing quantities in right triangles.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.

## Algebraic Concepts

- Algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems involving a constant rate of change can be modeled using proportional reasoning.
- Algebraic expressions, equations, inequalities, and functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic) are used to model relationships between quantities in real-world situations.

- Patterns and functions can be generalized and represented using verbal models, tables, equations, and graphs.
- Systems of equations are solved both graphically and algebraically and are used to model real-life problems.

### **Data Analysis and Probability**

- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Probability is used to make informed predictions and inferences.



# Mathematics Program Essential Questions

## The Nature of Mathematics

- What characteristics make mathematics a language?
- When is the correct solution not the answer to a problem?

## Numbers and Operations

- How do you know that an answer is reasonable?
- Why are there different number systems?
- How do you determine when to calculate with pencil and paper, find an estimate, or use a calculator?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

## Measurement

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension effect a figures length, area, and volume?

## Geometry

- Why do all statements need justification?
- What is the logical progression of statements in a proof?
- How are figures classified?
- How do you name a geometric figure and why are standard naming conventions important?
- Why are points, lines, and planes so important in Euclidean geometry?
- How and when is the Pythagorean Theorem used?
- What do similarity and congruency statements tell you about polygons?

## Algebraic Concepts

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a pattern/function in different ways?

## Data Analysis and Probability

- What is the purpose of collecting data?
- How is data used or abused?
- How do we make predictions based on probability?

# Math Intervention 7 Overview

## Desired Results

Course Description: This course is designed for students who would benefit from additional support to meet grade-level standards in mathematics. It focuses on reinforcing foundational skills and addressing learning gaps to build confidence and competence in core concepts.

Prerequisite: None

Committee Members: Katie Marttila, Mike Lechniak, Nicole Barlow, Brian Novick.

## Pacing Guide

| Math Intervention 7 Pacing Guide                                                   |            |
|------------------------------------------------------------------------------------|------------|
| Course Overview                                                                    | Days       |
| Semester 1A – Unit 1                                                               | 33         |
| Semester 1B – Unit 2                                                               | 24         |
| Semester 1C – Unit 3                                                               | 24         |
| <b>Semester 1 – Total Days</b>                                                     | <b>81</b>  |
| Semester 2A – Unit 3, Cont.                                                        | 19         |
| Semester 2B – Unit 4                                                               | 27         |
| Semester 2C – Unit 5                                                               | 11         |
| Semester 2D – Unit 6                                                               | 16         |
| <b>Semester 2 – Total Days</b>                                                     | <b>73</b>  |
| Beginning of Year Activities/Review/Remediation                                    | 5          |
| IXL Screener Arena                                                                 | 6          |
| Flex Days – Field Trips, Snow Days, Half Days, Assemblies, School Activities, etc. | 12         |
| PSSA Testing – 1 Day for ELA, 2 Days for Math                                      | 3          |
| <b>Total Days</b>                                                                  | <b>180</b> |

|                                                                                                                                                                                                                                 |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Semester 1A – 33 days</b>                                                                                                                                                                                                    |    |
| <b>Unit 1 – Number Systems and Operations</b>                                                                                                                                                                                   |    |
| <b>Aligned with Into Math Modules 1 and Module 2</b>                                                                                                                                                                            |    |
| Grade 7, Mission 2, Topic A – Representing Proportional Relationships with Tables                                                                                                                                               |    |
| Lesson 1: <i>One of These Things Is Not Like the Others (Online Only)</i>                                                                                                                                                       | .5 |
| Lesson 2: <i>Introducing Proportional Relationships with a Table</i>                                                                                                                                                            | 1  |
| Lesson 3: <i>More About Constant of Proportionality</i>                                                                                                                                                                         | 1  |
| <b>Foundational Lessons:</b> G6M3 Lesson 4: Use double number lines, tables, and thinking about "how much for 1" to convert measurement units. For additional support, G6M3 Lessons 1, 3-4.                                     |    |
| <b>Flex &amp; Progress Check #1</b>                                                                                                                                                                                             | 2  |
| Grade 7, Mission 2, Topic B – Representing Proportional Relationships with Equations                                                                                                                                            |    |
| Lesson 4: <i>Proportional Relationships and Equations</i>                                                                                                                                                                       | 1  |
| Lesson 6: <i>Using Equations to Solve Problems</i>                                                                                                                                                                              | 1  |
| <b>Foundational Lessons:</b> G6M3 Lesson 7: Identify a unit rate and use it to solve ratio problems. For additional support, G6M3 Lessons 5-7.                                                                                  |    |
| <b>Flex &amp; Progress Check #2</b>                                                                                                                                                                                             | 2  |
| Grade 7, Mission 2, Topic C – Comparing Proportional and Nonproportional Relationships                                                                                                                                          |    |
| Lesson 7: <i>Comparing Relationships with Tables</i>                                                                                                                                                                            | 1  |
| Lesson 8: <i>Comparing Relationships with Equations</i>                                                                                                                                                                         | 1  |
| Lesson 9: <i>Solving Problems about Proportional Relationships</i>                                                                                                                                                              | 1  |
| <b>Foundational Lessons:</b> G6M3 Lesson 8: Use unit rates to solve problems involving constant speed.                                                                                                                          |    |
| <b>Mid-Mission Assessment: Topics A-C – Progress Check #3</b>                                                                                                                                                                   | 2  |
| Grade 7, Mission 2, Topic D – Representing Proportional Relationships with Graphs                                                                                                                                               |    |
| Lesson 10: <i>Introducing Graphs of Proportional Relationships</i>                                                                                                                                                              | 1  |
| Lesson 11: <i>Interpreting Graphs of Proportional Relationships</i>                                                                                                                                                             | 1  |
| Lesson 12: <i>Using Graphs to Compare Relationships</i>                                                                                                                                                                         | 1  |
| <b>Foundational Lessons:</b> G6M6 Lesson 17: Create a table, graph, and equations to represent the relationship between distance and time for an object moving at a constant speed. For additional support, G6M6 Lessons 16-17. |    |
| <b>Flex &amp; Progress Check #4</b>                                                                                                                                                                                             | 2  |
| Grade 7, Mission 2, Topic E – Let's Put it to Work                                                                                                                                                                              |    |
| Lesson 14: <i>Four Representations</i>                                                                                                                                                                                          | 1  |
| <b>Foundational Lessons:</b> G7M2 Lesson 13: Interpret and compare the same proportional relationship using two different sets of tables, graphs, and equations.                                                                |    |
| <b>End-of-Mission Assessment: Topics D-E – Progress Check #5</b>                                                                                                                                                                | 2  |
| Grade 7, Mission 4, Topic B – Percent Increase and Decrease                                                                                                                                                                     |    |
| Lesson 6: <i>Increasing and Decreasing</i>                                                                                                                                                                                      | 1  |

|                                                                                                                                                                |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Lesson 7: <i>One Hundred Percent</i>                                                                                                                           | 1  |
| <b>Foundational Lessons:</b> G6M3 Lesson 11: <i>Use double number lines to find percentages.</i>                                                               |    |
| Lesson 8: <i>Percent Increase and Decrease with Equations</i>                                                                                                  | 1  |
| Lesson 9: <i>More and Less than 1%</i>                                                                                                                         | 1  |
| <b>Foundational Lessons:</b> G6M6 Lesson 7: <i>Use equations to solve problems involving percentages.</i>                                                      |    |
| <b>Flex &amp; Progress Check #6</b>                                                                                                                            | 2  |
| Grade 7, Mission 4, Topic C – Applying Percents                                                                                                                |    |
| Lesson 10: <i>Tax and Tip</i>                                                                                                                                  | 1  |
| Lesson 11: <i>Percentage Context</i>                                                                                                                           | 1  |
| Lesson 12: <i>Find the Percentage</i>                                                                                                                          | 1  |
| Lesson 14: <i>Percent Error (Online Only)</i>                                                                                                                  | .5 |
| <b>Foundational Lessons:</b> G6M3 Lesson 14: <i>Use a double number line diagram to solve percentage problems. For additional support, G6M3 Lessons 12-14.</i> |    |
| <b>End-of-Mission Assessment: Topics B-D – Progress Check #7</b>                                                                                               | 2  |

|                                                                                                                                                                                           |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>Semester 1B – 24 days</b>                                                                                                                                                              |   |
| <b>Unit 2 – Rational Number Operations</b>                                                                                                                                                |   |
| <b>Aligned with Modules 3 - 6</b>                                                                                                                                                         |   |
| Grade 7, Mission 5, Topic A – Interpreting Negative Numbers                                                                                                                               |   |
| Lesson 1: <i>Interpreting Negative Numbers</i>                                                                                                                                            | 1 |
| <b>Foundational Lessons:</b> G6M7 Lesson 5: <i>Interpret and use negative numbers in different contexts, including situations involving money. For additional support, G6M7 Lesson 1.</i> |   |
| Grade 7, Mission 5, Topic B – Adding and Subtracting Rational Numbers                                                                                                                     |   |
| Lesson 2: <i>Changing Temperatures</i>                                                                                                                                                    | 1 |
| Lesson 3: <i>Changing Elevation</i>                                                                                                                                                       | 1 |
| Lesson 4: <i>Money &amp; Debts</i>                                                                                                                                                        | 1 |
| <b>Foundational Lessons:</b> G6M7 Lesson 2: <i>Plot positive and negative numbers on a number line and understand opposites.</i>                                                          |   |
| <b>Flex &amp; Progress Check #1</b>                                                                                                                                                       | 2 |
| Lesson 5: <i>Representing Subtraction</i>                                                                                                                                                 | 1 |
| Lesson 6: <i>Subtracting Rational Numbers</i>                                                                                                                                             | 1 |
| Lesson 7: <i>Adding and Subtracting to Solve Problems</i>                                                                                                                                 | 1 |
| <b>Foundational Lessons:</b> G6M7 Lesson 6: <i>Use absolute value notation to describe a number's distance from zero.</i>                                                                 |   |
| <b>Mid-Mission Assessment: Topics A-B – Progress Check #2</b>                                                                                                                             | 2 |

| Grade 7, Mission 5, Topic C – Multiplying and Dividing Rational Numbers                                                                                                                                                                       |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Lesson 8: <i>Position Speed &amp; Direction</i>                                                                                                                                                                                               | 1 |
| Lesson 9: <i>Multiplying Rational Numbers</i>                                                                                                                                                                                                 | 1 |
| Lesson 11: <i>Dividing Rational Numbers</i>                                                                                                                                                                                                   | 1 |
| <b>Foundational Lessons:</b> G6M4 Lesson 5: Use diagrams and multiplication and division equations to represent and solve “how many groups?” questions in which the divisor is a non-unit fraction. For additional support, G6M4 Lessons 4-5. |   |
| <b>Flex &amp; Progress Check #3</b>                                                                                                                                                                                                           | 2 |
| Grade 7, Mission 5, Topic D – Four Operations with Rational Numbers                                                                                                                                                                           |   |
| Lesson 13: <i>Expressions with Rational Numbers</i>                                                                                                                                                                                           | 1 |
| Lesson 14: <i>Solving Problems with Rational Numbers</i>                                                                                                                                                                                      | 1 |
| <b>Foundational Lessons:</b> G6M6 Lesson 14: Use the order of operations to evaluate expressions with exponents, multiplication, division, addition, and subtraction.                                                                         |   |
| <b>Flex &amp; Progress Check #4</b>                                                                                                                                                                                                           | 2 |
| Grade 7, Mission 5, Topic E – Solving Equations Where There are Negative Numbers                                                                                                                                                              |   |
| Lesson 15: <i>Solving Equations with Rational Numbers</i>                                                                                                                                                                                     | 1 |
| Lesson 16: <i>Representing Context with Equations</i>                                                                                                                                                                                         | 1 |
| <b>Foundational Lessons:</b> G6M6 Lesson 4: Interpret and solve equations that represent the same situation.                                                                                                                                  |   |
| <b>End of Mission Assessment: Topics C-E – Progress Check #5</b>                                                                                                                                                                              | 2 |

| Semester 1C – 24 days                                                                                                                                                                      |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit 3 – Model with Expressions, Equations                                                                                                                                                 |   |
| Aligned with Modules 7 & 9*                                                                                                                                                                |   |
| *Module 9 is teacher specific                                                                                                                                                              |   |
| Grade 7, Mission 6, Topic D – Writing Equivalent Expressions                                                                                                                               |   |
| Lesson 18: <i>Subtraction in Equivalent Expressions</i>                                                                                                                                    | 1 |
| Lesson 19: <i>Expanding and Factoring</i>                                                                                                                                                  | 1 |
| Lesson 20: <i>Combining Like Terms (Part 1)</i>                                                                                                                                            | 1 |
| Lesson 21: <i>Combining Like Terms (Part 2)</i>                                                                                                                                            | 1 |
| Lesson 22: <i>Combining Like Terms (Part 3)</i>                                                                                                                                            | 1 |
| <b>Flex &amp; Progress Check #1</b>                                                                                                                                                        | 2 |
| <b>Foundational Guidance:</b> G6M6 Lesson 10: Use an area diagram and the distributive property to write equivalent expressions with variables. For additional support, G6M6 Lessons 8-10. |   |
| Grade 7, Mission 6, Topic A - Representing Situations of the Form $px + q = r$ and $p(x + q) = r$                                                                                          |   |
| Lesson 1: <i>Relationships between Quantities</i>                                                                                                                                          | 1 |

|                                                                                                                                                                |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>Foundational Lesson:</b> G7M2 Lesson 7: Use a table of values to determine if a relationship is proportional.                                               |   |
| Lesson 2: <i>Reasoning about Contexts with Tape Diagrams (Part 1)</i>                                                                                          | 1 |
| Lesson 3: <i>Reasoning about Contexts with Tape Diagrams (Part 2)</i>                                                                                          | 1 |
| <b>Flex &amp; Progress Check #2</b>                                                                                                                            | 2 |
| Lesson 4: <i>Reasoning about Equations and Tape Diagrams (Part 1)</i>                                                                                          | 1 |
| Lesson 5: <i>Reasoning about equations and Tape Diagrams (Part 2)</i>                                                                                          | 1 |
| Lesson 6: <i>Distinguishing between Two Types of Situations</i>                                                                                                | 1 |
| <b>Foundational Lessons:</b> G6M6 Lesson 1: Use tape diagrams to write equations and solve for unknown values. For additional support, G6M2 Lesson 15.         |   |
| <b>Flex &amp; Progress Check #3</b>                                                                                                                            | 2 |
| Grade 7, Mission 6, Topic B – Solving Equations of the form $px + q = r$ and $p(x + q) = r$                                                                    |   |
| Lesson 7: <i>Reasoning about Solving Equations (Part 1)</i>                                                                                                    | 1 |
| Lesson 8: <i>Reasoning about Solving Equations (Part 2)</i>                                                                                                    | 1 |
| Lesson 9: <i>Dealing with Negative Numbers</i>                                                                                                                 | 1 |
| Lesson 10: <i>Different Options for Solving One Equation</i>                                                                                                   | 1 |
| Lesson 11: <i>Using Tape Diagrams and Equations to Solve Problems</i>                                                                                          | 1 |
| <b>Foundational Lessons:</b> G6M6 Lesson 5: Divide using fractions when solving equations in the form of $px = q$ . . For additional support, G6M6 Lessons 2-5 |   |
| <b>Mid-Mission Assessment: Topics A-B – Progress Check #4</b>                                                                                                  | 2 |

## Mid-Year Movement

|                                                                                                                                                                                                     |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>Semester 2A – 19 days</b>                                                                                                                                                                        |   |
| <b>Cont., Unit 3 – Angle Relationships &amp; Inequalities</b>                                                                                                                                       |   |
| <b>Aligned with Modules 8, 10 &amp; 11</b>                                                                                                                                                          |   |
| Grade 7, Mission 7, Topic A – Angle Relationships                                                                                                                                                   |   |
| Lesson 1: <i>Relationships of Angles</i>                                                                                                                                                            | 1 |
| Lesson 2: <i>Adjacent Angles</i>                                                                                                                                                                    | 1 |
| Lesson 3: <i>Nonadjacent Angles</i>                                                                                                                                                                 | 1 |
| Lesson 4: <i>Solving for Unknown Angles</i>                                                                                                                                                         | 1 |
| Lesson 5: <i>Using Equations to Solve for Unknown Angles</i>                                                                                                                                        | 1 |
| <b>Foundational Lessons:</b> G4M4 Lesson 10: Use the addition of adjacent angle measures to solve problems using a symbol for the unknown angle measure. For additional support, G4M4 Lessons 9-10. |   |
| <b>Flex &amp; Progress Check #1</b>                                                                                                                                                                 | 2 |

| Grade 7, Mission 7, Topic B – Drawing Polygons with Given Conditions                                                                                                         |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Lesson 6: <i>Building Polygons (Part 1)</i>                                                                                                                                  | 1 |
| Lesson 7: <i>Building Polygons (Part 2)</i>                                                                                                                                  | 1 |
| Lesson 8: <i>Triangles with Three Common Measures</i>                                                                                                                        | 1 |
| <b>Foundational Lessons:</b> G5M5 Lesson 21: Draw and identify varied two-dimensional figures from given attributes. For additional support, G5M5 Lessons 16-21              |   |
| <b>Mid-Mission Assessment: Topics A – B – Progress Check #2 *Remove <i>drawing triangles</i>*</b>                                                                            | 2 |
| Grade 7, Mission 6, Topic C - Inequalities                                                                                                                                   |   |
| Lesson 13: <i>Reintroducing Inequalities</i>                                                                                                                                 | 1 |
| Lesson 14: <i>Finding Solutions to Inequalities in Context</i>                                                                                                               | 1 |
| Lesson 15: <i>Efficiently Solving Inequalities</i>                                                                                                                           | 1 |
| Lesson 16: <i>Inequalities in Context</i>                                                                                                                                    | 1 |
| Lesson 17: <i>Modeling with Inequalities</i>                                                                                                                                 | 1 |
| <b>Foundational Lessons:</b> G6M7 Lesson 9: Explain what it means to be a solution to an inequality and identify them in contexts. For additional support, G6M7 Lessons 8-9. |   |
| <b>End-of-Mission Assessment: Topic C – Progress Check #3<br/>(Move Topic D from assessment and add to Semester 1C Progress Check #1)</b>                                    | 2 |

| Semester 2B – 27 days                                                                                              |   |
|--------------------------------------------------------------------------------------------------------------------|---|
| Unit 4 – Geometry                                                                                                  |   |
| Aligned with Modules 10 & 11                                                                                       |   |
| Grade 7, Mission 3, Topic A – Circumference of a Circle                                                            |   |
| Lesson 1: <i>How well can you measure?</i>                                                                         | 1 |
| Lesson 2: <i>Exploring Circles</i>                                                                                 | 1 |
| Lesson 3: <i>Exploring Circumference</i>                                                                           | 1 |
| Lesson 4: <i>Applying Circumference</i>                                                                            | 1 |
| Lesson 5: <i>Circumference &amp; Wheels</i>                                                                        | 1 |
| <b>Foundational Lessons:</b> G4M3 Lesson 1: Investigate and use the formulas for area and perimeter of rectangles. |   |
| <b>Flex &amp; Progress Check #1</b>                                                                                | 2 |
| Grade 7, Mission 3, Topic B – Area of a Circle                                                                     |   |
| Lesson 6: <i>Estimating Areas</i>                                                                                  | 1 |
| Lesson 7: <i>Exploring the Area of a Circle</i>                                                                    | 1 |
| Lesson 8: <i>Relating Area to Circumference</i>                                                                    | 1 |



|                                                                                                                                                                                                            |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Lesson 9: <i>Applying Area of Circles</i>                                                                                                                                                                  | 1 |
| <b>Foundational Lessons:</b> G6M1 Lesson 11: Understand that you can find the area of a polygon by decomposing and rearranging it into rectangles and triangles. For additional support, G6M1 Lessons 1-6. |   |
| <b>Flex &amp; Progress Check #2</b>                                                                                                                                                                        | 2 |
| Grade 7, Mission 3, Topic C – Let's Put it to Work                                                                                                                                                         |   |
| Lesson 10: <i>Distinguishing Circumference and Area</i>                                                                                                                                                    | 1 |
| Lesson 11: <i>Stained-Glass Windows (optional)</i>                                                                                                                                                         | 1 |
| <b>Foundational Lessons:</b> G7M3 Lesson 8: Explain how the area of a circle and its circumference are related to each other and know and use the formula for area of a circle.                            |   |
| <b>End-of-Mission Assessment: Topics A – C – Progress Check #3</b>                                                                                                                                         | 2 |
| Grade 7, Mission 7, Topic C – Solid Geometry                                                                                                                                                               |   |
| Lesson 11: <i>Slicing Solids</i>                                                                                                                                                                           | 1 |
| Lesson 12: <i>Volume of Right Prisms</i>                                                                                                                                                                   | 1 |
| Lesson 13: <i>Decomposing Bases for Area</i>                                                                                                                                                               | 1 |
| <b>Foundational Lessons:</b> G6M4 Lesson 14: Understand the connection between volume, unit cubes, and volume formula. For additional support, G5M5 Lessons 4-7                                            |   |
| <b>Flex &amp; Progress Check #4</b>                                                                                                                                                                        | 2 |
| Lesson 14: <i>Surface Area of Right Prisms</i>                                                                                                                                                             | 1 |
| Lesson 15: <i>Distinguishing Volume and Surface Area</i>                                                                                                                                                   | 1 |
| Lesson 16: <i>Applying Volume and Surface Area</i>                                                                                                                                                         | 1 |
| <b>Foundational Lessons:</b> G6M1 Lesson 15: Draw an accurate net of a polyhedron and use it to calculate the surface area. For additional support, G6M1 Lessons 12, 14-15.                                |   |
| <b>End-of-Mission Assessment: Topic C – Progress Check #5</b>                                                                                                                                              | 2 |

|                                              |   |
|----------------------------------------------|---|
| <b>Semester 2C – 11 days</b>                 |   |
| <b>Unit 5 – Sampling &amp; Data Analysis</b> |   |
| <b>Aligned with Modules 12 &amp; 13</b>      |   |
| Grade 7, Mission 8, Topic C – Sampling       |   |
| Lesson 11: <i>Comparing Groups</i>           | 1 |
| Lesson 12: <i>Larger Populations</i>         | 1 |
| Lesson 13: <i>What makes a good sample?</i>  | 1 |
| Lesson 14: <i>Sampling in a Fair Way</i>     | 1 |

**Foundational Lessons:** G6M8 Lesson 5: Use dot plots to describe distributions and answer questions about data sets. For additional support, G6M8 Lessons 4-5.

|                                     |   |
|-------------------------------------|---|
| <b>Flex &amp; Progress Check #1</b> | 2 |
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Grade 7, Mission 8, Topic D – Using Samples

|                                                            |   |
|------------------------------------------------------------|---|
| Lesson 15: <i>Estimating Population Measures of Center</i> | 1 |
|------------------------------------------------------------|---|

|                                                     |   |
|-----------------------------------------------------|---|
| Lesson 16: <i>Estimating Population Proportions</i> | 1 |
|-----------------------------------------------------|---|

|                                                       |   |
|-------------------------------------------------------|---|
| Lesson 18: <i>Comparing Populations Using Samples</i> | 1 |
|-------------------------------------------------------|---|

**Foundational Lessons:** G6M8 Lesson 14: Choose which measure of center to use to describe a given data set and explain how the shape of the distribution affects the mean and median of a data set. For additional support, G6M8 Lessons 13-14

|                                                                        |   |
|------------------------------------------------------------------------|---|
| <b>End-of-Mission Assessment: Topics C &amp; D – Progress Check #2</b> | 2 |
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**Semester 2D – 16 days**

**Unit 6 – Probability**

**Aligned with Modules 14 & 15**

Grade 7, Mission 8, Topic A – Probabilities of Single Step Events

|                               |   |
|-------------------------------|---|
| Lesson 1: <i>Mystery Bags</i> | 1 |
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|                                     |   |
|-------------------------------------|---|
| Lesson 2: <i>Chance Experiments</i> | 1 |
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|                                          |   |
|------------------------------------------|---|
| Lesson 3: <i>What are probabilities?</i> | 1 |
|------------------------------------------|---|

|                                     |   |
|-------------------------------------|---|
| <b>Flex &amp; Progress Check #1</b> | 2 |
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|                                                                        |   |
|------------------------------------------------------------------------|---|
| Lesson 4: <i>Estimating Probabilities through Repeated Experiments</i> | 1 |
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|                                                |   |
|------------------------------------------------|---|
| Lesson 5: <i>More Estimating Probabilities</i> | 1 |
|------------------------------------------------|---|

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| Lesson 6: <i>Estimating Probabilities using Simulations (optional)</i> | 1 |
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**Foundational Lessons:** G7M4 Lesson 5: Use decimals to describe increases and decreases.

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| <b>Flex &amp; Progress Check #2</b> | 2 |
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Grade 7, Mission 8, Topic B – Probabilities of Multi-Step Events

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|----------------------------------------------------|---|
| Lesson 7: <i>Simulating Multi-Step Experiments</i> | 1 |
|----------------------------------------------------|---|

Foundational Lesson: G7M8 Lesson 6: Simulate real-world situations with simple experiments that reflect the probability of the actual event. For additional support, G7M8 Lessons 4-6.

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|---------------------------------------------------------|---|
| Lesson 8: <i>Keeping Track of All Possible Outcomes</i> | 1 |
|---------------------------------------------------------|---|

|                                         |   |
|-----------------------------------------|---|
| Lesson 9: <i>Multi-Step Experiments</i> | 1 |
|-----------------------------------------|---|

|                                         |   |
|-----------------------------------------|---|
| Lesson 10: <i>Designing Simulations</i> | 1 |
|-----------------------------------------|---|

**Foundational Lessons:** G7M8 Lesson 3: List the sample space of a chance experiment and calculate the probability of an event when all outcomes are equally likely.

**Mid-Mission Assessment: Topics A & B – Progress Check #3**

2

**Acceptable Evidence**

- Progress Monitoring: Exit tickets, mid-mission assessments, and end-of-mission assessments
- Growth: Progress toward meeting individualized goals
- Productivity: Independent lessons completed each week

**Course Grading:** The final course grade is calculated as follows:

- Each marking period grade counts for 25% of the student's final course grade.

Additional remediation in grade-level or prerequisite standards and content will be provided when the teacher determines that a student has not yet mastered the necessary content. Enrichment opportunities will also be provided for students who demonstrate understanding more quickly than their peers.

**Required and Supplementary Texts/Software**

Zearn Math

- Sharma, S. (2025). *Zearn Math*. Zearn.

IXL Math

**Calculator Recommendation**

The secondary mathematics department of Central Bucks School District recognizes calculators as valuable tools for learning in the mathematics classroom. In certain advanced courses, graphing calculators with specific capabilities are important for daily classroom performance and are required for Advanced Placement assessments. While no specific brands are endorsed, there are restrictions on the types of calculators allowed on certain classroom assessments and final exams. Calculators that perform operations with variables, such as the TI-89, TI-92, and HP49G, are not permitted on district assessments or final exams, even though they may be allowed on some national assessments. Teachers have discretion regarding whether these calculator types may be used for classroom-related purposes.

# Unit 1: Number Systems and Operations

Mission 2: Introducing Proportional Relationships

Mission 4: Proportional Relationships and Percent

## Desired Results

### Essential Questions:

- How can we recognize and represent proportional relationships in different ways (tables, graphs, equations, and contexts)?
- What does it mean for two quantities to have a constant relationship, and why does that matter?
- How can unit rate and proportional reasoning help us make predictions or solve real-world problems?
- How is percent a type of proportional relationship, and how can we use it to describe changes?
- Why can the same percent or ratio lead to different results depending on the situation?

### Enduring Understandings:

*Students will understand how to...*

Mission 2, Topic A: Representing Proportional Relationships with Tables

- Lesson 1: One of These Things Is Not Like the Others
- Lesson 2: Introducing Proportional Relationships with a Table
- Lesson 3: More About Constant of Proportionality

Mission 2, Topic B: Representing Proportional Relationships with Equations

- Lesson 4: Proportional Relationships and Equations
- Lesson 6: Using Equations to Solve Problems

Mission 2, Topic C: Comparing Proportional and Nonproportional Relationships

- Lesson 7: Comparing Relationships with Tables
- Lesson 8: Comparing Relationships with Equations
- Lesson 9: Solving Problems about Proportional Relationships

Mission 2, Topic D: Representing Proportional Relationships with Graphs

- Lesson 10: Introducing Graphs of Proportional Relationships
- Lesson 11: Interpreting Graphs of Proportional Relationships
- Lesson 12: Using Graphs to Compare Relationships

Mission 2, Topic E: Let's Put it to Work

- Lesson 14: Four Representations

Mission 4, Topic B: Percent Increase and Decrease

- Lesson 6: Increasing and Decreasing
- Lesson 7: One Hundred Percent

Mission 4, Topic C: Applying Percents

- Lesson 10: Tax and Tip
- Lesson 11: Percentage Context
- Lesson 12: Find the Percentage
- Lesson 14: Percent Error

## Knowledge:

### *Mission 2 Vocabulary*

axes, column, constant, constant of proportionality, coordinate plane, coordinates, equation, equivalent ratios, is proportional to, origin, per, plot, proportional relationship, quantity, reciprocal, relate, row, situation, steady, surface area, value, volume, x-coordinate, y-coordinate

### *Mission 4 Vocabulary*

(a fraction) less than, (a fraction) more than, commission, decimal representation, degrees Fahrenheit, distributive property, discount, final / new amount, initial / original amount, interest, long division, markdown, markup, measurement error, percentage, percentage decrease, percentage increase, percent error, repeating decimal, sales tax, tax rate, tape diagram, temperature, tip, unit rate

## Skills:

### **Mission 2:**

#### **Topic A - Representing Proportional Relationships with Tables**

- Lesson 1: Compare and create representations to compare ratios in the context of recipes or scaled copies.
- Lesson 2: Use a table to describe a proportional relationship, calculate the constant of proportionality, and find missing values.
- Lesson 3: Find the constant of proportionality from information given on a table and use the constant of proportionality to fill information on a table.

**Topic B – Representing Proportional Relationships with Equations**

- Lesson 4: Write equations to represent a proportional relationship described in a table.
- Lesson 6: Use tables and equations to solve problems involving proportional relationships.

**Topic C – Comparing Proportional and Nonproportional Relationships**

- Lesson 7: Use a table of values to determine if a relationship is proportional.
- Lesson 8: Recognize that proportional relationships are characterized by equations in the form  $y = kx$ .
- Lesson 9: Write an equation to represent a proportional relationship and solve problems about proportional relationships.

**Topic D – Representing Proportional Relationships with Graphs**

- Lesson 10: Generalize that the graph of a proportional relationship lies on a line through the origin.
- Lesson 11: Interpret points on the graph of a proportional relationship, and identify the constant of proportionality from the graph of a proportional relationship.
- Lesson 12: Interpret and compare two related proportional relationships on the same graph.

**Topic E – Let's Put It To Work**

- Lesson 14: Represent a proportional relationship in four different ways.

**Mission 4:****Topic B – Percent Increase and Decrease**

- Lesson 6: Find percent increases and decreases when given an original amount.
- Lesson 7: Use double number lines to solve problems about percent increases and decreases.
- Lesson 8: Use equations to represent percent increases and decreases.
- Lesson 9: Find percentages of quantities that are not whole numbers.

**Topic C – Applying Percentages**

- Lesson 10: Understand and solve problems about sales tax.
- Lesson 11: Understand and solve problems about commission, markups, and discounts.

- Lesson 12: Understand and solve problems involving percentage increase and percentage decrease using real-world contexts such as tax, tip, and discount.
- Lesson 14: Solve and interpret problems that involve percent error by finding the correct amount, erroneous amount, or percent error.

## Standards:

### Previous Standards:

CC.2.1.6.D.1 – Understand ratio concepts and use ratio reasoning to solve problems

CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions

CC.2.3.6.A.1 – Apply appropriate tools to solve problems involving area, surface area, and volume

### 7<sup>th</sup> grade Core Standard:

CC.2.1.7.D.1 – Analyze proportional relationships and use them to model and solve real-world

CC.2.3.7.A.2 – Visualize and represent geometric figures and describe the relationships between them

CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions

## Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

### **Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
    - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake,

they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.

- **Exit Ticket (Paper)**
  - The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student's understanding of a big mathematical idea, while others focus on students' procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.



**Summative Assessment/Progress Checks:**

- Progress Check #1
- Progress Check #2
- Mid-Mission Assessment: Topics A – C
- Progress Check #4
- End-of-Mission Assessment: Topics D – E
- Progress Check #6
- End-of-Mission Assessment: Topics B – D

**Suggested Learning Experiences and Instruction**

- Students will be able to explain how proportional relationships grow out of equivalent ratios learned in grade 6, including the use of scale factors and unit rates.
- Students will identify and interpret unit rates (per 1) and understand their role as the constant of proportionality in a relationship.
- Students will be able to represent proportional relationships using tables, equations of the form  $y = kx$ , and graphs that pass through the origin.
- Students should describe how the constant of proportionality determines the relationship between quantities and the steepness of a graph.
- Students will be able to apply proportional reasoning in real-world contexts such as constant speed, unit pricing, recipes, and measurement conversions.
- Students will determine whether a relationship is proportional and justify their reasoning using tables, unit rates, equations, or graphs.

**Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures (Warm-Up, Concept Exploration, Wrap-Up) that reduce cognitive load and allow them to focus on the math.
- Students will be supported through a progression from concrete to abstract learning, helping them build understanding using examples, visuals, and symbols over time.
- Students will have opportunities to think independently and then collaborate, allowing them to build confidence and deepen understanding with peer and teacher support.
- Students will be engaged through real-world contexts and applications, which make math meaningful and provide an entry point for diverse learners.
- Students will access content through multiple means (aligned with UDL principles), increasing accessibility for multilingual learners, students with disabilities, and those with unfinished learning.
- Students should receive structured supports and scaffolds embedded throughout lessons to ensure all learners can access and participate in mathematical thinking.

**For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require Further Intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

# Unit 2: Rational Number Operations

## Mission 5: Rational Number Arithmetic

### Desired Results

#### Essential Questions:

- How do positive and negative numbers help us describe and model real-world situations (e.g., temperature, money, elevation, direction)?
- How can a number line help us understand and predict the results of addition and subtraction with rational numbers?
- How do operations with positive and negative numbers (addition, subtraction, multiplication, division) work, and why do they follow these patterns?
- How can we use multiplication and division to reason about relationships and solve real-world problems involving constant rates?
- How can we apply operations with rational numbers to evaluate expressions and solve problems?
- How can we represent and solve real-world situations using equations involving positive and negative numbers?

#### Enduring Understandings:

*Students will understand how to...*

Topic A: Interpreting Negative Numbers

- Lesson 1: Interpreting Negative Numbers

Topic B: Adding and Subtracting Rational Numbers

- Lesson 2: Changing Temperatures
- Lesson 3: Changing Elevation
- Lesson 4: Money & Debts
- Lesson 5: Representing Subtraction
- Lesson 6: Subtracting Rational Numbers
- Lesson 7: Adding and Subtracting to Solve Problems

Topic C: Multiplying and Dividing Rational Numbers

- Lesson 8: Position, Speed, and Direction
- Lesson 9: Multiplying and Dividing Rational Numbers
- Lesson 11: Dividing Rational Numbers

Topic D: Four Operations with Rational Numbers

- Lesson 13: Expressions with Rational Numbers
- Lesson 14: Solving Problems with Rational Numbers

Topic E: Solving Equations Where There are Negatives

- Lesson 15: Solving Equations with Rational Numbers
- Lesson 16: Representing Context with Equations

## Knowledge:

### *Mission 5 Vocabulary*

absolute value, account balance, additive inverse, debt, decrease, degrees Celsius, deposit, difference, distance, elevation, expression, factor, increase, multiplicative inverse, negative, number line, operation, opposite, rational number, sea level, signed numbers, solution (to an equation), sum, temperature, variable, velocity, vertical, withdrawal, x-coordinate, y-coordinate

## Skills:

### Topic A: Interpreting Negative Numbers

- Lesson 1: Interpret signed numbers in the context of temperature and elevation.

### Topic B: Adding & Subtracting Rational Numbers

- Lesson 2: Use a number line to add positive and negative numbers.
- Lesson 3: Understand how to add positive and negative numbers in general.
- Lesson 4: Understand what positive and negative numbers mean in a situation involving money and calculate an account balance after a deposit or withdrawal.
- Lesson 5: Use a number line to subtract positive and negative numbers.
- Lesson 6: Solve subtraction expressions that have the same numbers in the opposite order, and explain the relationship between their differences.
- Lesson 7: Add and subtract signed numbers to represent gains and losses in different contexts.

### Topic C: Multiplying and Dividing Rational Numbers

- Lesson 8: Understand that the product of a negative number and positive number is negative and explain how signed numbers can be used to represent position and speed.
- Lesson 9: Interpret signed numbers when used to represent time in situations about speed and direction as well as understand that the product of two negative numbers is positive.
- Lesson 11: Use the relationship between multiplication and division to develop the rules for dividing rational numbers.
- Lesson 12: Multiply and divide rational numbers to solve problems involving constant rates

### Topic D: Four Operations with Rational Numbers

- Lesson 13: Use the relationship between addition and subtraction, and the relationship between multiplication and division, to evaluate expressions with all four operations on the rational numbers.

- Lesson 14: Interpret situations involving rational numbers, including positive and negative values, and use rational numbers to represent and solve problems.

#### Topic E: Solving Equations Where There are Negatives

- Lesson 15: Solve equations that involve negative numbers.
- Lesson 16: Write and solve equations to represent situations that involve negative numbers.

### Standards:

#### Previous Standards:

CC.2.1.6.D.1 – Understand ratio concepts and use ratio reasoning to solve problems.

CC.2.1.6.E.1 – Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

CC.2.1.6.E.2 – Identify and choose appropriate processes to compute fluently with multi-digit numbers.

CC.2.1.6.E.3 – Develop and/or apply number theory concepts to find common factors and multiples.

CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.

CC.2.2.6.B.2 – Understand the process of solving a one-variable equation or inequality and apply it to real-world and mathematical problems.

CC.2.2.6.B.3 – Represent and analyze quantitative relationships between dependent and independent variables.

#### 7<sup>th</sup> grade Core Standard:

CC.2.1.7.E.1 – Apply and extend previous understandings of operations with fractions to operations with rational numbers

CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions

CC.2.2.7.B.3 – Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations

CC.2.1.7.D.1 – Analyze proportional relationships and use them to model and solve real-world and mathematical problems

### Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

#### **Acceptable evidence:**

Lesson Components:

- Warm-up

- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
    - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.
  - **Exit Ticket (Paper)**
    - The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments

administered roughly halfway through the Mission and at the conclusion of the Mission respectively.

- Mid-Mission & End-of-Mission
  - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student's understanding of a big mathematical idea, while others focus on students' procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
- Optional Practice
  - Includes problems from current lessons along with a mix of topics from previous lessons.

#### **Summative Assessment/Progress Checks:**

- Progress Check #1
- Mid-Mission Assessment: Topics A – B Progress Check #2
- Progress Check #3
- Progress Check #4
- End of Mission Assessment: Topics C – E Progress Check #5

#### **Suggested Learning Experiences and Instruction**

- Students will be able to extend the operations of addition, subtraction, multiplication, and division from fractions to all rational numbers, written as decimals or in the form  $\frac{a}{b}$ .
- Students will be able to determine how signed numbers are used to represent quantities such as measurements of temperature and elevation, opposites (pairs of numbers on the number line that are the same distance from zero), and absolute value.
- Students will be able to extend addition and subtraction from fractions to all rational numbers.
- Students will be able to use multiplication and division to solve problems about position, direction, constant speed, and constant velocity in which students represent quantities with number line diagrams and tables of numerical expressions with signed numbers.
- Students will be able to work with expressions that use the four operations on rational numbers, making use of structure, e.g., to see without calculating that the product of two factors is positive because the values of the factors are both negative.
- Students will be able to begin working with linear equations in one variable that have rational number coefficients.

### **Differentiation/Intervention/Enrichment Options:**

Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.

- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

### **For Language Development:**

Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.

- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require further intervention:**

Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.

- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).



- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

# Unit 3: Model with Expressions, Equations, and Inequalities; Angle Relationships

Mission 6: Expressions, Equations, and Inequalities

Mission 7: Angles, Triangles and Prisms (Topics A & B)

## Desired Results

### Essential Questions:

- How can we represent real-world situations using equations, inequalities, and diagrams?
- What strategies can we use to solve equations and inequalities, and how do we know if our solutions make sense?
- How are visual models (like tape diagrams and hanger diagrams) helpful for understanding and solving algebraic problems?
- What does it mean for two expressions or equations to be equivalent, and why is that important in problem solving?
- What information is needed to determine if a triangle is unique, and why does that matter?
- How can angle relationships (like complementary, supplementary, and vertical angles) help us solve for unknown measures?
- How do 3D shapes change when sliced, and what can cross-sections tell us about their structure?
- How are area, surface area, and volume formulas useful for solving real-world problems involving three-dimensional shapes?

### Enduring Understandings:

*Students will understand how to...*

Mission 6, Topic D: Writing Equivalent Expressions

- Lesson 18: Subtraction in Equivalent Expressions
- Lesson 19: Expanding and Factoring
- Lesson 20: Combining Like Terms (Part 1)
- Lesson 21: Combining Like Terms (Part 2)
- Lesson 22: Combining Like Terms (Part 3)

Mission 6, Topic A: Representing Situations of the Form  $px + q = r$  and  $p(x + q) = r$

- Lesson 1: Relationships between Quantities
- Lesson 2: Reasoning about Contexts with Tape Diagrams (Part 1)
- Lesson 3: Reasoning about Contexts with Tape Diagrams (Part 2)
- Lesson 4: Reasoning about Equations and Tape Diagrams (Part 1)

- Lesson 5: Reasoning about equations and Tape Diagrams (Part 2)
- Lesson 6: Distinguishing between Two Types of Situations

Mission 6, Topic B: Solving Equations of the Form  $px + q = r$  and  $p(x + q) = r$  and Problems That Lead to Those Equations

- Lesson 7: Reasoning about Solving Equations (Part 1)
- Lesson 8: Reasoning about Solving Equations (Part 2)
- Lesson 9: Dealing with Negative Numbers
- Lesson 10: Different Options for Solving One Equation
- Lesson 11: Using Tape Diagrams and Equations to Solve Problems

Mission 7, Topic A: Angle Relationships

- Lesson 1: Relationships of Angles
- Lesson 2: Adjacent Angles
- Lesson 3: Nonadjacent Angles
- Lesson 4: Solving for Unknown Angles
- Lesson 5: Using Equations to Solve for Unknown Angles

Mission 7, Topic B: Drawing Polygons with Given Conditions

- Lesson 6: Building Polygons (Part 1)
- Lesson 7: Building Polygons (Part 2)
- Lesson 8: Triangles with Three Common Measures

Mission 6, Topic C: Inequalities

- Lesson 13: Reintroducing Inequalities
- Lesson 14: Finding Solutions to Inequalities in Context
- Lesson 15: Efficiently Solving Inequalities
- Lesson 16: Inequalities in Context
- Lesson 17: Modeling with Inequalities

## Knowledge:

### *Mission 6 Vocabulary*

associative property, balanced hanger, boundary, combine like terms, commutative (property), direction (of an inequality), distribute, each side (of an equation), equivalent expression, expand (an expression), factor (an expression), greater than, greater than or equal to, inequality, less than, less than or equal to, open / closed circle, operation, relationship, solution to an inequality, solve, substitute, term, unknown amount, variable

### *Mission 7 Vocabulary*

adjacent angles, angle measure, associative property, balanced hanger, base (of a prism or pyramid), boundary, combine like terms, commutative (property), compass, complementary, condition, cross section, degree, degrees, different triangle, direction (of an inequality), distribute, each side (of an equation), equivalent expression, expand (an expression), face, factor (an expression), greater than, greater than or equal to, identical copy, inequality, intersect, less than, less than or equal to, measurement error, open / closed circle, operation, parallel, perpendicular, perimeter, prism, protractor, pyramid, quadrilateral, relationship, right angle, segment, side length, solution to an inequality, solve, straight angle, substitute, supplementary, surface area, term, unknown amount, unique triangle, variable, vertex (of a pyramid), vertex (of an angle), vertical angles, volume

### **Skills:**

#### **Mission 6, Topic D: Writing Equivalent Expressions**

- Lesson 18: Extend the distributive property to expressions with negative coefficients.
- Lesson 19: Use the distributive property to find equivalent expressions by expanding or factoring.
- Lesson 20: Given an expression, write an equivalent expression with fewer terms using properties of operations, and explain why the expressions are equivalent.
- Lesson 21: Write expressions with fewer terms that are equivalent to a given expression that includes negative coefficients and parentheses.
- Lesson 22: Write equivalent expressions with fewer terms by combining like terms.

#### **Mission 6, Topic A: Representing Situations of the Form $px + q = r$ and $p(x + q) = r$**

- Lesson 1: Find unknown values in relationships, and interpret them as proportional and not proportional.
- Lesson 2: Interpret tape diagrams that represent word problems, and use them to find unknown values.
- Lesson 3: Write and match equations and tape diagrams that represent the same situation.
- Lesson 4: Coordinate tape diagrams, equations of the form  $px + q = r$ , and verbal descriptions of the situations, and reason about and interpret a solution.
- Lesson 5: Coordinate tape diagrams, equations of the form  $p(x + q) = r$ , and verbal descriptions of the situations, and reason about and interpret a solution.
- Lesson 6: Write and categorize equations of the forms  $px + q = r$  and  $p(x + q) = r$  from situations and tape diagrams.

#### **Mission 6, Topic B: Solving Equations of the Form $px + q = r$ and $p(x + q) = r$ and Problems That Lead to Those Equations**

- Lesson 7: Use a balanced hanger diagram to reason about writing and solving equations in the form  $px + q = r$ .

- Lesson 8: Use a balanced hanger diagram to reason about writing and solving equations in the form  $p(x + q) = r$ .
- Lesson 9: Solve equations of the form  $px + q = r$  and  $p(x + q) = r$  that involve negative numbers.
- Lesson 10: Decide between and use two common approaches for solving an equation of the form  $p(x + q) = r$ : expanding using the distributive property, or dividing each side by  $p$ .
- Lesson 11: Use tape diagrams to translate verbal descriptions for situations into an equation of the form  $px + q = r$  or  $p(x + q) = r$ , and solve the resulting equation to determine an unknown quantity in the situation.

#### Mission 7, Topic A: Angle Relationships

- Lesson 1: Find unknown angle measures by reasoning about adjacent angles with known measures.
- Lesson 2: Find unknown angle measures by reasoning about complementary or supplementary angles.
- Lesson 3: Find unknown angle measures by reasoning about vertical angles, and nonadjacent complementary or supplementary angles.
- Lesson 4: Solve multi-step problems involving complementary, supplementary, and vertical angles, and explain the reasoning.
- Lesson 5: Solve an equation that represents a relationship between angle measures, and explain the reasoning.

#### Mission 7, Topic B: Drawing Polygons with Given Conditions

- Lesson 6: Recognize that four side lengths do not determine a unique quadrilateral, but that three side lengths can determine a unique triangle.
- Lesson 7: Show that there is a minimum and maximum length the third side of a triangle could be, given the other two side lengths.
- Lesson 8: Compare and contrast triangles that share three common measures of angles or sides, and determine whether they are identical copies or different triangles.

#### Mission 6, Topic C: Inequalities

- Lesson 13: Write inequality statements to represent inequality situations, and use substitution to determine whether a given value for a variable makes an inequality true.
- Lesson 14: Write inequalities that represent situations, and use substitution or reasoning about the context to find the solution.
- Lesson 15: Solve inequalities using the associated equation and testing values to determine the direction of the inequality in the solution.
- Lesson 16: Match an inequality to a situation it represents, explain what the parts of the inequality mean, solve it, and then interpret what the solution means in the situation.
- Lesson 17: Write and solve an inequality to solve real-world problems and critique the solution to an inequality.

## Standards:

### Previous Standards:

- CC.2.1.6.E.2 – Identify and choose appropriate processes to compute fluently with multi-digit numbers
- CC.2.1.6.E.3 – Develop and/or apply number theory concepts to find common factors and multiples
- CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions
- CC.2.2.6.B.2 – Understand the process of solving one-variable equations and inequalities (and apply it to real-world and mathematical problems)
- CC.2.2.6.B.3 – Represent and analyze relationships between dependent and independent variables
- CC.2.3.6.A.1 – Apply appropriate tools to solve problems involving area, surface area, and volume

### Core Standards:

- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions
- CC.2.2.7.B.3 – Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations
- CC.2.3.7.A.1 – Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume
- CC.2.3.7.A.2 – Visualize and represent geometric figures and describe the relationships between them

## Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

### **Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.

- **The Tower of Power (Digital)**
  - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.
- **Exit Ticket (Paper)**
  - The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - **Mid-Mission & End-of-Mission**
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student's understanding of a big mathematical idea, while others focus on students' procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to

identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.

- Optional Practice
  - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

Unit 3:

- Progress Check #1
- Progress Check #2
- Progress Check #3
- Mid-Mission Assessment: Topics A-B – Progress Check #4

Cont., Unit 3:

- Progress Check #1
- Mid- Mission Assessment: Topics A – B- Progress Check #2
- End of Mission Assessment: Topics C Progress Check #5

### **Suggested Learning Experiences and Instruction**

- Students will represent and interpret relationships between quantities using tape diagrams, equations, and inequalities, and explain how the representations connect.
- Students will write, solve, and interpret equations of the forms  $px + q = r$  and  $p(x + q) = r$ , including in real-world contexts.
- Students will use visual models (tape diagrams, hanger diagrams, and area models) and properties of operations to justify strategies for solving equations and creating equivalent expressions.
- Students will analyze and solve inequalities, represent solutions on a number line, and interpret what solutions mean in context.
- Students will generate and explain equivalent expressions using the distributive property and combining like terms.
- Students will investigate how angle and side measurements determine triangles and reason about whether a triangle is unique, impossible, or has multiple solutions.
- Students will apply angle relationships (complementary, supplementary, vertical) and equations to find unknown angle measures and justify their reasoning.
- Students will analyze three-dimensional figures, including cross-sections, and solve real-world problems involving area, surface area, and volume using appropriate tools.

### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.



- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require further intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

# Unit 4: Geometry

Mission 3: Measuring Circles

Mission 7: Angles, Triangles and Prisms (Topic C)

## Desired Results

### Essential Questions:

- What defines a circle, and how are radius, diameter, circumference, and area related?
- Why is the circumference of a circle proportional to its diameter, and what role does  $\pi$  play?
- How can we use formulas to solve real-world problems involving circles, including area and circumference?
- What information is needed to determine whether a triangle is unique, impossible, or has multiple solutions?
- How do angle relationships (complementary, supplementary, and vertical) help us find unknown measures?
- How can cross-sections help us understand the structure of three-dimensional shapes?
- How are area, surface area, and volume used to solve real-world problems involving 3D figures?
- How do tools (such as rulers, protractors, and models) support accuracy and reasoning in geometric problem solving?

### Enduring Understandings:

*Students will understand how to...*

Mission 3, Topic A: Circumference of a Circle

- Lesson 1: How well can you measure?
- Lesson 2: Exploring Circles
- Lesson 3: Exploring Circumference
- Lesson 4: Applying Circumference
- Lesson 5: Circumference & Wheels

Mission 3, Topic B: Area of a Circle

- Lesson 6: Estimating Areas
- Lesson 7: Exploring the Area of a Circle
- Lesson 8: Relating Area to Circumference
- Lesson 9: Applying Area of Circles

Mission 3, Topic C: Let's Put it to Work

- Lesson 10: Distinguishing Circumference and Area
- Lesson 11: Stained-Glass Windows (optional)

#### Mission 7, Topic C: Solid Geometry

- Lesson 11: Slicing Solids
- Lesson 12: Volume of Right Prisms
- Lesson 13: Decomposing Bases for Area
- Lesson 14: Surface Area of Right Prisms
- Lesson 15: Distinguishing Volume and Surface Area
- Lesson 16: Applying Volume and Surface Area

### Knowledge:

#### *Mission 3 Vocabulary*

area of a circle, approximate, approximation, area of a circle, center (of a circle), circle, circumference, design, diameter, formula, half-circle, perimeter, pi, radius, relationship, rotation, squared, travel

#### *Mission 7 Vocabulary*

adjacent angles, angle measure, associative property, balanced hanger, base (of a prism or pyramid), boundary, combine like terms, commutative (property), compass, complementary, condition, cross section, degree, degrees, different triangle, direction (of an inequality), distribute, each side (of an equation), equivalent expression, expand (an expression), face, factor (an expression), greater than, greater than or equal to, identical copy, inequality, intersect, less than, less than or equal to, measurement error, open / closed circle, operation, parallel, perpendicular, perimeter, prism, protractor, pyramid, quadrilateral, relationship, right angle, segment, side length, solution to an inequality, solve, straight angle, substitute, supplementary, surface area, term, unknown amount, unique triangle, variable, vertex (of a pyramid), vertex (of an angle), vertical angles, volume

### Skills:

#### Mission 3, Topic A: Circumference of a Circle

- Lesson 1: Examine quotients and use a graph to decide whether two associated quantities are in a proportional relationship.
- Lesson 2: Describe characteristics that make a shape a circle and identify the diameter, radius, and center of a circle.
- Lesson 3: Explore the relationship between the diameter and circumference of circles.
- Lesson 4: Apply an understanding of circumference to find the distance around a shape.
- Lesson 5: Use the radius or diameter of a wheel to find the distance the wheel travels in any number of complete rotations.

#### Mission 3, Topic B: Area of a Circle

- Lesson 6: Calculate and estimate the area of irregular polygons.
- Lesson 7: Estimate the area of a circle using the area of a square with the same side length as the radius.
- Lesson 8: Explain how the area of a circle and its circumference are related, and use the formula for the area of a circle.
- Lesson 9: Calculate the area of more complicated shapes that include fractions of circles.

#### Mission 3, Topic C: Let's Put it to Work

- Lesson 10: Decide whether the circumference or area of a circle is most useful in solving a problem and use formulas for area and circumference to solve problems relating to real-world situations.
- Lesson 11: Apply understanding of area and circumference of circles to solve design problems

#### Mission 7, Topic C: Solid Geometry

- Lesson 11: Describe, compare, and contrast (orally and in writing) different cross sections that could result from slicing the same pyramid or prism.
- Lesson 12: Find the volume of a right prism, and explain why the volume of a prism can be found by multiplying the area of the base by the height of the prism.
- Lesson 13: Find the volume of prisms with non-rectangular bases by decomposing the base into rectangles and triangles.

### Standards:

#### **Previous Standards:**

CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions

CC.2.2.6.B.2 – Understand the process of solving one-variable equations and inequalities and apply it to real-world and mathematical problems

CC.2.2.6.B.3 – Represent and analyze quantitative relationships between dependent and independent variables

CC.2.1.6.E.2 – Identify and choose appropriate processes to compute fluently with multi-digit numbers

CC.2.1.6.E.3 – Develop and/or apply number theory concepts to find common factors and multiples

CC.2.3.6.A.1 – Apply appropriate tools to solve problems involving area, surface area, and volume

#### **7<sup>th</sup> grade Core Standard:**

CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions

CC.2.2.7.B.3 – Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations

CC.2.3.7.A.1 – Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume

CC.2.3.7.A.2 – Visualize and represent geometric figures and describe the relationships between them

## Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

### Acceptable evidence:

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
    - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.
  - **Exit Ticket (Paper)**

- The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
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  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

Unit 4:

- Progress Check #1
- Progress Check #2
- End – of – Mission Assessment – Topics A – C - Progress Check #3
- Progress Check #4
- End – of – Mission Assessment – Topics C - Progress Check #5

### **Suggested Learning Experiences and Instruction**

- Students will define a circle as a set of points equidistant from a center and identify and use radius, diameter, and circumference in context.

- Students will explain and apply the proportional relationship between the circumference and diameter of a circle, including the role of  $\pi$ .
- Students will model and solve problems involving the area and circumference of circles, expressing answers in terms of  $\pi$  or using reasonable approximations.
- Students will investigate how side lengths and angle measures determine triangles and reason about whether a triangle is unique, impossible, or has multiple solutions.
- Students will apply angle relationships (complementary, supplementary, vertical) and use equations to solve for unknown angle measures.
- Students will analyze cross-sections of three-dimensional figures and describe how slicing affects the shape and structure of prisms and pyramids.
- Students will solve real-world problems involving area, surface area, and volume, and use appropriate tools (e.g., rulers, protractors) to support their reasoning.

### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.

- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require further intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.



# Unit 5: Sampling & Data Analysis

## Mission 8: Probability & Sampling

### Desired Results

#### Essential Questions:

- How can we describe and analyze the possible outcomes of a chance experiment?
- How can we organize sample spaces (lists, tables, tree diagrams) to better understand possible outcomes?
- How does the long-run frequency of outcomes relate to probability?
- What makes a sample representative of a population, and why does that matter?
- How can different sampling methods lead to overrepresentation or underrepresentation of groups?
- How can we use samples to make comparisons and draw conclusions about populations?

#### Enduring Understandings:

*Students will understand how to...*

#### Mission 8, Topic C: Sampling

- Lesson 11: Comparing Groups
- Lesson 12: Larger Populations
- Lesson 13: What makes a good sample?
- Lesson 14: Sampling in a fair way

#### Mission 8, Topic D: Using Samples

- Lesson 15: Estimating Population Measures of Center
- Lesson 16: Estimating Population Proportions
- Lesson 18: Comparing Populations Using Samples

#### Knowledge:

#### *Mission 8 Vocabulary*

certain, center (of a distribution), chance experiment, distribution, equally likely as not, event, impossible, interquartile range (IQR), less likely, likely, mean, mean absolute deviation (MAD), measure of center, measure of variability, median, mode, more likely, outcome, overlap,

population, probability, proportion, random, random sample, representative sample, sample, sample space, simulation, spread, survey, symmetric, tree (diagram), unlikely

## **Skills:**

### **Mission 8, Topic C: Sampling**

- Lesson 11: Justify whether two populations are “very different” based on the difference in their means expressed as a multiple of the mean absolute deviation.
- Lesson 12: Understand what a population is, what a sample is, and why a sample might be used, and describe a sample for a given population.
- Lesson 13: Given dot plots, determine whether a sample is representative of the population and explain the reasoning.
- Lesson 14: Recognize that random sampling tends to produce representative samples and support valid inferences.

### **Mission 8, Topic D: Using Samples**

- Lesson 15: Use the mean and MAD of a sample to make inferences about the population, and explain the reasoning.
- Lesson 16: Use proportions from a random sample to make inferences about the population.
- Lesson 18: Apply reasoning about center and spread to determine whether two populations are likely to be meaningfully different.

## **Standards:**

### **Previous Standards:**

CC.2.4.6.B.1 – Develop an understanding of statistical variability by collecting, organizing, displaying, and analyzing data

CC.2.1.6.E.2 – Identify and choose appropriate processes to compute fluently with multi-digit numbers

CC.2.2.6.B.3 – Represent and analyze quantitative relationships between dependent and independent variables

### **7<sup>th</sup> grade Core Standard:**

CC.2.4.7.B.1 – Draw inferences about populations based on random sampling concepts

CC.2.4.7.B.2 – Draw informal comparative inferences about two populations

## **Acceptable Evidence**

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

**Acceptable evidence:**

## Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

## Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
    - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.
  - **Exit Ticket (Paper)**
    - The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.

- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student’s understanding of a big mathematical idea, while others focus on students’ procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

#### **Summative Assessment/Progress Checks:**

Unit 5:

- Progress Check #1
- End – of – Mission Assessment – Topics C & D - Progress Check #2

#### **Suggested Learning Experiences and Instruction**

- Students will represent sample spaces using lists, tables, and tree diagrams to identify all possible outcomes of a chance experiment.
- Students will generate and analyze samples from a population, identifying whether samples are representative or show overrepresentation or underrepresentation.
- Students will compare samples and populations to make inferences and draw conclusions about real-world situations.

#### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.

- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require further intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

# Unit 6: Probability

## Mission 8: Probability & Sampling

### Desired Results

#### Essential Questions:

- How can we determine and represent all possible outcomes of a chance experiment?
- What does probability tell us about how likely an event is to occur?
- How can we use simulations to estimate probability, and how reliable are those estimates?
- How does long-run frequency help us understand and predict probability?
- How can counting outcomes in a sample space help us calculate probability accurately?

#### Enduring Understandings:

*Students will understand how to...*

#### Mission 8, Topic A: Probabilities of Single Step Events

- Lesson 1: Mystery Bags
- Lesson 2: Chance Experiments
- Lesson 3: What are probabilities?
- Lesson 4: Estimating Probabilities through Repeated Experiments
- Lesson 5: More Estimating Probabilities
- Lesson 6: Estimating Probabilities using Simulations (optional)

#### Mission 8, Topic B: Probabilities of Multi-Step Events

- Lesson 7: Simulating Multi-Steps Experiments
- Lesson 8: Keeping Track of all Possible Outcomes
- Lesson 9: Multi-Step Experiments
- Lesson 10: Designing Simulations

#### Knowledge:

#### *Mission 8 Vocabulary*

certain, center (of a distribution), chance experiment, distribution, equally likely as not, event, impossible, interquartile range (IQR), less likely, likely, mean, mean absolute deviation (MAD), measure of center, measure of variability, median, mode, more likely, outcome, overlap, population, probability, proportion, random, random sample, representative sample, sample, sample space, simulation, spread, survey, symmetric, tree (diagram), unlikely

## Skills:

### Mission 8, Topic A: Probabilities of Single Step Events

- Lesson 1: Determine the likelihood of an event by using results from previous experiments.
- Lesson 2: Describe the likelihood of events and order events from least likely to most likely.
- Lesson 3: List the sample space of a chance experiment and calculate the probability of an event when all outcomes are equally likely.
- Lesson 4: Generalize that cumulative relative frequency approaches the probability of an event as an experiment is repeated many times.
- Lesson 5: Use the results from a repeated experiment to estimate the probability of an event.
- Lesson 6: Simulate real-world situations with simple experiments that reflect the probability of the actual event.

### Mission 8, Topic B: Probabilities of Multi-Step Events

- Lesson 7: Use a simulation to estimate the probability of a multi-step event.
- Lesson 8: Find the sample space for multi-step experiments using tables, trees, and organized lists, and determine the total number of possible outcomes for a compound event.
- Lesson 9: Use the sample space to calculate the probability of an event in a multi-step experiment.
- Lesson 10: Design a multi-step experiment to simulate a compound event, and perform a simulation to estimate its probability.

## Standards:

### Previous Standards:

CC.2.4.6.B.1 – Develop an understanding of statistical variability by collecting, organizing, displaying, and analyzing data

CC.2.1.6.E.2 – Identify and choose appropriate processes to compute fluently with multi-digit numbers

CC.2.2.6.B.3 – Represent and analyze quantitative relationships between dependent and independent variables

### 7<sup>th</sup> grade Core Standard:

CC.2.4.7.B.1 – Draw inferences about populations based on random sampling concepts

CC.2.4.7.B.2 – Draw informal comparative inferences about two populations

## Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-

based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

**Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

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  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

Unit 5:

- Progress Check #1
- Progress Check #2
- Mid – Mission Assessment – Topics A & B – Progress Check #3

### **Suggested Learning Experiences and Instruction**

- Students will use key probability and statistics vocabulary (e.g., event, outcome, sample space, probability, population, sample) to describe and analyze chance situations.
- Students will represent sample spaces using lists, tables, and tree diagrams to identify all possible outcomes of a chance experiment.
- Students will calculate probabilities by determining favorable outcomes and comparing them to the total number of possible outcomes.
- Students will design and use simulations to estimate probabilities and understand probability as long-run relative frequency.
- Students will generate and analyze samples from a population, identifying whether samples are representative or show overrepresentation or underrepresentation.

- Students will compare samples and populations to make inferences and draw conclusions about real-world situations.

### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require further intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).

- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** Math Intervention 7

**Date:** August 6, 2026

**Student Level:** Middle School

**Grade Level:** 7

**Characterization of Course of Study:**

This course is designed to support seventh grade students who would benefit from additional mathematics instruction. It provides targeted, standard-aligned support focused on strengthening foundational skills. Instruction emphasizes conceptual understanding, procedural fluency, problem solving, mathematical reasoning, and confidence with core topics such as proportional relationships, rational numbers, expressions, equations, geometry, data analysis, and probability.

**Reasons for Proposed Adoption:**

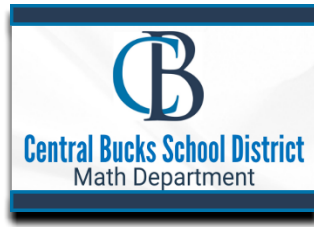
This course is intended for students who would benefit from additional support in meeting grade-level mathematics standards. It focuses on reinforcing foundational skills and addressing learning gaps in order to build student confidence and strengthen competence with core mathematical concepts.

The course provides a consistent structure for mathematics intervention across middle schools while allowing instruction to remain responsive to individual student needs. By offering targeted support during the school day, students receive additional practice with prerequisite and grade-level skills while remaining in the core mathematics sequence.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## **Intervention Math 8**

Course Number: 2845

Course Level: Intervention

Grade: 8

Time/Credit: 1 year/ 47 minutes daily

Development Date: Fall 2025 - Summer 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## K – 12 Mathematics Program Learning Principles

### Teaching and Learning Principles:

1. Teaching mathematics for understanding requires providing experiences that stimulate students' curiosity and build confidence in investigating, problem solving, and communicating (speaking, reading, writing, representing, and listening).
2. Differentiated instruction addresses student strengths, interests, and learning styles.
3. Instruction should be appropriately paced to make the curriculum accessible to all students.
4. High expectations with strong support from teachers, parents and administrators motivate all students to achieve excellence in mathematics.
5. To create new understanding, students must be actively engaged in learning experiences designed to connect to their prior knowledge.
6. Presenting new ideas within rich and meaningful contexts helps learners to transfer and use knowledge meaningfully.
7. Making connections both within and outside of school helps learners to transfer and use knowledge meaningfully.
8. The learning process is enhanced when new ideas are presented using manipulatives, computers, calculators, and real-time data collection devices.
9. Teacher collaboration and reflection enrich learning experiences for students.
10. Assessment is an ongoing process that guides instruction and monitors student progress to include mastery of mathematics content and higher-level thinking skills.

### Documents Considered:

(2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

## Mathematics Program Enduring Understandings

**Students will understand that:**

### The Nature of Mathematics

- Mathematics is a language of carefully defined terms and symbols.
- Mathematics is used to make informed decisions about problems in everyday life.

### Numbers and Operations

- There are multiple representations for any number.
- Numbers are classified and compared within our number system.
- Depending on the situation, calculations may be done using mental math or paper-and-pencil calculations using a variety of mathematically sound algorithms.
- Estimates help determine the reasonableness of an answer.
- Expressions are simplified using a predetermined order of operations.

### Measurement

- Measurements collected using any tools (except for counting) are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing one linear dimension in a figure with two or three dimensions will have a different effect on the figure's perimeter, circumference, area, or volume.

### Geometry

- Points, lines, and planes are the building blocks of geometry.
- Each geometric figure has a specific naming convention.
- Postulates, theorems, definitions, and properties are used to:
  - justify reasoning in a direct proof.
  - establish relationships involving two and three-dimensional figures.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- A shape's characteristics (dimensionality, side measures, angle measures, faces, edges, area, perimeter, and volume) are used for identification.
- The Pythagorean Theorem and trigonometric ratios are used to find missing quantities in right triangles.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.

### Algebraic Concepts

- Algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems involving a constant rate of change can be modeled using proportional reasoning.



- Algebraic expressions, equations, inequalities, and functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic) are used to model relationships between quantities in real-world situations.
- Patterns and functions can be generalized and represented using verbal models, tables, equations, and graphs.
- Systems of equations are solved both graphically and algebraically and are used to model real-life problems.

### **Data Analysis and Probability**

- Data is collected, organized, and displayed for analysis.
- Interpretations and predictions about data are influenced by the method that data is collected and displayed.
- Probability is used to make informed predictions and inferences.

# Mathematics Program Essential Questions

## The Nature of Mathematics

- What characteristics make mathematics a language?
- When is the correct solution not the answer to a problem?

## Numbers and Operations

- How do you know that an answer is reasonable?
- Why are there different number systems?
- How do you determine when to calculate with pencil and paper, find an estimate, or use a calculator?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

## Measurement

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension effect a figures length, area, and volume?

## Geometry

- Why do all statements need justification?
- What is the logical progression of statements in a proof?
- How are figures classified?
- How do you name a geometric figure and why are standard naming conventions important?
- Why are points, lines, and planes so important in Euclidean geometry?
- How and when is the Pythagorean Theorem used?
- What do similarity and congruency statements tell you about polygons?

## Algebraic Concepts

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a pattern/function in different ways?

## Data Analysis and Probability

- What is the purpose of collecting data?
- How is data used or abused?
- How do we make predictions based on probability?

## Math Intervention 8 Overview

### **Desired Results**

Course Description: This course is designed for students who would benefit from additional support to meet grade-level standards in mathematics. It focuses on reinforcing foundational skills and addressing learning gaps to build confidence and competence in core concepts.

Prerequisite: None

Committee Members: Katie Marttila, Mike Lechniak, Brian Novick, Nicole Barlow, Nicole Kee, Kari Farrell.

## Pacing Guide

| Math Intervention 8 Pacing Guide                                                   |            |
|------------------------------------------------------------------------------------|------------|
| Course Overview                                                                    | Days       |
| Semester 1A – Unit 1                                                               | 25         |
| Semester 1B – Unit 2                                                               | 21         |
| Semester 1C – Unit 3                                                               | 35         |
| <b>Semester 1 – Total Days</b>                                                     | <b>81</b>  |
| Semester 2A – Unit 3, Cont.                                                        | 12         |
| Semester 2B – Unit 4                                                               | 14         |
| Semester 2C – Unit 5                                                               | 18         |
| Semester 2D – Unit 6                                                               | 29         |
| <b>Semester 2 – Total Days</b>                                                     | <b>73</b>  |
| Beginning of Year Activities/Review/Remediation                                    | 5          |
| IXL Screener Arena                                                                 | 6          |
| Flex Days – Field Trips, Snow Days, Half Days, Assemblies, School Activities, etc. | 12         |
| PSSA Testing – 1 Day for ELA, 2 Days for Math                                      | 3          |
| <b>Total Days</b>                                                                  | <b>180</b> |

| Semester 1A – 25 Days                                                                                                                                                                                                                 |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit 1 – Transformational Geometry                                                                                                                                                                                                    |   |
| Aligned with Modules 1 and 2                                                                                                                                                                                                          |   |
| Grade 8, Mission 1, Topic A – Rigid Transformations                                                                                                                                                                                   |   |
| Lesson 2: Naming the Moves                                                                                                                                                                                                            | 1 |
| Lesson 3: Grid Moves                                                                                                                                                                                                                  | 1 |
| Lesson 4: Making the Moves                                                                                                                                                                                                            | 1 |
| <b>Foundational Lessons:</b> <i>G7M7 Lesson 6: Recognize that four side lengths do not determine a unique quadrilateral, but that three side lengths can determine a unique triangle.</i>                                             | 1 |
| Lesson 5: Coordinate Moves                                                                                                                                                                                                            | 1 |
| Lesson 6: Describing Transformations                                                                                                                                                                                                  | 1 |
| <b>Foundational Lessons:</b> <i>G6M7 Lesson 15: Plot points on the coordinate plane to make polygons, and solve problems about vertical and horizontal distance between points. • For additional support, G6M7 Lessons 11, 14-15.</i> | 1 |
| <b>Flex and Progress Check #1</b>                                                                                                                                                                                                     | 2 |
| Grade 8, Mission 1, Topic B – Properties of Rigid Transformations                                                                                                                                                                     |   |
| Lesson 7: No Bending or Stretching                                                                                                                                                                                                    | 1 |
| Lesson 8: Rotation Patterns                                                                                                                                                                                                           | 1 |
| <b>Foundational Lessons:</b> <i>G7M7 Lesson 8: Compare and contrast triangles that share three common measures of angles or sides, and determine whether they are identical copies or different triangles.</i>                        | 1 |
| Grade 8, Mission 1, Topic C - Congruence                                                                                                                                                                                              |   |
| Lesson 11: What is the Same?                                                                                                                                                                                                          | 1 |
| Lesson 12: Congruent Polygons                                                                                                                                                                                                         | 1 |
| <b>Foundational Lessons:</b> <i>G8M1 Lesson 7: Compare measurements of sides and angles on a shape before and after rigid transformations.</i>                                                                                        | 1 |
| <b>Mid – Mission &amp; End – of – Mission Assessment – Topic C – Progress Check #2 (Remove D, E)</b>                                                                                                                                  | 2 |
| Grade 8, Mission 2, Topic A – Dilations                                                                                                                                                                                               |   |
| Lesson 4: <i>Dilations on a Square Grid</i>                                                                                                                                                                                           | 1 |
| <b>Foundational Lessons:</b> <i>G7M1 Lesson 5: Describe how scale factors of 1, less than 1, and greater than 1 affect the size of a scaled copy, and explain how scaling can be reversed using reciprocal scale factors.</i>         | 1 |
| Grade 8, Mission 2, Topic B – Similarity                                                                                                                                                                                              |   |
| Lesson 6: Similarity                                                                                                                                                                                                                  | 1 |
| Lesson 7: Similar Polygons                                                                                                                                                                                                            | 1 |
| Lesson 9: Side Length Quotients in Similar Triangles                                                                                                                                                                                  | 1 |
| <b>Foundational Lessons:</b> <i>G7M1 Lesson 2: Identify corresponding parts and determine the scale factor between two figures.</i>                                                                                                   | 1 |

# End of Mission Progress Check #3 (Use topic B questions)

2

## Semester 1B – 21 Days

### Unit 2 – Linear Equations and Applications

#### Aligned with Module 3

#### Grade 8, Mission 4, Topic B – Linear Equations in One Variable

|                                                                                                                                                                                                                                                                                             |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Lesson 3: Balanced Moves                                                                                                                                                                                                                                                                    | 2 |
| Lesson 4: More Balanced Moves                                                                                                                                                                                                                                                               | 2 |
| Lesson 5: Solving Any Linear Equation                                                                                                                                                                                                                                                       | 2 |
| <b>Foundational Lessons:</b> <i>G7M6 Lesson 9: Solve equations of the form <math>px + q = r</math> and <math>p(x + q) = r</math> that involve negative numbers. For additional support, G7M6 Lessons 7-9.</i>                                                                               | 1 |
| <b>Flex and Progress Check #1</b>                                                                                                                                                                                                                                                           | 2 |
| Lesson 6: Strategic Solving                                                                                                                                                                                                                                                                 | 2 |
| <b>Foundational Lessons:</b> <i>G7M6 Lesson 10: Decide between and use two common approaches for solving an equation of the form <math>p(x + q) = r</math>: expanding using the distributive property, or dividing each side by <math>p</math>.</i>                                         | 1 |
| Lesson 7: All, Some, or No Solutions                                                                                                                                                                                                                                                        | 2 |
| Lesson 8: How Many Solutions                                                                                                                                                                                                                                                                | 2 |
| Lesson 9: When Are They the Same?                                                                                                                                                                                                                                                           | 2 |
| <b>Foundational Lessons:</b> <i>G7M6 Lesson 11: Use tape diagrams to translate verbal descriptions of situations into an equation of the form <math>px + q = r</math> or <math>p(x + q) = r</math>, and solve the resulting equation to determine an unknown quantity in the situation.</i> | 1 |
| <b>Mid Mission Assessment: Topics B (Only) – Progress Check #2</b>                                                                                                                                                                                                                          | 2 |

| Semester 1C – 35 Days                                                                                                                                                                                                      |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit 3 – Relationships and Functions                                                                                                                                                                                       |   |
| Aligned with Modules 5 and 6                                                                                                                                                                                               |   |
| Grade 8, Mission 3, Topic A – Proportional Relationships                                                                                                                                                                   |   |
| Lesson 1: Understanding Proportional Relationships                                                                                                                                                                         | 1 |
| Lesson 2: Graphs of Proportional Relationships                                                                                                                                                                             | 1 |
| Lesson 3: Representing Proportional Relationships                                                                                                                                                                          | 1 |
| <b>Foundational Lessons:</b> <i>G7M2 Lesson 12: Interpret and compare two related proportional relationships on the same graph. For additional Support, G7M2 Lessons 10-11.</i>                                            |   |
| Lesson 4: Comparing Proportional Relationships                                                                                                                                                                             | 1 |
| <b>Foundational Lessons:</b> <i>G7M2 Lesson 14: Represent a proportional relationship in four different ways.</i>                                                                                                          |   |
| <b>Flex and Progress Check #1</b>                                                                                                                                                                                          | 2 |
| Grade 8, Mission 3, Topic B – Representing Linear Relationships                                                                                                                                                            |   |
| Lesson 5: Introduction to Linear Relationships                                                                                                                                                                             | 1 |
| Lesson 6: More Linear Relationships                                                                                                                                                                                        | 1 |
| Lesson 7: Representations of Linear Relationships                                                                                                                                                                          | 1 |
| Lesson 8: Translating to $y = mx + b$                                                                                                                                                                                      | 1 |
| <b>Foundational Lessons:</b> <i>G7M4 Lesson 3: Calculate and interpret the scale factor and constant of proportionality for a proportional relationship.</i>                                                               |   |
| <b>Mid-Mission Assessment: Topics: A &amp; B - Progress Check #2</b>                                                                                                                                                       | 2 |
| Grade 8, Mission 3, Topic C – Finding Slopes                                                                                                                                                                               |   |
| Lesson 9: Slopes Don't Have to be Positive                                                                                                                                                                                 | 1 |
| Lesson 10: Calculating Slope                                                                                                                                                                                               | 2 |
| Lesson 11: Equations of All Kinds of Lines                                                                                                                                                                                 | 1 |
| <b>Foundational Lessons:</b> <i>G8M2 Lesson 11: Write an expression for the slope of a line using the quotient of the vertical and horizontal side lengths of a slope triangle. For additional Support, G8M2 Lesson 10</i> |   |
| Grade 8, Mission 3, Topic D – Linear Equations                                                                                                                                                                             |   |
| Lesson 12: Solutions to Linear Equations                                                                                                                                                                                   | 1 |
| Lesson 13: More Solutions to Linear Equations                                                                                                                                                                              | 1 |
| <b>Foundational Lessons:</b> <i>G8M2 Lesson 12: Write an equation for a line and use line equations to determine if a point is on a line.</i>                                                                              |   |
| <b>End-of-Mission Assessment: (Eliminate Topic E) – Progress Check #3</b>                                                                                                                                                  | 2 |
| Grade 8, Mission 5, Topic A – Input & Output                                                                                                                                                                               |   |
| Lesson 1: Inputs and Outputs                                                                                                                                                                                               | 1 |
| Lesson 2: Introduction to Functions                                                                                                                                                                                        | 1 |
| <b>Foundational Lessons:</b> <i>G7M6 Lesson 11: Find unknown values in relationships, and interpret them as proportional and not proportional</i>                                                                          |   |
| Grade 8, Mission 5, Topic B – Representing and Interpreting Functions                                                                                                                                                      |   |

|                                                                                                                                                                                                              |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Lesson 3: Equations for Functions                                                                                                                                                                            | 2        |
| Lesson 4: Tables, Equations, and Graphs of Functions                                                                                                                                                         | 2        |
| <b>Flex and Progress Check #4</b>                                                                                                                                                                            | <b>2</b> |
| Lesson 5: More Graphs of Functions                                                                                                                                                                           | 1        |
| Lesson 6: Even More Graphs of Functions                                                                                                                                                                      | 1        |
| Lesson 7: Connecting Representations of Functions                                                                                                                                                            | 1        |
| <b>Foundational Lessons:</b> <i>G7M2 Lesson 14: Represent a proportional relationship in four different ways. For additional Support, G7M2 Lessons 10-12.</i>                                                |          |
| Grade 8, Mission 5, Topic C – Linear Functions and Rates of Change                                                                                                                                           |          |
| Lesson 8: Linear Functions                                                                                                                                                                                   | 1        |
| Lesson 9: Linear Models                                                                                                                                                                                      | 1        |
| <b>Foundational Lessons:</b> <i>G8M3 Lesson 7: Interpret the slope and vertical intercept in context, and write equations that represent linear relationships. For additional Support, G8M3 Lessons 5-6.</i> |          |
| <b>Mid-Mission Assessment Progress Check A-C Progress Check #5</b>                                                                                                                                           | <b>2</b> |

## Mid-Year Movement

|                                                                                                                                                                 |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Semester 2A – 12 Days                                                                                                                                           |          |
| Unit 3, Cont. – Relationships and Functions                                                                                                                     |          |
| Aligned with Modules 5 and 6                                                                                                                                    |          |
| Grade 8, Mission 4, Topic C – Systems of Linear Equations                                                                                                       |          |
| Lesson 10: On or Off the Line?                                                                                                                                  | 1        |
| Lesson 11: On Both of the Lines                                                                                                                                 | 1        |
| <b>Foundational Lessons:</b> <i>G8M3 Lesson 12: Determine pairs of values that satisfy or do not satisfy a linear relationship using an equation or graph.</i>  |          |
| Lesson 12: Systems of Equations                                                                                                                                 | 1        |
| Lesson 13: Solving Systems of Equations                                                                                                                         | 1        |
| <b>Flex &amp; Progress Check #1</b>                                                                                                                             | <b>2</b> |
| Lesson 14: Solving More Systems                                                                                                                                 | 2        |
| Lesson 15: Writing Systems of Equations                                                                                                                         | 2        |
| <b>Foundational Lessons:</b> <i>G8M4 Lesson 6: Use different strategies for solving linear equations in one variable based on their features or structures.</i> |          |
| <b>End-of-Mission Assessment - Topic C, Progress Check #2</b>                                                                                                   | <b>2</b> |



| Semester 2B – 14 Days                                                                                                                                                                                                                                                                                                                                              |   |
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| Unit 4 – Statistics and Probability                                                                                                                                                                                                                                                                                                                                |   |
| Aligned with Modules 8 and 9                                                                                                                                                                                                                                                                                                                                       |   |
| Standards – Based Intervention                                                                                                                                                                                                                                                                                                                                     |   |
| <b>8<sup>th</sup> grade Core Standard:</b><br>CC.2.4.8.B.1 Students acquire the knowledge and skills needed to: Analyze and/or interpret bivariate data displayed in multiple representations.<br>· CC.2.4.8.B.2 Students acquire the knowledge and skills needed to: Understand that patterns of association can be seen in bivariate data utilizing frequencies. |   |
| Grade 8, Mission 6, Topic A – Does This Predict That?                                                                                                                                                                                                                                                                                                              |   |
| Lesson 1: Organizing Data                                                                                                                                                                                                                                                                                                                                          | 1 |
| Lesson 2: Plotting Data                                                                                                                                                                                                                                                                                                                                            | 1 |
| <b>Foundational Lessons:</b> <i>G5M6 Lesson 9: Generate two number patterns from given rules, plot the points, and analyze the patterns.</i>                                                                                                                                                                                                                       |   |
| Grade 8, Mission 6, Topic B - Associations in Numerical Data                                                                                                                                                                                                                                                                                                       |   |
| Lesson 3: What a Point in a Scatter Plot Means                                                                                                                                                                                                                                                                                                                     | 1 |
| Lesson 4: Fitting a Line to Data                                                                                                                                                                                                                                                                                                                                   | 1 |
| <b>Foundational Lessons:</b> <i>G6M7 Lesson 13: Interpret the meaning of points on a coordinate plane to solve real-world problems.</i>                                                                                                                                                                                                                            |   |
| Lesson 5: Describing Trends in Scatter Plots                                                                                                                                                                                                                                                                                                                       | 1 |
| <b>Flex and Progress Check #1</b>                                                                                                                                                                                                                                                                                                                                  | 2 |
| Lesson 6: The Slope of a Fitted Line                                                                                                                                                                                                                                                                                                                               | 1 |
| Lesson 7: Observing More Patterns in Scatter Plots                                                                                                                                                                                                                                                                                                                 | 1 |
| Lesson 8: Analyzing Bivariate Data                                                                                                                                                                                                                                                                                                                                 | 1 |
| <b>Foundational Lessons:</b> <i>G8M3 Lesson 7: Interpret the slope and vertical intercept in context, and write equations that represent linear relationships.</i>                                                                                                                                                                                                 |   |
| Grade 8, Mission 6, Topic C - Associations in Categorical Data                                                                                                                                                                                                                                                                                                     |   |
| Lesson 9: Looking for Associations                                                                                                                                                                                                                                                                                                                                 | 1 |
| Lesson 10: Using Data Displays to Find Associations                                                                                                                                                                                                                                                                                                                | 1 |
| <b>Foundational Lessons:</b> <i>G6M3 Lesson 16: Find the percentage that C is of B by computing <math>C/B \cdot 100</math>.</i>                                                                                                                                                                                                                                    |   |
| <b>End-of-Mission, Topics A – C, Progress Check #2</b>                                                                                                                                                                                                                                                                                                             | 2 |

| Semester 2C – 18 Days                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |
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| Unit 5 – Real Numbers and Pythagorean Theorem                                                                                                                                                                                                                                                                                                                                                                                                                                |   |
| Aligned with Modules 10 and 11                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |
| Standards – Based Intervention                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |
| <b>8<sup>th</sup> grade Core Standard:</b><br>CC.2.1.8.E.1 Students acquire the knowledge and skills needed to: Distinguish between rational and irrational numbers using their properties.<br>· CC.2.1.8.E.4 Students acquire the knowledge and skills needed to: Estimate irrational numbers by comparing them to rational numbers.<br>· CC.2.3.8.A.3 Students acquire the knowledge and skills needed to: Understand and apply the Pythagorean Theorem to solve problems. |   |
| Grade 8, Mission 8, Topic B – Side Lengths and Areas of Squares                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| Lesson 3: Rational and Irrational Numbers                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 |
| Lesson 4: Square Roots on the Number Line                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 |
| Lesson 5: Reasoning about Square Roots                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 |
| <b>Foundational Lessons:</b> G7M4 Lesson 5: Use decimals to describe increases and decreases.                                                                                                                                                                                                                                                                                                                                                                                |   |
| <b>Mid – Mission Progress Check #1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2 |
| Grade 8, Mission 8, Topic C – The Pythagorean Theorem                                                                                                                                                                                                                                                                                                                                                                                                                        |   |
| Lesson 6: Finding Side Lengths of Triangles                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 |
| Lesson 8: Finding Unknown Side Lengths                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 |
| Lesson 9: The Converse of the Pythagorean Theorem                                                                                                                                                                                                                                                                                                                                                                                                                            | 1 |
| Lesson 10: Applications of the Pythagorean Theorem                                                                                                                                                                                                                                                                                                                                                                                                                           | 1 |
| <b>Foundational Lessons:</b> G4M4 Lesson 14: Define and construct triangles from given criteria. Explore symmetry in triangles                                                                                                                                                                                                                                                                                                                                               |   |
| Lesson 11: Finding Distances in the Coordinate Plane                                                                                                                                                                                                                                                                                                                                                                                                                         | 1 |
| <b>Foundational Lessons:</b> G6M7 Lesson 14: Use coordinates to find distances and reflections on the coordinate plane.                                                                                                                                                                                                                                                                                                                                                      |   |
| <b>Flex and Progress Check #2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2 |
| Grade 8, Mission 8, Topic D – Side Lengths and Volumes of Cubes                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| Lesson 12: Edge Lengths & Volumes                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1 |
| Lesson 13: Cube Roots                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1 |
| <b>Foundational Lessons:</b> G6M1 Lesson 17: Use exponents to express the area of a square and volume of a cube.                                                                                                                                                                                                                                                                                                                                                             |   |
| Grade 8, Mission 8, Topic E – Decimal Representation of Rational & Irrational Numbers                                                                                                                                                                                                                                                                                                                                                                                        |   |

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| Lesson 14: Decimal Representation of Rational Numbers                                                                                   | 1        |
| Lesson 15: Infinite Decimal Expansions                                                                                                  | 1        |
| <b><u>Foundational Lessons:</u></b> G6M5 Lesson 11: Use long division to divide whole numbers that result in a quotient with a decimal. |          |
| <b>End-of-Mission, Topics C – E, Progress Check #3</b>                                                                                  | <b>2</b> |

| Semester 2D – 29 Days                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |
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| Unit 6 – Exponents, Scientific Notation & Volume                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |
| Aligned with Modules 12 and 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |
| Standards – Based Intervention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |
| <b>8<sup>th</sup> grade Core Standard:</b><br>CC.2.3.8.A.1 Students acquire the knowledge and skills needed to: Apply the concepts of volume of cylinders, cones, and spheres to solve real-world and mathematical problems.<br>• CC.2.3.8.A.3 Students acquire the knowledge and skills needed to: Understand and apply the Pythagorean Theorem to solve problems.<br>• CC.2.2.8.B.1 Students acquire the knowledge and skills needed to: Apply concepts of radicals and integer exponents to generate equivalent expressions. |          |
| Grade 8, Mission 7, Topic A – Exponent Review                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |
| Lesson 1: Exponent Review                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1        |
| <b><u>Foundational Lessons:</u></b> G5M1 Lesson 3: Use exponents to name place value units, and explain patterns in the placement of the decimal point.                                                                                                                                                                                                                                                                                                                                                                         |          |
| Grade 8, Mission 7, Topic B – Exponent Rules                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          |
| Lesson 2: Multiplying Powers of 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1        |
| Lesson 3: Powers of Powers of 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1        |
| Lesson 4: Dividing Powers of 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1        |
| <b>Flex &amp; Progress Check #1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>2</b> |
| Lesson 5: Negative Exponents with Powers of 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1        |
| Lesson 6: What About Other Bases?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1        |
| Lesson 7: Practice with Rational Bases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1        |
| Lesson 8: Combining Bases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1        |
| <b><u>Foundational Lessons:</u></b> G6M6 Lesson 13: Decide if expressions are equal by evaluating expressions and understanding what exponents mean. • For additional support, G6M6 Lessons 12-13.                                                                                                                                                                                                                                                                                                                              |          |
| <b>Mid-Mission, Topics A – B, Progress Check #2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>2</b> |
| Grade 8, Mission 7, Topic C - Scientific Notation                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
| Lesson 9: Describing Large and Small Values Using Powers of 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1        |
| Lesson 12: Applications of Arithmetic with Powers of 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1        |

**Foundational Lessons:** G6M6 Lesson 15: Evaluate expressions with a variable, an exponent and another operation, and determine whether a given value is a solution to an equation. • For additional support, G6M6 Lessons 14-15.

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|---------------------------------------------------------------------------|---|
| Lesson 13: Definition of Scientific Notation                              | 1 |
| Lesson 14: Multiplying, Dividing, and Estimating with Scientific Notation | 1 |
| Lesson 15: Adding and Subtracting with Scientific Notation                | 1 |

**Foundational Lessons:** G8M7 Lesson 4: Generalize the exponent rule and write equivalent exponential expressions of division expressions with a base of 10.

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| <b>End-of-Mission Progress Check #3 (exclude topic D)</b> | <b>2</b> |
| Grade 8, Mission 5, Topic D - Cylinders and Cones         |          |
| Lesson 11: Filling Containers                             | 1        |
| Lesson 12: How Much Will Fit (Optional)                   | 1        |
| Lesson 13: Volume of a Cylinder                           | 1        |
| Lesson 14: Finding Cylinder Dimensions                    | 1        |
| Lesson 15: Volume of a Cone                               | 1        |
| Lesson 16: Finding Cone Dimensions                        | 1        |

**Foundational Lessons:** G7M3 Lesson 8: Explain how the area of a circle and its circumference are related to each other, and know and use the formula for area of a circle. • For additional Support, G7M3 Lessons 6-7.

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|------------------------------------------------------|---|
| Grade 8, Mission 5, Topic E - Dimensions and Spheres |   |
| Lesson 20: Volume of a Sphere                        | 1 |
| Lesson 21: Cylinders, Cones, & Spheres               | 1 |

**Foundational Lessons:** G7M1 Lesson 6: Describe how the area of a scaled copy is related to the area of the original figure and the scale factor that was used.

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| <b>End-of-Mission, Topics D – E, Progress Check #4 (Eliminate scaling)</b> | <b>2</b> |
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### Acceptable Evidence

- Progress Monitoring: Exit tickets, mid-mission assessments, and end-of-mission assessments
- Growth: Progress toward meeting individualized goals
- Productivity: Independent lessons completed each week

**Course Grading:** The final course grade is calculated as follows:

- Each marking period grade counts for 25% of the student's final course grade.

Additional remediation in grade-level or prerequisite standards and content will be provided when the teacher determines that a student has not yet mastered the necessary content. Enrichment

opportunities will also be provided for students who demonstrate understanding more quickly than their peers.

### **Required and Supplementary Texts/Software**

Zearn Math

- Sharma, S. (2025). *Zearn Math*. Zearn.

IXL Math

### **Calculator Recommendation**

The secondary mathematics department of Central Bucks School District recognizes calculators as valuable tools for learning in the mathematics classroom. In certain advanced courses, graphing calculators with specific capabilities are important for daily classroom performance and are required for Advanced Placement assessments. While no specific brands are endorsed, there are restrictions on the types of calculators allowed on certain classroom assessments and final exams. Calculators that perform operations with variables, such as the TI-89, TI-92, and HP49G, are not permitted on district assessments or final exams, even though they may be allowed on some national assessments. Teachers have discretion regarding whether these calculator types may be used for classroom-related purposes.

# Unit 1: Transformational Geometry

Mission 1: Rigid Transformations and Congruence

Mission 2: Dilations, Similarity, and Introducing Slope

## Desired Results

### Essential Questions:

- How can we describe and classify different types of transformations (translations, rotations, reflections, and dilations)?
- What information determines how a figure changes under a transformation, including center and scale factor?
- How do transformations affect size, shape, and orientation, and which properties are preserved?
- What does it mean for two figures to be congruent or similar, and how are these ideas connected to transformations?
- How can corresponding sides and angles be used to justify whether figures are congruent or similar?
- How can transformations help us generate, compare, and reason about geometric figures?

### Enduring Understandings:

*Students will understand how to...*

#### Mission 1, Topic A: Rigid Transformations

- Lesson 2: Naming the Moves
- Lesson 3: Grid Moves
- Lesson 4: Making the Moves
- Lesson 5: Coordinate Moves
- Lesson 6: Describing Transformations

#### Mission 1, Topic B: Properties of Rigid Transformations

- Lesson 7: No Bending or Stretching
- Lesson 8: Rotation Patterns

#### Mission 1, Topic C: Congruence

- Lesson 11: What is the Same?
- Lesson 12: Congruent Polygons

#### Mission 2, Topic A: Dilations

- Lesson 4: Dilations on a Square Grid

## Mission 2, Topic B: Similarity

- Lesson 6: Similarity
- Lesson 7: Similar Polygons
- Lesson 9: Side Length Quotients in Similar Triangles

### Knowledge:

#### *Mission 1 Vocabulary*

alternate interior angles, angle of rotation, area, center (of rotation), clockwise, congruent, coordinates, corresponding, counterclockwise, direction, distance, image, intersect, line of reflection, measure, measurement, midpoint, opposite, parallel, perimeter, plane, point, polygon, preserve, reflection, rigid transformation, right angle, rotate, rotation, segment, sequence of transformations, slide, straight angle, symmetry, tessellation, transform, transformation, translate, translation, transversal, turn, vertex/vertices, vertical angles, x-axis, y-axis

#### *Mission 2 Vocabulary*

approximate, center of a dilation, dilation, dilate, equation of a line, estimate, midpoint, quotient, radius, scale factor, scaled copy, scaling, similar, similarity, slope, slope triangle, x-coordinate, y-coordinate

### Skills:

#### Mission 1:

##### **Topic A – Rigid Transformations**

- Lesson 2: Describe the movement of shapes using the terms “clockwise,” “counterclockwise,” “translations,” “rotations,” and “reflections” of figures.
- Lesson 3: Draw the image of a figure that results from a translation, rotation, and reflection on a grid.
- Lesson 4: Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.
- Lesson 5: Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.
- Lesson 6: Apply a sequence of transformations to points on a coordinate plane and determine whether the order of a sequence of transformations has an effect on the image.

##### **Topic B – Properties of Rigid Transformations**

- Lesson 7: Compare measurements of sides and angles on a shape before and after rigid transformations.

- Lesson 8: Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment, and generalize the outcomes of rotating a segment 180 degrees around different points.

### **Topic C – Congruence**

- Lesson 11: Determine whether two shapes are congruent by considering their area and perimeter and using rigid transformations.
- Lesson 12: Use rigid transformations to decide whether or not two figures are congruent.

### **Mission 2:**

### **Topic A – Dilations**

- Lesson 4: Dilate polygons on a square grid using the origin as the center of dilation and a given scale factor, and use coordinates to describe points on the original polygon and the image.

### **Topic B – Similarity**

- Lesson 6: Apply a sequence of transformations to one figure to get a similar figure, and use a sequence of transformations to explain why two figures are similar.
- Lesson 7: Understand that similar polygons have congruent corresponding angles and proportional side lengths.
- Lesson 9: Calculate unknown side lengths in similar triangles using the scale factor between similar triangles and understand that the quotients of pairs of side lengths in similar triangles are equal.

### **Standards:**

### **Previous Standards:**

- CC.2.1.6.D.1 – Understand ratio concepts and use ratio reasoning to solve problems.
- CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.
- CC.2.3.6.A.1 – Apply appropriate tools to solve problems involving area, surface area, and volume.
- CC.2.1.7.D.1 – Analyze proportional relationships and use them to model and solve real-world problems.
- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions.
- CC.2.3.7.A.2 – Visualize and represent geometric figures and describe the relationships between them.

### **8th Grade Core Standards:**



- CC.2.3.8.A.2 – Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions, and apply formulas to determine the volumes of cones, cylinders, and spheres.
- CC.2.2.8.B.2 – Demonstrate an understanding of rational and irrational numbers, and represent and compare quantities expressed in scientific notation.

### Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

#### Acceptable evidence:

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
    - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.
  - **Exit Ticket (Paper)**

- The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student’s understanding of a big mathematical idea, while others focus on students’ procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

#### **Mission 1:**

- Progress Check #1
- Mid-Mission Assessment & End-of-Mission Assessment: Topics A – C, Progress Check #2

#### **Mission 2:**

- End-of-Mission Assessment: Topic B, Progress Check #3

### **Suggested Learning Experiences and Instruction**

- Students will build on prior knowledge of geometry, measurement, and scale factors to understand how plane figures can be transformed and compared.
- Students will identify, describe, and apply translations, rotations, reflections, and dilations, including the key features that define each transformation.

- Students will use precise mathematical language (e.g., corresponding points, corresponding sides, image) to describe transformations on and off the coordinate plane.
- Students will explain that rigid transformations preserve distance and angle measure, and use sequences of these transformations to determine congruence.
- Students will describe the properties of dilations, including how angle measures are preserved and side lengths are scaled by a factor.
- Students will determine whether figures are similar by identifying sequences of transformations, including dilations, and justify their reasoning.
- Students will apply properties of transformations and similarity to reason about geometric relationships, including triangles, slope, and linear relationships.

#### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures (Warm-Up, Concept Exploration, Wrap-Up) that reduce cognitive load and allow them to focus on the math.
- Students will be supported through a progression from concrete to abstract learning, helping them build understanding using examples, visuals, and symbols over time.
- Students will have opportunities to think independently and then collaborate, allowing them to build confidence and deepen understanding with peer and teacher support.
- Students will be engaged through real-world contexts and applications, which make math meaningful and provide an entry point for diverse learners.
- Students will access content through multiple means (aligned with UDL principles), increasing accessibility for multilingual learners, students with disabilities, and those with unfinished learning.
- Students should receive structured supports and scaffolds embedded throughout lessons to ensure all learners can access and participate in mathematical thinking.

#### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

### **For Learners Who Require Further Intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

## Unit 2: Linear Equations and Applications

### Mission 4: Linear Equations (Topic B only)

#### Desired Results

#### Essential Questions:

- How can linear equations be written and solved to represent real-world situations?
- What do different types of solutions (no solution, one solution, infinitely many solutions) tell us about an equation?
- How do we interpret the meaning of a solution in the context of a problem?
- What does it mean to be a solution to a system of equations?
- How are equations, tables, and graphs connected when representing linear relationships?
- How can graphs be used to find and interpret solutions to systems of equations?

#### Enduring Understandings:

*Students will understand how to...*

#### Topic B: Linear Equations in One Variable

- Lesson 3: Balanced Moves
- Lesson 4: More Balanced Moves
- Lesson 5: Solving Any Linear Equation
- Lesson 6: Strategic Solving
- Lesson 7: All, Some, or No Solutions
- Lesson 8: How Many Solutions
- Lesson 9: When are they the same?

#### Knowledge:

#### *Mission 4 Vocabulary*

algebraically, coefficient, common denominator, constant term, distribute, distributive property, equation, expression, factor, infinitely many solutions, linear equation, like terms, no solution, one solution, ordered pair, representation, solution of an equation, solution of a system of equations, substitute, substitution, systems of equations, term, variable

#### Skills:

#### Topic B: Linear Equations in One Variable

- Lesson 3: Solve linear equations in one variable, including equations with the distributive property or variables on both sides, by performing balanced moves
- Lesson 4: Solve linear equations in one variable by performing balanced moves, including equations with variables on both sides that involve the distributive property and/or combining like terms

- Lesson 5: Solve linear equations in one variable, including equations with the distributive property, variables on both sides, and fractions, by performing balanced moves
- Lesson 6: Use different strategies for solving linear equations in one variable based on their features or structures
- Lesson 7: Solve linear equations with different numbers of solutions and determine whether there is one solution, no solution, or infinitely many solutions
- Lesson 8: Determine the number of solutions a linear equation has using its structure and describe features of equations with one solution, no solution, or infinitely many solutions
- Lesson 9: Write an equation with one variable to represent a situation with two equal conditions and interpret the solution

### Standards:

#### Previous Standards:

- CC.2.1.6.D.1 – Understand ratio concepts and use ratio reasoning to solve problems.
- CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.
- CC.2.3.6.A.1 – Apply appropriate tools to solve problems involving area, surface area, and volume.
- CC.2.1.7.D.1 – Analyze proportional relationships and use them to model and solve real-world problems.
- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions.
- CC.2.2.7.B.3 – Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and graphical representations.

#### 8th Grade Core Standards:

- CC.2.2.8.B.3 – Use numbers expressed in the form of a single digit multiplied by an integer power of 10 to estimate very large or very small quantities, and express how many times as much one is than the other.

### Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

#### **Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice

- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
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  - **Exit Ticket (Paper)**
    - The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some

assessment items highlight a student's understanding of a big mathematical idea, while others focus on students' procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.

- Optional Practice
  - Includes problems from current lessons along with a mix of topics from previous lessons.

#### **Summative Assessment/Progress Checks:**

- Progress Check #1
- Mid-Mission Assessment: Topic B Progress Check #2

#### **Suggested Learning Experiences and Instruction**

- The student will write and solve linear equations in one variable using algebraic methods.
- The student will represent problem situations with equations, define variables clearly, and interpret solutions in context.
- The student will use diagrams, tables, graphs, and equations to model and solve linear relationships.
- The student will solve linear equations with exactly one solution, no solution, or infinitely many solutions and explain what each means.
- The student will connect the idea of balance in hanger diagrams to algebraic strategies for solving equations.
- The student will write and solve systems of linear equations in two variables and explain what it means for a pair of values to be a solution to the system.
- The student will analyze graphs of linear equations to determine whether a system has one solution, no solution, or infinitely many solutions.

#### **Differentiation/Intervention/Enrichment Options:**

Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.

- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.



- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

#### **For Language Development:**

Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.

- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

#### **For Learners Who Require Further Intervention:**

Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.

- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

## Unit 3: Relationships and Functions

Mission 3: Linear Relationships

Mission 4: Linear Systems (Topic C, Only)

Mission 5: Functions (Topics A – C)

### Desired Results

#### Essential Questions:

- How can we use inputs and outputs to determine whether a relationship is a function?
- What makes a relationship linear, and how is it different from a proportional relationship?
- How are slope, rate of change, constant of proportionality, and vertical intercept connected in linear functions?
- How can we represent and interpret functions using tables, graphs, and equations?
- How does the graph of a linear equation show all of its solutions, and what do features like slope and intercept tell us?
- How can we describe and compare linear functions, including whether they are increasing, decreasing, or related through transformations?

#### Enduring Understandings:

*Students will understand how to...*

Mission 3, Topic A: Proportional Relationships

- Lesson 1: Understanding Proportional Relationships
- Lesson 2: Graphs of Proportional Relationships
- Lesson 3: Representing Proportional Relationships
- Lesson 4: Comparing Proportional Relationships

Mission 3, Topic B: Representing Linear Relationships

- Lesson 5: Introduction to Linear Relationships
- Lesson 6: More Linear Relationships
- Lesson 7: Representations of Linear Relationships
- Lesson 8: Translating to  $y = mx + b$

Mission 3, Topic C: Finding Slopes

- Lesson 9: Slopes Don't Have to be Positive
- Lesson 10: Calculating Slope
- Lesson 11: Equations of all kinds of lines
- Lesson 12: Solutions to Linear Equations
- Lesson 13: More Solutions to Linear Equations

Mission 5, Topic A: Input & Output

- Lesson 1: Inputs and Outputs
- Lesson 2: Introduction to Functions

#### Mission 5, Topic B: Representing and Interpreting Functions

- Lesson 3: Equations for Functions
- Lesson 4: Tables, Equations, and Graphs of Functions
- Lesson 5: More Graphs of Functions
- Lesson 6: Even More Graphs of Functions
- Lesson 7: Connecting Representations of Functions

#### Mission 5, Topic C: Linear Functions and Rates of Change

- Lesson 8: Linear Functions
- Lesson 9: Linear Models

#### Mission 4, Topic C: Systems of Linear Equations

- Lesson 10: On or Off the Line?
- Lesson 11: On Both of the Lines
- Lesson 12: Systems of Equations
- Lesson 13: Solving Systems of Equations
- Lesson 14: Solving More Systems
- Lesson 15: Writing Systems of Equations

### Knowledge:

#### *Mission 3 Vocabulary*

combination, constant of proportionality, constant rate, constraint, equation, horizontal intercept, horizontal line, initial (value or amount), intersection point, label, linear relationship, productive, rate of change, relate, represent, scale, set of solutions, slope, solution to an equation with two variables, variable, vertical intercept, vertical line, x-intercept, y-intercept

#### *Mission 5 Vocabulary*

approximate range, approximation for  $\pi$ , base (of a cylinder or cone), cone, cube, cubic centimeter, cylinder, depends on, dependent variable, dimension, function, functional relationship, hemisphere, independent variable, input, linear function, mathematical model, output, piecewise linear function, prediction, radius, rectangular prism, sphere, three-dimensional, volume

### Skills:

#### Mission 3, Topic A: Proportional Relationships

- Lesson 1 Create appropriate graphs and equations for proportional relationships by finding a constant of proportionality.

- Lesson 2 Compare graphs that represent proportional relationships using differently scaled axes. Use the graph of a proportional relationship to find the constant of proportionality and an equation that represents the relationship.
- Lesson 3 Find the rate of change of a proportional relationship given the graph, equation, table, or situation.
- Lesson 4 Compare the rates of change of proportional relationships presented in multiple ways.

#### Mission 3, Topic B: Representing Linear Relationships

- Lesson 5: Find the rate of change of a linear relationship by figuring out the slope of the line representing the relationship. Determine if a linear relationship is proportional or non-proportional by looking at its graph.
- Lesson 6: Interpret the slope and vertical intercept of a graph of a real-world situation.
- Lesson 7: Interpret the slope and vertical intercept in context, and write equations that represent linear relationships.
- Lesson 8: Create and compare equations that represent linear relationships with the same rate of change but different initial values.

#### Mission 3, Topic C: Finding Slopes

- Lesson 9: Create and interpret a graph of a line representing a linear relationship with a non-positive rate of change.
- Lesson 10: Calculate the slope of any line given the coordinates of two points on the line.
- Lesson 11: Write equations for vertical and horizontal lines, given the graph or a situation in which one variable does not vary and the other can take any value.

#### Mission 3, Topic D: Linear Equations

- Lesson 12: Determine pairs of values that satisfy or do not satisfy a linear relationship using an equation or graph.
- Lesson 13: Calculate the solution to a linear equation given one variable, and determine whether a point is a solution to an equation of a line.

#### Mission 5, Topic A: Input & Output

- Lesson 1: Use rules to find the output for a given input in an input-output table. Find rules that apply to multiple input-output pairs.
- Lesson 2: Define a function and determine if an input-output relationship represents a function.

#### Mission 5, Topic B: Representing and Interpreting Functions

- Lesson 3: Create an equation that represents a function rule, and calculate the output of a function for a given input using an equation in two variables.
- Lesson 4: Connect equations and graphs of functions by interpreting points on a graph. Determine whether a graph represents a function.
- Lesson 5: Use graphs of functions to analyze a context and interpret what is happening over intervals of input values.

- Lesson 6: Sketch and interpret graphs given the context of a real world situation.
- Lesson 7: Interpret multiple representations of functions, including graphs, tables, and equations.

#### Mission 5, Topic C: Linear Functions and Rates of Change

- Lesson 8: Understand that any linear function can be represented by an equation in the form  $y = mx + b$ , where  $m$  and  $b$  are the rate of change and initial value of the function, respectively.
- Lesson 9: Use linear functions to model real-world situations and make predictions. Determine the reasonableness of the mathematical model by comparing your predictions to the actual data.

#### Mission 4, Topic C: Systems of Linear Equations

- Lesson 10: Determine a point that satisfies two equations, using tables or graphs. Interpret points that lie on one, both, or neither line on a graph of two equations.
- Lesson 11: Create a graph that represents two linear relationships in context, and interpret the point of intersection.
- Lesson 12: Solve a system of equations graphically or algebraically. Understand that finding the solution to a system means finding values of the variables that make both equations true at the same time.
- Lesson 13: Solve a system of equations, and identify the number of solutions it has.
- Lesson 14: Calculate values that are a solution for a system of equations using substitution.
- Lesson 15: Create a system of equations that represents a situation and interpret the solution in context.

#### Standards:

##### Previous Standards:

- CC.2.1.6.D.1 – Understand ratio concepts and use ratio reasoning to solve problems.
- CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.
- CC.2.3.6.A.1 – Apply appropriate tools to solve problems involving area, surface area, and volume.
- CC.2.1.7.D.1 – Analyze proportional relationships and use them to model and solve real-world problems.
- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions.
- CC.2.2.7.B.3 – Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and graphical representations.
- CC.2.2.7.C.1 – Apply and extend previous understandings of operations with fractions to operations with rational numbers.

- CC.2.2.7.C.2 – Interpret and apply properties of operations to multiply and divide rational numbers.

### **8th Grade Core Standards:**

- CC.2.3.8.A.1 – Analyze and solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
- CC.2.2.8.B.2 – Demonstrate an understanding of rational and irrational numbers, and represent and compare quantities expressed in scientific notation.
- CC.2.2.8.B.3 – Use numbers expressed in the form of a single digit multiplied by an integer power of 10 to estimate very large or very small quantities, and express how many times as much one is than the other.
- CC.2.2.8.C.1 – Use rational and irrational numbers to solve real-world and mathematical problems.
- CC.2.2.8.C.2 – Apply properties of operations to generate equivalent numerical expressions involving rational and irrational numbers.

### **Acceptable Evidence**

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

### **Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
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complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.

- **Exit Ticket (Paper)**
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- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student’s understanding of a big mathematical idea, while others focus on students’ procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

#### **Unit 3:**

- Progress Check #1
- Mid-Mission Assessment: Mission 3, Topics A-B – Progress Check #2

- End-of-Mission Assessment: Mission 3, Topics C-D – Progress Check #3
- Progress Check #4
- Mid-Mission Assessment: Mission 5, Topics A-C – Progress Check #5

Cont., Unit 3:

- End-of-Mission Assessment: Mission 4, Topic C – Progress Check #6

### **Suggested Learning Experiences and Instruction**

- Students will analyze and connect multiple representations (tables, graphs, and equations) of proportional and linear relationships.
- Students will determine and interpret the constant of proportionality and rate of change in context.
- Students will represent linear relationships using graphs, tables, and equations, and explain how these representations are connected.
- Students will compare proportional and non-proportional relationships and justify their reasoning using graphs and equations.
- Students will select and use appropriate tools (e.g., graph paper, tables, equations) to model and solve real-world problems involving linear relationships.
- Students will interpret slope and intercepts in context, including situations with positive and negative rates of change.
- Students will solve and interpret systems of linear equations, making connections between graphical, tabular, and algebraic solutions.

### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.



- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

#### **For Learners Who Require Further Intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

## Unit 4: Statistics and Probability

### Mission 6: Associations in Data

#### Desired Results

#### Essential Questions:

- How can scatter plots help us identify patterns and relationships between two variables?
- What does the strength and direction of an association (positive, negative, or none) tell us about a data set?
- How can we distinguish between linear and non-linear relationships in bivariate data?
- How do clusters and outliers influence how we interpret data and draw conclusions?
- How can a fitted line (line of best fit) be used to model data and make predictions, and how accurate are those predictions?
- How can different representations (scatter plots, two-way tables, and bar graphs) help us understand both numerical and categorical data?

#### Enduring Understandings:

*Students will understand how to...*

Mission 6, Topic A: Does This Predict That?

- Lesson 1: Organizing Data
- Lesson 2: Plotting Data

Mission 6, Topic B: Associations in Numerical Data

- Lesson 3: What a point in a scatter plot means
- Lesson 4: Fitting a line to data
- Lesson 5: Describing trends in scatter plots
- Lesson 6: The slope of a fitted line
- Lesson 7: Observing more patterns in scatter plots
- Lesson 8: Analyzing Bivariate Data

Mission 6, Topic C: Associations in Categorical Data

- Lesson 9: Looking for associations
- Lesson 10: Using data displays to find associations

#### Knowledge:

#### *Mission 6 Vocabulary*

attribute, bar graph, categorical data, cluster, data display, fitted line, independent variable, linear association, linear model, negative association, no association, nonlinear association, numerical

data, outlier, overpredict, positive association, predict, relative frequency, scatter plot, segmented bar graph, two-way (frequency) table, underpredict, dependent variable

### **Skills:**

#### **Mission 6, Topic A: Does this Predict That?**

- Lesson 1: Organize data, describe patterns, and make predictions using tables and scatter plots.
- Lesson 2: Create a scatter plot from a table of data and describe the trend of the data.

#### **Mission 6, Topic B: Associations in Numerical Data**

- Lesson 4: Use a model to predict values for data and identify outliers on a scatter plot.
- Lesson 5: Draw a linear model to fit data in a scatter plot, and say whether data in a scatter plot has a positive or negative association (or neither).
- Lesson 6: Use the slope of a line fit to data in a scatter plot to say how the variables are connected in real-world situations.
- Lesson 7: Describe features of data on scatter plots, including “linear” and “nonlinear association” and “clustering” using informal language.
- Lesson 8: Analyze a set of data to determine associations between two variables, and interpret features of a scatter plot with a line of fit, including outliers, slope of the line, and clustering.

#### **Mission 6, Topic C: Associations with Categorical Data**

- Lesson 9: Calculate relative frequencies and describe associations between variables using a relative frequency table.
- Lesson 10: Create relative frequency tables, bar graphs, and segmented bar graphs from frequency tables to find associations among variables, and interpret the associations in context.

### **Standards:**

#### **Previous Standards:**

- CC.2.1.6.D.1 – Understand ratio concepts and use ratio reasoning to solve problems.
- CC.2.1.7.D.1 – Analyze proportional relationships and use them to model and solve real-world problems.
- CC.2.2.6.B.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.
- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions.
- CC.2.2.7.C.1 – Apply and extend previous understandings of operations with fractions to operations with rational numbers.
- CC.2.2.7.C.2 – Interpret and apply properties of operations to multiply and divide rational numbers.
- CC.2.4.7.B.1 – Draw, construct, and describe geometrical figures and describe the relationships between them.

- CC.2.4.7.B.2 – Apply and extend previous understandings of geometry to solve problems involving scale drawings and geometric figures.

#### **8th Grade Core Standards:**

- CC.2.4.8.B.1 – Apply knowledge of angle relationships and transformations to solve problems.
- CC.2.4.8.B.2 – Understand and apply the Pythagorean Theorem to solve problems involving right triangles.

#### **Acceptable Evidence**

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

#### **Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
  - **The Tower of Power (Digital)**
    - The Tower of Power is a scaffolded assessment, administered automatically at the end of each Independent Digital Lesson. The Tower of Power is focused on the content of a single lesson and allows students to demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.
  - **Exit Ticket (Paper)**

- The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student’s understanding of a big mathematical idea, while others focus on students’ procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

Unit 4:

- Progress Check #1
- End – of – Mission Assessment – Progress Check #2

### **Suggested Learning Experiences and Instruction**

- Students will represent and analyze bivariate data using scatter plots, identifying patterns and trends in real-world contexts.
- Students will interpret points on a scatter plot and explain what they represent about the relationship between two variables.
- Students will describe the type and direction of associations (positive, negative, none, linear, non-linear) between two variables.

- Students will create and use fitted lines to model data and make predictions, then compare predicted values to actual data.
- Students will identify and interpret outliers and explain their impact on the overall data set.
- Students will organize and analyze categorical data using two-way tables and calculate relative frequencies to identify associations.
- Students will represent categorical data using bar graphs and segmented bar graphs to compare groups and draw conclusions.

#### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

#### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

#### **For Learners Who Require Further Intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.

- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
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- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

## Unit 5: Real Numbers and Pythagorean Theorem

### Mission 8: Pythagorean Theorem and Irrational Numbers

#### Desired Results

#### Essential Questions:

- How can square roots and cube roots be represented and interpreted in mathematical expressions and on the number line?
- What is the difference between rational and irrational numbers, and how can we recognize each?
- How can we approximate irrational numbers and represent them using rational numbers?
- How does the Pythagorean Theorem describe relationships between side lengths in geometric figures?
- How can we use the Pythagorean Theorem to solve problems in two and three dimensions?
- How are numerical, algebraic, and geometric representations connected when solving problems involving roots and right triangles?

#### Enduring Understandings:

*Students will understand how to...*

#### Mission 8, Topic B: Side Lengths and Areas of a Square

- Lesson 3: Rational and Irrational Numbers
- Lesson 4: Square roots on the Number Line
- Lesson 5: Reasoning about Square Roots

#### Mission 8, Topic C: Pythagorean Theorem

- Lesson 6: Finding Side Lengths of Triangles
- Lesson 8: Finding Unknown Side Lengths
- Lesson 9: The Converse of the Pythagorean Theorem
- Lesson 10: Applications of the Pythagorean Theorem
- Lesson 11: Finding Distances in the Coordinate Plane

#### Mission 8, Topic D: Side Lengths and Volume of Cubes

- Lesson 12: Edge Lengths & Volumes
- Lesson 13: Cube Roots

#### Mission 8, Topic E: Decimal Representation of Rational and Irrational Numbers

- Lesson 14: Decimal Representation of Rational Numbers
- Lesson 15: Infinite Decimal Expansions



## Knowledge:

### *Mission 8 Vocabulary*

converse of the Pythagorean Theorem, cube root, decimal approximation, decimal representation, diagonal, edge length, hypotenuse, infinite decimal expansion, irrational number, legs, Pythagorean Theorem, rational number, repeating decimal, right triangle, square (of a number), square root, square root symbol

## Skills:

### Mission 8, Topic B: Side Lengths and Areas of Squares

- Lesson 3: Comprehend the term “rational number” to mean a fraction or its opposite, and “irrational number” to mean a number that is not rational, and identify examples of each.
- Lesson 4: Find a decimal approximation for square roots, and locate its approximation on the number line.
- Lesson 5: Identify the two whole number values that a square root is between.

### Mission 8, Topic C: Pythagorean Theorem

- Lesson 6: Comprehend the term “Pythagorean Theorem” as the equation  $a^2 + b^2 = c^2$ , where  $a$  and  $b$  are the lengths of the legs and  $c$  is the length of the hypotenuse of a right triangle.
- Lesson 8: Calculate unknown side lengths of a right triangle by using the Pythagorean Theorem.
- Lesson 9: Determine whether a triangle with given side lengths is a right triangle using the converse of the Pythagorean Theorem.
- Lesson 10: Use the Pythagorean Theorem to solve problems within a context.
- Lesson 11: Calculate the distance between two points in the coordinate plane by using the Pythagorean Theorem.

### Mission 8, Topic D: Side Lengths and Volumes of Cubes

- Lesson 12: Comprehend the term “cube root of  $a$ ” and the notation  $\sqrt[3]{a}$  to mean the side length of a cube with a volume of  $a$  cubic units.
- Lesson 13: Determine the whole numbers that a cube root lies between.

### Mission 8, Topic E: Decimal Representation of Rational and Irrational Numbers

- Lesson 14: Write fractions as terminating or repeating decimals and understand that every number has a decimal expansion.
- Lesson 15: Write a repeating decimal as a fraction.

## Standards:

### Previous Standards:

- CC.2.1.6.E.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.
- CC.2.1.7.E.1 – Apply and extend previous understandings of operations with rational numbers.
- CC.2.1.7.E.2 – Use properties of operations to generate equivalent expressions.
- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions.
- CC.2.2.7.C.1 – Apply and extend previous understandings of operations with rational numbers.
- CC.2.2.7.C.2 – Apply properties of operations to multiply and divide rational numbers.
- CC.2.3.7.A.1 – Solve real-world and mathematical problems involving area, surface area, and volume.

#### **8th Grade Core Standards:**

- CC.2.1.8.E.1 – Apply properties of integer exponents to generate equivalent numerical expressions.
- CC.2.1.8.E.4 – Interpret expressions and equations by viewing one or more of their parts as a single entity.
- CC.2.2.8.B.1 – Apply properties of irrational numbers to approximate and locate them on a number line.
- CC.2.3.8.A.3 – Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres and relate volume to functional relationships.

#### **Acceptable Evidence**

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

#### **Acceptable evidence:**

Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

Formative/Summative Assessments:

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demonstrate their new understanding. If students make a mistake, they receive real-time remediation at the point of misconception, allowing them to correct their understanding and continue through the assessment. Each Tower of Power contains two to four stages of problems that increase in complexity and decrease in scaffolding as students progress. The problems in each stage are carefully designed to focus on the big ideas of each lesson, mirroring the progression of learning students have just completed. Students must successfully complete 100% of the Tower of Power before moving on to their next Independent Digital Lesson. Since the Tower of Power is software-based, teachers can access a report that lets them know if a student is struggling with the daily digital assessment, allowing them to adjust instruction as needed.

- **Exit Ticket (Paper)**
  - The Exit Ticket is a paper assessment that is also focused on the content of a single lesson but is less scaffolded than the Tower of Power. The Exit Ticket is optional and can be administered after the completion of each Independent Digital Lesson, providing teachers with a second data point that they can use to monitor daily learning. The Exit Ticket determines if the student transferred their learning from the Independent Digital Lesson to a less scaffolded, open-response item that requires them to show their thinking and work by drawing models, writing explanations, or both. Since Exit Ticket problems are designed to highlight the big mathematical idea of each lesson, or a piece of it, we do not recommend editing them for content.
- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - Mid-Mission & End-of-Mission
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student’s understanding of a big mathematical idea, while others focus on students’ procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.
  - Optional Practice
    - Includes problems from current lessons along with a mix of topics from previous lessons.

## **Summative Assessment/Progress Checks:**

### **Unit 5:**

- Mid – Mission Assessment – Topic B – Progress Check #1
- Progress Check #2
- End – of – Mission Assessment – Topics B – E – Progress Check #3

## **Suggested Learning Experiences and Instruction**

- Students will compare the areas of squares using grid models and explain how area relationships connect to the Pythagorean Theorem.
- Students will decompose and rearrange shapes to demonstrate geometric proofs of the Pythagorean Theorem.
- Students will estimate and calculate side lengths and areas of squares on a coordinate grid using square root relationships.
- Students will define and distinguish between rational and irrational numbers and represent them on a number line.
- Students will approximate irrational numbers (e.g.,  $\sqrt{2}$ ,  $\pi$ ) using rational numbers and plot their locations on a number line.
- Students will apply the Pythagorean Theorem to find missing side lengths in two- and three-dimensional figures.
- Students will use cube roots to determine unknown edge lengths of cubes and connect volume to side length.

## **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.
- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

## **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.

- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

#### **For Learners Who Require Further Intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

## Unit 6: Exponents, Scientific Notation & Volume

### Mission 7: Exponents and Scientific Notation

### Mission 5: Volume (Topics D & E)

#### Desired Results

#### Essential Questions:

- How do exponent rules, including zero and negative exponents, extend our understanding of powers?
- What patterns and properties explain how exponent operations work and why they are consistent?
- How is the base-ten system represented using powers of 10?
- How does scientific notation help us represent, compare, and understand very large and very small numbers?
- What is order of magnitude, and how does it help describe the scale of quantities?
- How can exponent rules be applied to simplify expressions and solve real-world problems?
- How can volume formulas be compared and generalized across different shapes?
- How do changes in dimensions (like height or radius) impact the volume of a figure?

#### Enduring Understandings:

*Students will understand how to...*

#### Mission 7, Topic A: Exponent Review

- Lesson 1: Exponent Review

#### Mission 7, Topic B: Exponent Rules

- Lesson 2: Multiplying powers of 10
- Lesson 3: Powers of powers of 10
- Lesson 4: Dividing powers of 10
- Lesson 5: Negative Exponents with powers of 10
- Lesson 6: What about other bases?
- Lesson 7: Practice with Rational Bases
- Lesson 8: Combining Bases

#### Mission 7, Topic C: Scientific Notation

- Lesson 9: Describing large and small values using powers of 10
- Lesson 12: Applications of arithmetic with powers of 10
- Lesson 13: Definition of scientific notation
- Lesson 14: Multiplying, Dividing, and estimating with scientific notation
- Lesson 15: Adding and Subtracting with Scientific Notation

#### Mission 7, Topic D: Cylinders and Cones

- Lesson 11: Filling Containers
- Lesson 12: How much will fit (optional)
- Lesson 13: Volume of a cylinder
- Lesson 14: Finding cylinder dimensions
- Lesson 15: Volume of a Cone
- Lesson 16: Finding cone dimensions

#### Mission 5, Topic E: Dimensions and Spheres

- Lesson 20: Volume of a Sphere
- Lesson 21: Cylinders, Cones, & Spheres

#### Mission 5, Topic D: Cylinders and Cones

- Lesson 11: Filling Containers
- Lesson 12: How much will fit (optional)
- Lesson 13: Volume of a cylinder
- Lesson 14: Finding cylinder dimensions
- Lesson 15: Volume of a Cone
- Lesson 16: Finding cone dimensions

#### Mission 5, Topic E: Dimensions and Spheres

- Lesson 20: Volume of a Sphere
- Lesson 21: Cylinders, Cones, & Spheres

#### Knowledge:

##### *Mission 7 Vocabulary*

base (of an exponent), billion, evaluate, expanded, exponent, factor, integer, multiple of, negative exponent, positive exponent, power, powers of 10, powers of powers, reciprocal, repeated multiplication, scientific notation, square (of a number), trillion, zero exponent

##### *Mission 5 Vocabulary*

base (of a cylinder or cone), cone, cube, cubic centimeter, cylinder, dimension, hemisphere, radius, rectangular prism, sphere, spherical, three-dimensional, volume

#### Skills:

##### Mission 7, Topic A: Exponent Review

- Lesson 1: Compare quantities using expressions that represent repeated multiplication, and comprehend that repeated division of a number is equivalent to repeated multiplication by its reciprocal.

#### Mission 7, Topic B: Exponent Rules

- Lesson 2: Generalize the exponent rule  $10^n \cdot 10^m = 10^{n+m}$  and write equivalent exponential expressions of multiplication expressions with a base of 10.
- Lesson 3: Explain and use a rule for raising a power of 10 to a power, that  $(10^n)^m = 10^{n \cdot m}$ .
- Lesson 4: Generalize the exponent rule  $10^m / 10^n = 10^{m-n}$  and write equivalent exponential expressions of division expressions with a base of 10.
- Lesson 5: Generalize the exponent rule  $10^{-n} = 1 / 10^n$  and write equivalent exponential expressions involving negative exponents.
- Lesson 6: Generalize exponent rules for bases other than 10, and use exponent rules to write equivalent exponent expressions for any nonzero base.
- Lesson 7: Use an appropriate exponent rule to rewrite an expression with a single, positive exponent.
- Lesson 8: Generalize a process for multiplying expressions with different bases having the same exponent.

#### Mission 7, Topic C: Scientific Notation

- Lesson 9: Describe large and small numbers as multiples of powers of 10.
- Lesson 12: Use exponent rules and powers of 10 to solve problems in context.
- Lesson 13: Identify numbers written in scientific notation, and rewrite numbers written in different forms in scientific notation.
- Lesson 14: Multiply and divide numbers in scientific notation, and use scientific notation and estimation to compare quantities.
- Lesson 15: Add and subtract numbers in scientific notation.

#### Mission 5, Topic D: Cylinders and Cones

- Lesson 11: Gather data of the heights of certain cylinders as a function of volume, graph the relationship, and compare the rates of change of the functions.
- Lesson 12: Estimate the volumes of various containers using different units of measure and explain the reasoning.
- Lesson 13: Calculate the volume of a cylinder.
- Lesson 14: Calculate the value of one dimension of a cylinder and explain the reasoning.
- Lesson 15: Find the volumes of cones and cylinders given their radii and heights, and compare the volumes of a cylinder and cone with the same radius and height.
- Lesson 16: Calculate the value of one dimension of a cone and explain the reasoning.

#### Mission 5, Topic E: Dimensions and Spheres

- Lesson 20: Find the volume of a sphere given its radius, and explain the relationship between the volumes of a sphere, cone, and cylinder with the same radius and height.
- Lesson 21: Find the volumes of cylinders, cones, spheres, and rectangular prisms.



## Standards:

### **Previous Standards:**

- CC.2.1.6.E.1 – Apply and extend previous understandings of arithmetic to algebraic expressions.
- CC.2.1.7.E.1 – Apply and extend previous understandings of operations with rational numbers.
- CC.2.2.7.B.1 – Apply properties of operations to generate equivalent expressions.
- CC.2.2.7.C.1 – Apply and extend previous understandings of operations with rational numbers.
- CC.2.2.7.C.2 – Apply properties of operations to multiply and divide rational numbers.
- CC.2.3.7.A.1 – Solve real-world and mathematical problems involving area, surface area, and volume.
- CC.2.3.7.A.2 – Visualize and represent geometric figures and describe the relationships between them.

### **8th Grade Core Standards:**

- CC.2.1.8.E.1 – Apply the properties of integer exponents to generate equivalent numerical expressions.
- CC.2.2.8.C.1 – Use rational and irrational numbers to solve real-world and mathematical problems.
- CC.2.2.8.C.2 – Apply properties of operations to generate equivalent numerical expressions involving rational and irrational numbers.
- CC.2.3.8.A.1 – Analyze and solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

## Acceptable Evidence

Assessments focus on the big ideas of mathematics and allow students to demonstrate their understanding across multiple modalities through a thoughtful balance of software- and paper-based experiences. All assessments are designed to fit into the classroom model and allocated time, and to enhance – rather than distract from – instruction.

### **Acceptable evidence:**

#### Lesson Components:

- Warm-up
- Fluency
- Guided Practice
- Independent Practice
- Wrap-up

#### Formative/Summative Assessments:

- **Daily lesson – level assessments:** Lesson – level assessments are embedded into the curriculum and occur as part of recommended daily core instructional time, not in addition to it.
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- **Mission – Level Assessments/Progress Monitoring:** Mission-level assessments with scoring guidance and detailed rubrics are used for consistency and fidelity of program management. Mid-Mission and End-of-Mission assessments are assessments administered roughly halfway through the Mission and at the conclusion of the Mission respectively.
  - **Mid-Mission & End-of-Mission**
    - Paper assessments consist of open-response items that require students to show their work or explain their thinking in a variety of ways, including drawing models and writing explanations, similar to an Exit Ticket. Some assessment items highlight a student’s understanding of a big mathematical idea, while others focus on students’ procedural fluency. Each part of any multi-step problem has a clear objective, is aligned with the explicit

expectations of the target standards, and allows teachers to identify whether students are struggling with the foundational math concept or the multi-step aspect of the problem.

- Optional Practice
  - Includes problems from current lessons along with a mix of topics from previous lessons.

### **Summative Assessment/Progress Checks:**

Unit 6:

- Progress Check #1
- Mid – Mission Assessment – Mission 7, Topics A & B – Progress Check #2
- End – of – Mission Assessment – Mission 7, Topics A – D – Progress Check #3
- End – of – Mission Assessment – Mission 5, (no scaling) – Progress Check #4

### **Suggested Learning Experiences and Instruction**

- Students will apply exponent rules (including zero and negative exponents) to simplify expressions and explain their meaning.
- Students will analyze patterns in powers of 10 to justify exponent rules for multiplication, division, and powers of powers.
- Students will represent, compare, and interpret very large and very small numbers using powers of 10 and scientific notation.
- Students will perform operations with numbers in scientific notation and use order of magnitude to reason about scale.
- Students will model and analyze the relationship between height and volume in cylinders using tables, graphs, and equations.
- Students will calculate volume and determine missing dimensions for cylinders, cones, and spheres, explaining their reasoning.
- Students will compare volumes of different three-dimensional figures and recognize relationships between their formulas (e.g., cone vs. cylinder).

### **Differentiation/Intervention/Enrichment Options:**

- Students will benefit from predictable lesson structures and a progression from concrete to abstract learning that supports sense-making and reduces cognitive load.
- Students will engage in both independent thinking and collaboration, building confidence and deepening understanding with peer and teacher support.
- Students will access content through real-world contexts and multiple modalities (aligned to UDL), ensuring meaningful and accessible entry points for diverse learners.
- Students will be supported with embedded scaffolds and structured tools (e.g., guided notes, graphic organizers, checklists) to promote access, participation, and independence.

- Students will utilize accessible design features and assistive technologies (e.g., clear visuals, text-to-speech) to support understanding and engagement.
- Students will learn in flexible, supportive environments with opportunities to use manipulatives, adjust pacing, and revisit content as needed.

#### **For Language Development:**

- Students will benefit from explicit instruction and repeated exposure to key mathematical vocabulary, helping them build confidence in using academic language.
- Students will be supported through structured discussion routines (e.g., Think-Pair-Share) that include sentence frames and conversation starters to guide participation.
- Students will engage in meaningful math conversations where they explain their thinking, listen to others, and build on shared ideas.
- Students will be supported by the use of multiple languages when appropriate, allowing them to process mathematical ideas in their first language to deepen understanding.
- Students will access learning through visual supports, models, and teacher-created displays that capture and reinforce important language and concepts.
- Students should participate in structured language routines (such as clarifying responses, comparing strategies, and refining ideas) that strengthen both mathematical reasoning and language development.

#### **For Learners Who Require Further Intervention:**

- Students will be supported through built-in, just-in-time scaffolds within digital lessons that connect new learning to prior knowledge and address gaps as they arise.
- Students will receive adaptive support during lessons through visual and conceptual models that strengthen understanding of key mathematical ideas.
- Students will benefit from ongoing diagnostic tools (like the Tower of Power) that identify areas of struggle and provide immediate, targeted support (“Boosts”).
- Students should receive additional foundational lessons when needed, helping them build essential skills connected to grade-level content.
- Students will access learning through personalized assignments that allow them to move between grade-level work and targeted support seamlessly and without stigma.
- Students will benefit from teacher monitoring and data reports that guide instructional decisions and provide deeper interventions when necessary.

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** Math Intervention 8

**Date:** August 6, 2026

**Student Level:** Middle School

**Grade Level:** 8

**Characterization of Course of Study:**

This course is designed to support eighth grade students who would benefit from additional mathematics instruction. It provides targeted, standards-aligned support focused on strengthening foundational skills while helping students access grade-level content. Instruction emphasizes conceptual understanding, procedural fluency, problem solving, mathematical reasoning, and confidence with core Grade 8 topics such as transformations and similarity, linear equations, proportional and linear relationships, functions, systems of equations, bivariate data, rational and irrational numbers, the Pythagorean Theorem, integer exponents, scientific notation, and volume.

**Reasons for Proposed Adoption:**

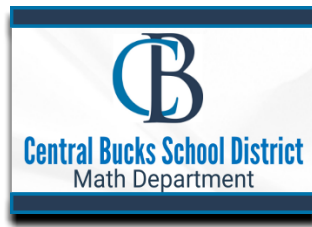
This course is intended for students who would benefit from additional support in meeting grade-level mathematics standards. It focuses on reinforcing foundational skills and addressing learning gaps in order to build student confidence and strengthen competence with core mathematical concepts.

The course provides a consistent structure for mathematics intervention across middle schools while allowing instruction to remain responsive to individual student needs. By offering targeted support during the school day, students receive additional practice with prerequisite and grade-level skills while remaining in the core mathematics sequence.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## AP Cybersecurity

Course Number: 2009

Course Level: Advanced/College Bound

Grade: 9-12

Time/Credit: 83 minutes daily: Grades 9, 10, 11, and 12  
1 credit: 9<sup>th</sup> – 12<sup>th</sup> grade

Board Approval Date:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## **Central Bucks School District**

### **K-12 Computer Science Teaching and Learning Principles**

1. Investigating, problem-solving, and communicating about computer science (speaking, reading, writing, representing, and listening) stimulates students' curiosity, builds confidence, and leads students toward deeper conceptual understanding.
2. Lessons should address students' strengths, interests, and learning styles through differentiated instruction.
3. All students can achieve excellence in computer science when:
  - instruction is appropriately paced
  - teachers set high expectations
  - students feel supported by their teachers, parents and administrators
4. Students must be actively engaged in learning experiences designed to connect to their prior knowledge.
5. For students to transfer and use knowledge meaningfully teachers need to:
  - present new ideas within rich and meaningful contexts
  - help students to make connections to their lives both within and outside of school
6. Computer Science instruction is more effective when teachers incorporate:
  - manipulatives
  - integrated development environments, both online and device based
7. Assessment should be ongoing, diagnostic, and aligned with instruction.

#### Documents Considered:

College Board (2019). AP Computer Science A: Course and Exam Description.  
Retrieved from <https://apcentral.collegeboard.org/courses>.

Computer Science Teachers Association (2017). CSTA K-12 Computer Science Standards, Revised 2017.  
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Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*.  
Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*.  
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Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New Standards for Teaching and Learning in America's Schools*. Portsmouth, NH: Heinemann.



# **Central Bucks School District**

## **K-12 Computer Science Program Enduring Understandings**

**Students will understand that:**

### **Computing Systems**

- Abstractions hide the underlying implementation details of computing systems embedded in everyday objects.
- Levels of abstraction and interactions between application software, system software, and hardware layers can be compared.
- Guidelines that convey systematic troubleshooting strategies can be developed that others can use to identify and fix errors.

### **Networks and the Internet**

- There is scalability and reliability of networks, in which the relationship between routers, switches, servers, topology, and addressing can be described.
- Sensitive data can be affected by malware and other attacks.
- Security measures can address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.

### **Data and Analysis**

- There are different bit representations of real-world phenomena, such as characters, numbers, and images.
- There are tradeoffs in how data elements are organized and where data is stored.

### **Algorithms and Programming**

- Algorithms are used to solve computational problems by leveraging prior student knowledge and personal interests.
- Programmers must justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made.
- Problems can be decomposed into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- Documentation of design decisions using text, graphics, presentations, and/or demonstrations is an integral part in the development of complex programs.

### **Impacts of Computing**

- Computing affects personal, ethical, social, economic, and cultural practices.
- Computational artifacts must be tested and refined to reduce bias and equity deficits.

# **Central Bucks School District**

## **K-12 Computer Science Program Essential Questions**

### **Computing Systems**

- What is an abstraction?
- How does abstraction manage complexity?

### **Networks and the Internet**

- How do scalability and redundancy relate to reliability on the Internet?
- What is malware and how is sensitive data affected by it?
- How do efficiency, feasibility, and ethical impacts impact security measures?

### **Data and Analysis**

- What are the tradeoffs in how data elements are organized and where data is stored?
- How do we collect, visualize, and store large amounts of data?
- Why do we create computational models and how does the data we use affect those models?
- What is the purpose of creating prototypes to solve computational problems?

### **Algorithms and Programming**

- What is an algorithm?
- How do algorithms and programs differ?
- Why is the selection of specific control structures important when considering implementation, readability, and program performance?
- Why is the decomposition into smaller components in constructs such as procedures, modules, and/or objects important in the software development process?
- Why are documentation and design decisions an integral part in the development of complex programs?

### **Impacts of Computing**

- What is the purpose of collecting data?
- How is data used or abused?
- What are the ways that computing affects personal, ethical, social, economic, and cultural practices?
- Why must we test and refine computational artifacts to reduce bias and equity deficits?

## AP Cybersecurity Overview

### Desired Results.

#### Course Description:

#### **2009 AP Cybersecurity (18 weeks, 1 credit)**

AP Cybersecurity introduces students to the principles, practices, and tools used to secure digital systems. Through a combination of hands-on labs, real-world scenarios, and project-based learning, students explore foundational topics such as network security, cryptography, risk assessment, system vulnerabilities, and ethical hacking. The course emphasizes both the technical and human aspects of cybersecurity and prepares students for further study or careers in the field. Up to one credit from computer science courses may be used to fulfill graduation requirements for mathematics.

Committee Members (Original): Dustin Frey, Aaron Fromal, Anthony Paglione, Matt Quinn, Brian Novick:  
K – 12 Mathematics Supervisor

### Acceptable Evidence.

Course Grading: The final course grade is calculated as follows:

- Each marking period grade counts for 45% of the students' course grade.
- The final exam counts for 10% of the students' course grade.

| <b>AP Cybersecurity Pacing Guide</b>                                                                                                                                                                                                                                                                                                      |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1: Introduction to Security</b>                                                                                                                                                                                                                                                                                                   | <b>15</b> |
| 1.1 – Understanding Social Engineering<br>1.2 - Suspicious Wi-Fi Login<br>1.3 - The Dangers of Public Wi-Fi<br>1.4 - AI Based Cybersecurity Attacks<br>1.5 - Leveraging AI in Cyber Defense<br>Formative Assessment                                                                                                                       | 13        |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                | 1         |
| Unit 1 Summative Assessment                                                                                                                                                                                                                                                                                                               | 1         |
| <b>Unit 2: Securing Spaces</b>                                                                                                                                                                                                                                                                                                            | <b>12</b> |
| 2.1 – Cyber Foundations<br>2.2 - Physical Vulnerabilities and Attacks<br>2.3 - Protecting Physical Spaces<br>2.4 - Detecting Physical Attacks<br>Formative Assessment                                                                                                                                                                     | 10        |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                | 1         |
| Unit 2 Summative Assessment                                                                                                                                                                                                                                                                                                               | 1         |
| <b>Unit 3: Securing Networks</b>                                                                                                                                                                                                                                                                                                          | <b>15</b> |
| 3.1 – Network Vulnerabilities and Attacks<br>3.2 - Protecting Networks: Managerial Controls and Wireless Security<br>3.3 - Protecting Networks: Segmentation<br>3.4 - Protecting Networks: Firewalls<br>3.5 - Detecting Network Attacks<br>Formative Assessment                                                                           | 13        |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                | 1         |
| Unit 3 Summative Assessment                                                                                                                                                                                                                                                                                                               | 1         |
| <b>Unit 4: Securing Devices</b>                                                                                                                                                                                                                                                                                                           | <b>12</b> |
| 4.1 – Device Vulnerabilities and Attacks<br>4.2 - Authentication<br>4.3 - Protecting Devices<br>4.4 - Detecting Attacks on Devices<br>Formative Assessment                                                                                                                                                                                | 10        |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                | 1         |
| Unit 4 Summative Assessment                                                                                                                                                                                                                                                                                                               | 1         |
| <b>Unit 5: Securing Applications and Data</b>                                                                                                                                                                                                                                                                                             | <b>18</b> |
| 5.1 - Application and Data Vulnerabilities and Attacks<br>5.2 - Protecting Applications and Data: Managerial Controls and Access Controls<br>5.3 - Protecting Stored Data with Cryptography<br>5.4 - Asymmetric Cryptography<br>5.5 - Protecting Applications<br>5.6 - Detecting Attacks on Data and Applications<br>Formative Assessment | 16        |
| Remediation and Enrichment                                                                                                                                                                                                                                                                                                                | 1         |

|                                         |                |
|-----------------------------------------|----------------|
| Unit 5 Summative Assessment             | 1              |
| <b>Projects, Review, and Final Exam</b> | <b>8 - 12</b>  |
| Projects                                | 5-8            |
| Review                                  | 2-3            |
| Final Exam                              | 1              |
| Total Days for Course:                  | <b>80 - 84</b> |

## Required and Supplementary Technology and Texts

### Required Technology

- Student Laptops
- College Board:
  - AP Classroom Progress Checks
  - AP Cybersecurity Labs
  - Released Multiple-Choice and Free Response Questions
- Suggested Online Resources
  - Cyber.org
  - [web.mit.edu/mprat/Public/web/Terminus/Web/main.html](http://web.mit.edu/mprat/Public/web/Terminus/Web/main.html)

### Supplemental Resources

- Code.org
- CodeHS.com
- [CyberChef](#)
- [BleepingComputer | Cybersecurity, Technology News and Support](#)

## Central Bucks School District – Course of Study

### Unit 1: Introduction to Security

#### Desired Results

##### Essential Questions:

- What evidence could you use to convince a teacher that an email is not legitimate?
- What elements of an email might cause someone to act impulsively?
- What are some potential consequences for someone who clicked a malicious link in an email?
- What types of information does an authorization log contain?
- What patterns do you notice in an authorization log?
- What entries in an authorization log are suspicious and why?
- How could you avoid joining a malicious network?
- What other types of services or applications could be impacted while logged into a malicious network?
- Do you know all your online connections (on social media and gaming platforms) in real life?
- Do you know that all your online connections are who they claim to be?
- Have you heard of adversaries trying to impersonate someone to get money out of a relative?
- How could you help protect relatives from becoming victims of an impersonation scheme?
- What are some potential advantages and disadvantages of using an AI-powered tool to review application code?
- Why is it important for the software development team to review the changes to the application code before implementing them?
- Are there times when you use AI-powered tools to help you review your work?

##### Enduring Understandings:

*Students will understand that...*

- Social engineering attacks employ psychological tactics to manipulate users into revealing sensitive information (elicitation), downloading a malicious file, or clicking on a malicious link. Social engineering can be performed in person but is often done by email, by text message, or through social media messages.
- Adversaries often use psychological tactics like intimidation and urgency to achieve their goals. Intimidation is when an adversary threatens a target with negative consequences if they do not comply. Urgency is when an adversary creates reasons why a target should act quickly.
- Social engineering tactics rely on common psychological principles that influence human behavior.
- Intimidation leverages a natural human aversion to negative consequences. By drawing attention to possible negative consequences, adversaries use fear to incite targets to act.
- Urgency leverages a natural human response to react quickly to time-sensitive needs. When targets detect a sense of urgency in a message, they feel pressured to respond or act quickly, which can prevent them from taking the time to consider whether an action is reasonable or safe.
- Victims may give an adversary personal information that could lead to impersonation, such as name, phone number, address, workplace, pets' names, or birthdate. These types of information are often used on websites as challenge questions to verify a user's identity.

- Victims may give an adversary secure information like a one-time password (OTP) or authentication login code, which could allow an adversary to log in to a service as the victim.
- Victims may download malware or click a link that installs malware on their device, steals information from their web browser, or directs them to a website where their login credentials can be captured by an adversary.
- In an online password attack, adversaries try to log in to a device or service using common passwords, common password patterns, or stolen passwords.
- Signs of an online password attack include:
  - Many failed attempts to log in over a short duration
  - Login attempts at unusual times
  - Login attempts from unknown devices
- Many people use common patterns when creating passwords, such as:
  - Starting a password with one or two words, adding a two-digit number (often signifying a year), and putting a special character at the end
  - Including the names of family or pets in their passwords
  - Including personally significant dates in their passwords
- Adversaries often construct a dictionary of possible passwords based on personal information gathered about a target, such as birthday, anniversary, names of pets, and names of family members, and use an automated tool to submit potential passwords.
- Users should increase password complexity by using lowercase and uppercase letters, numbers, and special characters, and spreading the special characters and numbers throughout the password.
- When available, users should enable multifactor authentication (MFA), which will require the user to provide extra proof of identity—such as a one-time code—in addition to the password as an extra layer of security.
- Adversaries can be classified by their skill levels.
- Adversaries have a variety of motivations, including greed, desire for recognition, dedication to a cause, revenge, politics, or beliefs.
- In an evil twin attack, an adversary sets up their own wireless access point (WAP) with a service set identifier (SSID) similar or identical to a target network; the adversary's network is called the evil twin. Victims of this attack could select to unknowingly connect to the evil twin, allowing the adversary to capture their network traffic.
- In a jamming attack, an adversary floods an area with a strong electromagnetic (EM) signal in the same frequency range as the wireless network, which prevents legitimate traffic between the access point (AP) and users. This type of attack that prevents users from accessing resources is called a denial of service (DoS) attack.
- In a war driving attack, adversaries try to detect wireless network beacons while driving or walking around a target. If a wireless signal is detected, the adversary can gather information about the type of wireless network used and find areas where the wireless signal extends outside the physical building.
- Individuals should verify that the name of any wireless network they join exactly matches the name of the network they intend to join.
- Individuals should avoid joining unprotected wireless networks. Unprotected wireless networks do not require a password or authentication to join.
- Individuals may consider using a virtual private network (VPN), which encrypts all their traffic, so that any intercepted traffic would not be immediately readable.

- Adversaries can use AI-powered tools that leverage existing voice and image samples of a person to create a digital avatar of that person. The use of these technologies enables adversaries to impersonate someone over the phone or even on a video call, which can lead to financial loss or the sharing of sensitive or private information. As more organizations adopt voice-based authentication, the impact of voice-impersonation has a larger potential impact.
- Adversaries can use generative AI tools, like large language models (LLMs), to create convincing phishing messages in any target language. Because traditional phishing messages are sometimes written by non-native speakers of the target's language, unnatural language is a feature that has been used to distinguish phishing messages from legitimate messages. However, with AI tools, adversaries can now craft phishing messages in any language that read as though they were written by a native speaker.
- Adversaries can craft prompts that extract secure or sensitive information from LLMs. Secure or sensitive information in LLMs can come from user input and the large data sets used to train LLMs.
- Adversaries can publish websites or modify existing websites to contain false information so that the false information will be included in the training sets for LLMs, causing the LLMs to repeat the false information.
- Adversaries can perform reconnaissance on a target using AI-powered tools that scan the internet to gather information posted on social media and public websites.
- Adversaries can use AI-enhanced coding tools to help them write new malware, modify existing application code to perform malicious activities, or to find vulnerabilities in large code bases.
- Shared secrets with close friends and relatives that can be used to verify each other's identities should be established. A secret word or phrase known only to two parties can be used to authenticate identities in high stakes situations.
- Multifactor authentication (MFA) should be enabled. If an adversary clones a target's voice to access a system with voice authentication, requiring a second authentication factor could prevent an adversary from gaining access to accounts.
- Personal or sensitive data should not be entered into any AI-powered tools, such as chatbots or virtual assistants. Some AI-powered tools feed user input back into the model to provide continuous training. Adversaries could extract data that users have included in prompts.
- Output from AI-powered tools should be carefully evaluated. Information from AI-powered tools should be verified using reputable, stable, non-AI-based sources.
- AI tools can review current security configurations, like firewall rules and access controls, and recommend more secure options. Recommendations should always be checked by a knowledgeable security technician before being implemented.
- AI-powered tools can analyze application code to identify vulnerabilities and recommend mitigations. Recommendations should always be reviewed by a knowledgeable programmer before being implemented.
- AI-powered tools can suggest rules for automated detection systems. Detection rules should always be reviewed by a knowledgeable detection engineer before being added to a system.
- Of the millions of digital events that happen on networks daily, some likely represent an adversary conducting malicious activity. Humans cannot carefully examine all those events to identify the malicious activity.
- AI-powered tools can be trained to quickly analyze digital events and sort the events that are likely malicious activity from those that are harmless.



- AI-powered tools can be programmed to alert human cybersecurity personnel when likely malicious activity is detected or to take specific corrective actions based on the type of malicious activity detected.
- AI-powered tools enable threat-detection and response teams to catch malicious activity and intervene quickly to prevent loss, harm, damage, and destruction to digital infrastructure and data.

### **Knowledge:**

*Students will know...*

- Definitions: Social engineering, elicitation, intimidation, urgency, impersonation, one-time password (OTP), authentication login code, multifactor authentication (MFA), shared secrets, malware, phishing, online password attack, denial of service (DoS) attack, evil twin attack, jamming attack, war driving, reconnaissance, password complexity, password patterns, dictionary attack, wireless access point (WAP), service set identifier (SSID), virtual private network (VPN), unprotected wireless network, voice impersonation, generative AI, large language models (LLMs), AI-powered tools, AI-enhanced coding tools.

### **Skills:**

*Students will be able to...*

- Identify, with and without the support of AI, vulnerabilities, threats, and attack methods, and explain how they generate risk.
- Identify security controls and explain how they mitigate risks.
- Identify methods for monitoring systems and explain how they detect attacks.

### **Computer Science Standards:**

#### **CSTA K-12 Computer Science Standards**

- 2-NI-05 Explain how physical and digital security measures protect electronic information. (P7.2)
- 3A-NI-05 Give examples to illustrate how sensitive data can be affected by malware and other attacks.
- 2-NI-06 Apply multiple methods of encryption to model the secure transmission of information.
- 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
- 3A-NI-07 Compare various security measures, considering tradeoffs between the usability and security of a computing system.
- 3A-NI-08 Explain tradeoffs when selecting and implementing cybersecurity recommendations.
- 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure.
- 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
- 3A-IC-30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

#### **AP Cybersecurity Computational Thinking Practices**

- 1.1.A Identify common indicators of social engineering tactics.
- 1.1.B Explain how social engineering tactics influence victims to perform a desired action
- 1.1.C Describe possible impacts for victims of social engineering attacks.

- 1.2.A Identify common signs of a password attack.
- 1.2.B Explain how adversaries take advantage of weak authentication.
- 1.2.C Explain how to make authentication stronger
- 1.3.A Identify the type of adversary conducting a cyberattack
- 1.3.B Identify types of wireless cyberattacks.
- 1.3.C Explain how individuals can protect themselves from some cyberattacks.
- 1.4.A Explain how adversaries use AI-powered tools to augment cyberattacks.
- 1.4.B Explain how to protect against some AI-augmented cyberattacks.
- 1.5.A Explain how cyber defenders can leverage AI-powered tools to protect networks, applications, and data.
- 1.5.B Explain how AI-powered tools are enabling faster and more accurate threat detection and response.

## Acceptable Evidence.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Warm-ups
- Check point assignments
- Class work
- Homework
- Exit slips
- Keep a notebook
- Current Event Reports
- Quizzes
- Canvas Quizzes
- Programming Assignments
- Unit Quiz

#### Summative Assessment

- Unit Test

## Suggested learning experiences and instruction

### Learning Experiences:

- AP Classroom: Progress Check for Unit 1.
- AP Classroom Scenario: Detecting Phishing Messages.
- AP Classroom Scenario: Detecting Unauthorized Logins.
- AP Classroom Scenario: Impacts of Using Public Wi-Fi.
- AP Classroom Scenario: AI-Powered Cyberattacks.
- AP Classroom Scenario: AI-Powered Cyber Defense.

### Instructional Strategies:

- Use a presentation to demonstrate new material.
- Use PowerPoint slides to present concepts and terminology.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

**Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension related to cybersecurity concepts and practices.
- Provide additional scaffolds such as guided notes, network diagrams, templates, structured lab procedures, and step by step protocols for students who need support.
- Provide opportunities for students ready for additional challenge to apply advanced concepts, evaluate emerging threats, and design secure solutions to authentic cybersecurity problems.

**For Language Development:**

- Create and maintain a student generated cybersecurity glossary that includes terminology, definitions, examples, and real world applications.
- Provide opportunities for students to explain cybersecurity concepts, threats, and mitigation strategies using appropriate technical vocabulary in both written and verbal formats.
- Use graphic organizers, diagrams, and visual models to connect terminology with concepts such as network security, encryption, authentication, risk management, and incident response.
- Develop study guides with clear definitions, case studies, and opportunities to practice cybersecurity communication and analysis.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced cybersecurity topics followed by challenging extension activities.
- Allow students to engage in more rigorous investigations, simulations, and problem-solving tasks that require deeper analysis of cybersecurity threats and defenses.
- Provide opportunities for students to explore specialized areas such as ethical hacking, digital forensics, cloud security, artificial intelligence security, cryptography, or security operations.
- Encourage students to complete enrichment projects involving security assessments, threat analysis, cyber defense strategies, policy development, or research on emerging cybersecurity issues that extend the core content while maintaining alignment with course objectives.

## Central Bucks School District – Course of Study

### Unit 2: Securing Spaces

#### Desired Results

##### Essential Questions:

- How do social engineers exploit psychological principles to manipulate individuals into compromising security?
- What motivates different types of adversaries, and how do their skill levels and goals influence the nature of their attacks?
- What are the phases of a cyberattack, and how do adversaries progress from reconnaissance to evasion?
- How do risk, vulnerabilities, and threats interact to compromise assets, and how can organizations assess and manage these risks?
- What are the principles of confidentiality, integrity, and availability, and how do security controls uphold these principles?
- How do physical security threats like tailgating, shoulder surfing, dumpster diving, and card cloning compromise cybersecurity?
- How do organizations use access control mechanisms and device restrictions to prevent unauthorized access and malware infections?
- How do natural disasters pose cybersecurity risks, and what strategies can mitigate their impact on digital infrastructure and data?
- How do organizations prioritize risk mitigation?

##### Enduring Understandings:

*Students will understand that...*

- Social engineers use psychological tactics to manipulate targets into taking a desired action.
- Pretexting is when adversaries create a believable reason to contact a target.
- Authority is when adversaries impersonate someone with power over a target or pretend to relay instructions from that person.
- Intimidation is when adversaries state negative consequences if demands are not met.
- Consensus is when adversaries create social pressure by making a target believe everyone else is doing a desired action.
- Scarcity is when adversaries create a sense of limited availability.
- Familiarity is when adversaries pretend to be or know someone close to a target to establish trust.
- Urgency is when adversaries create a deadline that requires quick action by a target to avert negative consequences.
- Script kiddies are low-skilled adversaries who use tools developed by others without understanding how the tools work. They are often motivated by greed or a desire for recognition.
- Hacktivists are motivated by social, political, or personal causes. They compromise computers and networks to support their cause or stop perceived harm, believing their goals justify their illegal methods.

- Cyberterrorists are motivated by politics or beliefs and seek to disrupt entire communities, regions, or nations through cyberattacks (e.g., attacking a power grid, water treatment plant, or other civil infrastructure). They can act independently or on behalf of governments or criminal organizations.
- Transnational criminal organizations seek financial gain primarily by deploying ransomware and stealing corporate intellectual property (IP) to sell in illegal markets.
- Cyberattacks aim to disrupt, harm, steal, or destroy devices, networks, or data. Adversaries work in phases, which may not all be used in every attack.
- In the reconnaissance phase of an attack, adversaries gather as much information as possible about their target, often using open source intelligence (OSINT), which is freely available information.
- In the initial-access phase of an attack, adversaries establish a foothold on the target's computer, often through social engineering or compromised or weak credentials.
- After gaining access during an attack, adversaries establish persistence to maintain access without needing to regain it. They may use a command and control (C2) protocol to send commands to the device and receive output, often through malware like a remote access trojan (RAT) or rootkit.
- In the lateral-movement phase of an attack, adversaries try to escalate their privileges by accessing computers and user accounts with elevated permissions to services and data.
- In the taking-action phase of an attack, adversaries act on their objectives by collecting targeted data, exfiltrating it, and disrupting services or destroying data.
- In the final phase of an attack, many adversaries try to evade detection by removing or editing log files and erasing other files they may have planted on devices (e.g., malware).
- Risk occurs when a threat can exploit a vulnerability to compromise an asset.
- An asset is anything valuable. Assets include financial resources, intellectual property, data, digital infrastructure, physical property, and reputation.
- The severity of an attack is often measured by financial cost, which can also include reputational and operational impacts.
- The result of a risk assessment can be quantitative or qualitative.
- Risk assessment documentation should include:
  - Vulnerable assets and their value
  - Descriptions of likely threats to the assets
  - Details of specific vulnerabilities for specific assets and how they would be exploited
  - An explanation of the severity of damage (financial, operational, reputational, etc.) if a specific asset were compromised, and the likelihood of that compromise occurring
  - A final rating, quantitative or qualitative, for each risk identified
- Once a risk has been identified and assessed, an organization has four options for managing that risk: avoid, transfer, mitigate, or accept.
- Residual risk is the risk that remains after an organization has gone through avoidance, transference, and mitigation. The residual risk is the level of risk that an organization is willing to accept. Risk acceptance acknowledges the fact that absolute security is unattainable.
- To conserve financial resources and employee capacity, an organization will often favor solutions that are cost effective and easy to implement and maintain.
- Security controls address at least one of the following principles:
  - Confidentiality ensures that only authorized individuals, systems, or processes can access data. Systems lacking confidentiality are vulnerable to data theft or destruction.

- Integrity ensures that data is accurate and trustworthy. Systems lacking integrity are vulnerable to data manipulation.
- Availability ensures that data and services are accessible to authorized individuals when needed. Systems lacking availability may experience unexpected downtime.
- Security controls can be classified by type.
  - Physical controls provide security in the physical space and include locks, fences, cameras, bollards, and security guards.
  - Technical controls provide security in the digital space and include firewalls, anti-malware software, and encryption.
  - Managerial controls provide rules, guidelines, policies, and procedures that specify what security should be in place and include password policies, regular access reviews, and incident response plans (IRPs).
- Security controls can be classified by function.
  - Preventive controls address potential vulnerabilities with the goal of stopping an adversary from attacking and include locks and encryption.
  - Detective controls help identify attacks when they occur and include intrusion detection systems (IDSs), cameras, security incidents, and event management (SIEM) systems.
  - Corrective controls fix problems and help restore systems to an operational state. Examples include vulnerability patching, repairing a broken card reader, and intrusion prevention systems (IPSs).
- A defense-in-depth strategy, or layered defense, uses multiple types of security controls to protect sensitive data and systems.
- A defense-in-depth strategy allows an organization to address different types of threats, each with a security control most suited to mitigate it.
- A defense-in-depth strategy allows for resilience in data protection, so when one security control is bypassed by an adversary, another security control may still prevent access to the data or system or limit the damage done to the data or system.
- Layers in a defense-in-depth strategy can include human, physical, network, device, application, and data.
- Adversaries often use social engineering when conducting a physical attack.
- Piggybacking is the name for an attack where an adversary uses social engineering to manipulate an authorized individual to grant the adversary access to a restricted area. Common piggybacking tactics include carrying something large to entice an authorized person to hold the door open, pretending to be an authorized person who has forgotten their access token, or pretending to be a maintenance person who needs to get into a certain area to perform an inspection or repair.
- Tailgating is the name for an attack where an adversary gains unauthorized access to a restricted area by following close behind an authorized individual without that individual's awareness or knowledge.
- Shoulder surfing is the name for an attack where an adversary watches as a user accesses sensitive information, so the adversary can use it later. Sometimes adversaries use a camera to record the target by accessing sensitive information for later analysis.
- Dumpster diving is the name for an attack where an adversary goes through a target's physical trash to look for information that could be used to help the adversary reach their goal.
- Card cloning is the name for an attack where an adversary makes a copy of an authorized user's access card so they can gain access to all the resources the user is authorized to access.

- Threats include human adversaries seeking to cause harm or disruption as well as natural disasters. Natural disasters can cause physical damage or destruction to computers and data as well as disruption of digital services provided by computers.
- Vulnerabilities are weaknesses or flaws that could allow an asset to be compromised.
- When adversaries gain access to an area with sensitive information, they can steal or copy sensitive information.
- When adversaries gain physical access to a device and its ports, they can plug in a keylogger or external drive containing malware, which could allow them to collect data from a user or possibly even to gain control of the device. With direct physical access, adversaries can also physically destroy a device, making the device itself, any data stored on it, and any services it provides unavailable.
- Physical access to devices can allow adversaries to bypass many technical controls and layers of security.
- Organizations should conduct employee security awareness training to educate employees about how they can contribute to the organization's security.
- Organizations should have a workstation security policy that outlines the measures necessary to protect a physical workplace. The policy may have tiers of workstation security based on the type of data handled at a workstation.
- To determine a relevant control, a cyber defender considers how an adversary could take advantage of a vulnerability to attack a system and how to prevent, detect, or correct the attack.
- Card readers can record which employee badges are being used to access different entries at specific times and deny access to unauthorized badges.
- Access control vestibules and turnstiles can prevent an authorized person from intentionally or accidentally admitting an unauthorized person into a restricted area.
- Organizations can disable USB ports to prevent external drives from loading malware onto a computer.
- An uninterruptible power supply (UPS) provides a backup power source for a device in the event of a power outage. Organizations can also use power generators to provide power at a larger scale to a building or set of critical devices.
- Organizations prioritize risk mitigations based on the severity of the risks and the cost of the recommended mitigations.
- Locks should be placed on all entries to areas containing sensitive information or systems. For areas with particularly sensitive information or systems, an organization could use an access control vestibule at the entry point to prevent piggybacking or tailgating.
- Security guards can be stationary or patrolling. Stationary guards can provide constant protection for a specific area, entrance, or high-value item. Patrolling guards are more difficult for an adversary to plan around and can create time pressure for an adversary. Placing stationary guards at places that funnel traffic (e.g., entry gates, main entrances or lobbies, and entrances to more secure access areas) can be highly effective, while patrolling guards are better suited for perimeters and exterior areas.
- Cameras provide visual monitoring and a visual record of activity within a designated space. Cameras can be paired with facial recognition software that can provide alerts when unauthorized individuals enter controlled areas. Once a physical breach has been detected, defenders can use live and recorded camera footage to track an adversary's path and actions.
- Motion detectors work best when paired with cameras. When a security alert is raised because a motion detector has been activated, defenders can use cameras to check the space visually and verify a physical security breach.

- When employees are required to use an electronic badge to unlock a door to a restricted area, a sensor can record how long the door was open. In reviewing entry logs for the door, potential piggybacking or tailgating can be detected by doors being open for longer than normal lengths of time.

### **Knowledge:**

*Students will know...*

- Definitions: Social engineering, pretexting, authority, intimidation, consensus, scarcity, familiarity, urgency, script kiddies, hackers, insiders, adversaries, cyberterrorists, transnational criminal organizations, cyberattacks, reconnaissance, open source intelligence (OSINT), initial access, persistence, command and control (C2), remote access trojan (RAT), rootkit, lateral movement, taking action, data exfiltration, evasion, risk, threat, vulnerability, asset, risk assessment, quantitative assessment, qualitative assessment, risk avoidance, risk transference, risk mitigation, residual risk, risk acceptance, confidentiality, integrity, availability, security controls, physical controls, technical controls, tailgating, shoulder surfing, dumpster diving, card cloning, natural disasters, access control vestibules, turnstiles, USB port disabling, piggybacking, tailgating.

### **Skills:**

*Students will be able to...*

- Identify vulnerabilities, threats, and attack methods, and explain how they generate risk.
- Identify security controls and explain how they mitigate risks.
- Evaluate the likelihood and impact of risks.
- Document the likelihood and impact of risks.
- Identify security controls and explain how they mitigate risks.
- Determine layered security controls that address vulnerabilities.
- Identify methods for monitoring systems and explain how they detect attacks.
- Determine strategies and methods to detect attacks.

### **Computer Science Standards:**

#### **CSTA K-12 Computer Science Standards**

- 2-NI-05 Explain how physical and digital security measures protect electronic information. (P7.2)
- 3A-NI-05 Give examples to illustrate how sensitive data can be affected by malware and other attacks.
- 2-NI-06 Apply multiple methods of encryption to model the secure transmission of information.
- 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
- 3A-NI-07 Compare various security measures, considering tradeoffs between the usability and security of a computing system.
- 3A-NI-08 Explain tradeoffs when selecting and implementing cybersecurity recommendations.
- 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure.
- 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
- 3A-IC-30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.



## **AP Cybersecurity Computational Thinking Practices**

- 2.1.A Identify social engineering attacks.
- 2.1.B Identify types of adversaries.
- 2.1.C Describe the phases of a cyberattack.
- 2.1.D Describe the risk assessment process.
- 2.1.E Identify strategies for managing risk.
- 2.1.F Identify types of security controls.
- 2.1.G Explain why a defense-in-depth security strategy is necessary to optimally protect an organization.
- 2.2.A Identify common physical attacks.
- 2.2.B Explain how threats can exploit common physical vulnerabilities to cause loss, damage, disruption, or destruction to assets.
- 2.2.C Assess and document risks from physical vulnerabilities.
- 2.3.A Identify managerial controls related to physical security.
- 2.3.B Determine mitigation strategies for risks from physical vulnerabilities.
- 2.4.A Identify ways security controls can detect physical attacks.
- 2.4.B Determine effective placement of security controls for detecting physical attacks.
- 2.4.C Apply detection techniques to identify physical attacks.

### **Acceptable Evidence**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups
- Check point assignments
- Class work
- Homework
- Exit slips
- Keep a notebook
- Current Event Reports
- Quizzes
- Canvas Quizzes
- Programming Assignments
- Unit Quiz

##### **Summative Assessment**

- Unit Test

### **Suggested learning experiences and instruction**

#### **Learning Experiences:**

- AP Classroom: Progress Check for Unit 2.
- AP Classroom Scenario: Securing Xtensr Labs.
- AP Classroom Scenario Discussion: A server that stores customer data is in a room with no lock which is accessed via an unmonitored hallway.

- AP Classroom Scenario Discussion: Employees in an office that requires badge access have laptop computers that they leave on their desks unattended when they all go to lunch together. The computers do not contain any sensitive information, but there are no cables securing the devices to the desks.
- AP Classroom Scenario Discussion: A hacktivist is passionate about illegal fishing practices supported by a local food production company. The main webpage of this food production company would be a high value target for this hacktivist; defacing the webpage to expose the company's support of illegal fishing would provide no financial gain to the adversary but would allow them to raise awareness about an issue that motivates them.

#### **Instructional Strategies:**

- Use a presentation to demonstrate new material.
- Use PowerPoint slides to present concepts and terminology.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

#### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension related to cybersecurity concepts and practices.
- Provide additional scaffolds such as guided notes, network diagrams, templates, structured lab procedures, and step by step protocols for students who need support.
- Provide opportunities for students ready for additional challenge to apply advanced concepts, evaluate emerging threats, and design secure solutions to authentic cybersecurity problems.

#### **For Language Development:**

- Create and maintain a student generated cybersecurity glossary that includes terminology, definitions, examples, and real-world applications.
- Provide opportunities for students to explain cybersecurity concepts, threats, and mitigation strategies using appropriate technical vocabulary in both written and verbal formats.
- Use graphic organizers, diagrams, and visual models to connect terminology with concepts such as network security, encryption, authentication, risk management, and incident response.
- Develop study guides with clear definitions, case studies, and opportunities to practice cybersecurity communication and analysis.

#### **For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced cybersecurity topics followed by challenging extension activities.
- Allow students to engage in more rigorous investigations, simulations, and problem-solving tasks that require deeper analysis of cybersecurity threats and defenses.
- Provide opportunities for students to explore specialized areas such as ethical hacking, digital forensics, cloud security, artificial intelligence security, cryptography, or security operations.
- Encourage students to complete enrichment projects involving security assessments, threat analysis, cyber defense strategies, policy development, or research on emerging cybersecurity issues that extend the core content while maintaining alignment with course objectives.

## Central Bucks School District – Course of Study

### Unit 3: Securing Networks

#### Desired Results

##### Essential Questions:

- How can cybersecurity professionals evaluate and document the likelihood and impact of risks, with and without AI support?
- What role does AI play in enhancing risk assessment and mitigation strategies in cybersecurity?
- How do protective risk management strategies reduce the impact of threats, and how can their effectiveness be evaluated?
- What are the key types of security controls, and how do they help mitigate specific cybersecurity risks?
- How can mitigations be implemented and logged effectively to support ongoing security operations?
- What methods are used to detect and classify cyberattacks, and how can digital evidence be analyzed to support this process?
- How do different threat detection methods (e.g., signature-based, anomaly-based, hybrid) impact the speed, accuracy, and cost of response?
- What are the benefits and limitations of using AI in threat detection and incident response?

##### Enduring Understandings:

*Students will understand that...*

- The address resolution protocol (ARP) is used by a default gateway on a network to establish a table that pairs internet protocol (IP) addresses with media access control (MAC) addresses. An ARP poisoning attack is when an adversary sends falsified ARP packets to the default gateway to modify the table so that the adversary's device receives traffic intended for the target by linking the target's IP address to the adversary's MAC address. Faking a MAC address is called MAC spoofing. This is an example of an on-path attack (or man-in-the middle attack), which is when an adversary interrupts a data stream between two parties, captures both parties' data, and copies or alters the data before sending them on. Both parties think they are communicating directly with each other, but instead they are each communicating with the adversary who is secretly intercepting their messages.
- A MAC flooding attack is when an adversary sends the target switch many Ethernet frames, each with a different MAC address. This can force the switch into broadcast mode, and the adversary can then collect all of the frames on the network (because they are being broadcast), which could allow the adversary to access sensitive information. This is an example of eavesdropping (or sniffing), which is when an adversary captures data in transit and can record and copy the data.
- A domain name system (DNS) poisoning attack is when an adversary pretends to be an authoritative name server (NS) and plants a fake DNS record on a DNS server to redirect browser traffic to a malicious website designed to steal credentials. This is an example of credential harvesting, which is when adversaries set up a fake login site that looks like a real one. Unsuspecting users enter their real credentials, which the adversaries capture and use.
- Adversaries can send malicious traffic into a network to flood it, create a DoS, map the internal structure of the network, or spoof a legitimate device. Networks without firewalls, or with improperly configured firewalls, are vulnerable to these types of attacks.

- Adversaries that have compromised a device often attempt to leverage their access to compromise other devices on the local area network (LAN).
- Adversaries that physically plug into a data port can gain access to a LAN through the switch port unless port security is enabled. This allows adversaries to launch DoS attacks or perform MAC flooding or MAC spoofing attacks.
- Adversaries standing outside of physically secure spaces can pick up the signals and beacon frames from a wireless access point that is broadcasting outside the physical space. This allows them to gather information about the wireless network and to attempt eavesdropping and cryptographic attacks on it.
- Adversaries can attempt to join networks to launch attacks from within the networks. Networks that do not authenticate devices and users make it easier for adversaries to join.
- If there is an open network port, an adversary can plug a wireless access point into the port creating a rogue access point. The adversary could use this rogue access point to access the internal network wirelessly (maybe even from outside the physical space). This allows the adversary direct access to the LAN, bypassing any firewalls.
- Vulnerabilities on a network can lead to adversaries being able to intercept and alter data in transit, launch DoS attacks, or move laterally on a network to gain access to more sensitive or critical systems. Network vulnerabilities can constitute a risk to confidentiality, integrity, and availability.
- There are automated vulnerability scanners that can check networks, devices, and applications for known vulnerabilities. These scanners produce a report that often includes the vulnerabilities detected, their severity, and mitigation recommendations.
- Successfully exploiting a network vulnerability often requires advanced technical ability and knowledge. This can impact the likelihood of an exploit.
- High risks from network vulnerabilities allow an adversary to easily have a significant impact by capturing network traffic, spoofing a legitimate device on the network, or launching a DoS attack.
- Moderate risks from network vulnerabilities could include vulnerabilities that might give adversaries the ability to gain information about systems or devices on a network.
- Low risks from network vulnerabilities include vulnerabilities that would be difficult to exploit and would likely have minimal negative impacts on an organization.
- A router security policy will set forth a minimum configuration standard for routers on an organization's network.
- A switch security policy will set forth a minimum configuration standard for switches on an organization's network.
- A virtual private network (VPN) policy will detail the minimum security requirements for employees using a VPN to access an organization's internal network.
- A wireless security policy will establish the minimum security requirements for wireless networks within an organization.
- Organizations can disable beacon frame broadcasting on wireless access points (WAPs) to make it harder for adversaries to find their wireless network and learn its basic properties.
- Organizations can control the broadcast direction and signal strength of a WAP so the signal does not extend beyond the physical space the access point is meant to cover.
- Organizations should enable strong wireless encryption protocols to ensure wireless frames are not readable by adversaries who might intercept them.
- Organizations can require users to authenticate to join a network. Organizations can also enable MAC filtering to prevent unauthorized devices from accessing the network.

- Firewall zones and rules can be used to create a screened subnet (also known as a demilitarized zone, or DMZ)—a network segment that sits between public, external networks like the internet and internal, private networks. A screened subnet is typically a lower security zone than the internal, private networks, and it typically holds an organization's publicly facing resources, separating them from the internal network.
- Subnetting can be used to create different subnets based on IP addressing. If a device is compromised by an adversary, subnets can contain a security breach to reduce the number of exposed devices.
- Switches can be used to create VLANs, which logically separate devices physically connected to central switches.
- Network segmentation refers to the process of dividing a network into smaller, isolated segments or subnetworks (subnets).
- Dividing a network into smaller subnets isolates network traffic, which can prevent attacks on one subnet from impacting devices on other subnets.
- Network segmentation can allow for different security policies and controls to be applied to different segments of the network, allowing for higher security zones and lower security zones.
- Port security on a switch can prevent MAC flooding by limiting the number of addresses assignable to any single switch port.
- A firewall is used to allow or deny network traffic in or out of a network. The firewall itself is software that can be hosted on a standalone device or integrated into another network device, such as a router.
- A stateless firewall filters traffic based on information in packet headers, such as IP addresses, ports, and protocols.
- A stateful firewall (also known as dynamic packet filtering) tracks the state of network connections passing through the firewall and can filter according to connection-related rules in addition to the filtering done by a stateless firewall. This allows for more control over content allowed in and out of a network.
- A next-generation firewall (NGFW) has both the capabilities of typical stateless and stateful firewalls and additional advanced features, such as intrusion prevention, deep packet inspection, and filtering by application type.
- Network administrators create a set of rules, called an access control list (ACL), that a firewall uses to permit or deny inbound and outbound network traffic.
- The requirements for a firewall will specify what type of traffic from which sources or to which destinations should be allowed or denied.
- Automated detection tools analyze data collected from an organization's network and devices, such as switches and routers, servers, firewalls, and user computers. These data are often collected in a log file.
- A network intrusion detection system (NIDS) is an automated tool that analyzes data to determine if malicious activity is taking place on a network. When an attack is detected, it generates an alert.
- A network intrusion prevention system (NIPS) is an automated tool that, like an IDS, analyzes data to determine if malicious activity is taking place on a network. A NIPS can also mitigate or halt an attack by closing ports, blocking specific IP or MAC addresses, or rejecting specific protocols.
- A security information and event management (SIEM) system collects and analyzes data from multiple sources (including firewalls, NIDS/NIPS, device logs, and application logs) to detect patterns that may indicate a cyberattack and raises an alert if a potential attack is detected. Security analysts investigate the alert to determine whether it represents a true threat and follow standard operating procedures to resolve or escalate the alert.

- Computers log every action that users take. Firewalls, IDS, IPS, and other network sensors log all the traffic passing through various points in a network. A medium-sized organization's network is logging millions (or even tens of millions) of data points per day. Even a large team of humans is incapable of analyzing so much data.
- Threat detection teams are creating AI algorithms to analyze large amounts of data and classify the data patterns as malicious or normal.
- Volume of network traffic is a criterion for determining a detection method. Signature-based detection is more efficient for networks with high traffic volume. Signature-based detection compares detection data to a database of known indicators of compromise (IoCs), called signatures. Signature databases must be updated with IoCs for the latest attacks. Signature-based detection runs more quickly than anomaly-based detection.
- Cost is a factor in evaluating the impact of a network detection method. Detection tools and ongoing costs need to be within a budget. Anomaly-based detection systems require more expensive hardware to operate than signature-based systems. Hybrid detection is the most expensive option because it combines both anomaly-based and signature-based methods.
- Cost is a factor in evaluating the impact of a network detection method. Detection tools and ongoing costs need to be within a budget. Anomaly-based detection systems require more expensive hardware to operate than signature based. Hybrid detection is the most expensive option because it combines both anomaly and signature based methods.
- Evil-twin attacks can be detected by regularly scanning for service set identifiers (SSIDs) that look suspicious or similar to local legitimate SSIDs. Signal triangulation can be used to locate and disable an access point broadcasting an evil-twin network.
- Jamming attacks can be detected by recognizing that no wireless devices in a specific physical space are able to connect to a wireless network and by scanning for electromagnetic (EM) noise in the wireless range.
- ARP poisoning attacks can be detected by monitoring network traffic for unusual ARP messages (particularly duplicate MAC address ARP packets) and checking the ARP table on the default gateway.
- MAC flooding attacks can be detected by monitoring network traffic for an unexpected surge of Ethernet frames with different MAC addresses and checking the MAC address table on a switch.
- DNS poisoning attacks are difficult to detect. However, if an organization's website experiences an abrupt and otherwise inexplicable drop in traffic, DNS records should be examined as a potential cause.
- Smurf attacks can be detected by watching network traffic for a sudden increase in ICMP requests sent to the network's broadcast address.

### **Knowledge:**

#### *Students will know...*

- Definitions: ARP, ARP poisoning, MAC address, MAC spoofing, MAC flooding, DNS poisoning, credential harvesting, DoS attack, firewall (stateless, stateful), access control list (ACL), port security, LAN, WAP, rogue access point, SSID, jamming attack, cryptographic attack, network segmentation, VLANs, subnetting, IP addressing, network vulnerabilities, lateral movement, confidentiality, integrity, availability, vulnerability scanner, detection tools (NIDS, NIPS, SIEM), threat detection, signature-based detection, anomaly-based detection, hybrid detection, indicators of compromise (IoCs), Smurf attack, ICMP requests, broadcast address, wireless encryption, MAC filtering, screened subnet (DMZ), router/switch/VPN/wireless security policies, beacon frames, signal triangulation, log files.

**Skills:**

*Students will be able to...*

- Evaluate, with and without the support of AI, the likelihood and impact of risks.
- Document, with and without the support of AI, the likelihood and impact of risks.
- Evaluate, with and without the support of AI, the impact of protective risk management strategies.
- Implement and log mitigations with and without the support of AI.
- Identify security controls and explain how they mitigate risks.
- Evaluate the impact of threat detection methods.
- Detect and classify cyberattacks by analyzing digital evidence with and without the support of AI.

**Computer Science Standards:****CSTA K-12 Computer Science Standards**

- 2-NI-05 Explain how physical and digital security measures protect electronic information. (P7.2)  
3A-NI-05 Give examples to illustrate how sensitive data can be affected by malware and other attacks.
- 2-NI-06 Apply multiple methods of encryption to model the secure transmission of information.
- 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
- 3A-NI-07 Compare various security measures, considering tradeoffs between the usability and security of a computing system.
- 3A-NI-08 Explain tradeoffs when selecting and implementing cybersecurity recommendations.
- 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure.
- 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
- 3A-IC-30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

**AP Cybersecurity Computational Thinking Practices**

- 3.1.A Identify common network attacks.
- 3.1.B Explain how adversaries can exploit network vulnerabilities to steal, disrupt, or destroy network communication.
- 3.1.C Assess and document risks from network vulnerabilities.
- 3.2.A Identify managerial controls related to network security.
- 3.2.B Configure wireless network security features.
- 3.3.A Identify techniques for segmenting a network.
- 3.3.B Explain why network segmentation can increase network security.
- 3.4.A Identify types of network-based firewalls.
- 3.4.B Explain how a firewall uses an access control list to allow or deny traffic entering or leaving a network.
- 3.4.C Determine the effective placement of firewalls in a network.
- 3.4.D Configure a firewall to manage the flow of network traffic.
- 3.5.A Identify types of automated security tools used to detect network attacks.

- 3.5.B Explain how organizations can leverage artificial intelligence (AI) to enhance threat detection and response.
- 3.5.C Determine a network detection method.
- 3.5.D Evaluate the impact of a network detection method.
- 3.5.E Apply detection techniques to identify indicators of network attacks by analyzing log files.

## **Acceptable Evidence**

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessment**

- Warm-ups
- Check point assignments
- Class work
- Homework
- Exit slips
- Keep a notebook
- Current Event Reports
- Quizzes
- Canvas Quizzes
- Programming Assignments
- Unit Quiz

#### **Summative Assessment**

- Unit Test

## **Suggested learning experiences and instruction**

### **Learning Experiences:**

- AP Classroom: Progress Check for Unit 3.
- AP Classroom Scenario: Protecting Patient Medical Data
- AP Classroom Scenario: Protecting a Network on a Naval Submarine
- AP Classroom Scenario: Configuring a Secure Wireless Network

### **Instructional Strategies:**

- Use a presentation to demonstrate new material.
- Use PowerPoint slides to present concepts and terminology.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension related to cybersecurity concepts and practices.
- Provide additional scaffolds such as guided notes, network diagrams, templates, structured lab procedures, and step by step protocols for students who need support.
- Provide opportunities for students ready for additional challenge to apply advanced concepts, evaluate emerging threats, and design secure solutions to authentic cybersecurity problems.



**For Language Development:**

- Create and maintain a student generated cybersecurity glossary that includes terminology, definitions, examples, and real world applications.
- Provide opportunities for students to explain cybersecurity concepts, threats, and mitigation strategies using appropriate technical vocabulary in both written and verbal formats.
- Use graphic organizers, diagrams, and visual models to connect terminology with concepts such as network security, encryption, authentication, risk management, and incident response.
- Develop study guides with clear definitions, case studies, and opportunities to practice cybersecurity communication and analysis.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced cybersecurity topics followed by challenging extension activities.
- Allow students to engage in more rigorous investigations, simulations, and problem-solving tasks that require deeper analysis of cybersecurity threats and defenses.
- Provide opportunities for students to explore specialized areas such as ethical hacking, digital forensics, cloud security, artificial intelligence security, cryptography, or security operations.
- Encourage students to complete enrichment projects involving security assessments, threat analysis, cyber defense strategies, policy development, or research on emerging cybersecurity issues that extend the core content while maintaining alignment with course objectives.

## Central Bucks School District – Course of Study

### Unit 4: Securing Devices

#### Desired Results

##### Essential Questions:

- How do different types of computing devices (servers, personal computers, handheld devices, and embedded systems) impact cybersecurity strategies?
- What unique security challenges do Internet of Things (IoT) devices and embedded systems present in critical infrastructure and everyday life?
- How can adversaries exploit common device vulnerabilities such as weak authentication, open ports, and unpatched software?
- What role does malware—including fileless malware—play in cyberattacks, and how can organizations defend against it?
- Why are cryptographic hash functions important for password security, and how do adversaries attempt to compromise them?
- How do authentication mechanisms, password complexity requirements, and multifactor authentication (MFA) strengthen security?
- What policies and technical controls (e.g., acceptable use policies, anti-malware software, host-based firewalls) help protect devices and networks?
- How do detection methods (signature-based, anomaly-based, hybrid) and system resource limitations influence cybersecurity performance and risk management?
- How do cost considerations, device sensitivity, and authentication practices influence the selection and implementation of threat detection methods in cybersecurity?

##### Enduring Understandings:

*Students will understand that...*

- Server computers are devices that provide one or more services to other computers (e.g., DNS, DHCP, FTP). Any computer can be a server, and in an enterprise environment servers typically have more processing power and storage than a personal computer.
- Personal computers are devices that are designed to be used by one person for work or recreational purposes (e.g., word processing, graphic design, web browsing, and media production or viewing). These include desktop, laptop, and notebook computers.
- Handheld computers (also called mobile computers or information appliances) are smaller than personal computers and run on battery power. These include tablets, smartphones, and wearable technology like smart watches.
- Embedded computers are devices that are part of a machine. Embedded devices have specific instruction sets for interfacing with the specialized components of the machine in which they are embedded. Embedded computers tend to be slower and cheaper than other computers and have minimal storage.
- Everyday devices with embedded computers are often called Internet of Things (IoT) devices. Embedded computers are found in transportation (e.g., cars, trains, and airplanes), devices that operate critical infrastructure (e.g., operating circuit breakers at electrical substations and pumps at water treatment plants), medical equipment (e.g., IV pumps, MRI scanners, pacemakers, and insulin pumps), and everyday devices like washing machines, coffee makers, and thermostats.

- Malware is often used as a tool to accomplish part of an adversary's plan to achieve their ultimate goal(s). There are many types of malware.
- Devices with unpatched software are vulnerable to these exploits, which could allow an adversary to crash a system, view user actions, enable or disable various services or components on the device, such as turning on a webcam or microphone, or even take control of the device to issue commands to steal or destroy information on the device.
- Adversaries can take advantage of weak authentication requirements by guessing a user's password or using social engineering to get a user to divulge their password.
- Adversaries can leverage open ports to connect to a device.
- Adversaries can send malicious data to devices to disrupt them or attempt to take control of them. Devices that have no firewall (or a misconfigured firewall) cannot filter out this malicious data.
- Adversaries often attempt to install malware on a device to disrupt or control it. Devices lacking anti-malware software are more vulnerable to this type of attack.
- Risk from device vulnerabilities can come from unauthorized access or malware that allows an adversary to impersonate an authorized user, remotely control a device, encrypt a device's drive to ransom the data, or wipe a device's memory, destroying data or rendering the device inoperable. The level of risk varies depending on the criticality of the device, the services the device provides, or the data it stores.
- A cryptographic hash function (also called a message digest function) is a mathematical algorithm that takes binary data of an arbitrary length, processes it according to a set of instructions, and outputs a fixed-length binary string called the hash (or checksum or message digest).
- Adversaries try to compromise hashing functions by forcing collisions in their output. If an efficient algorithm exists to force a collision for a specific hash function, then that hash function will be deprecated (no longer used in secure settings). MD5 and SHA1 are examples of deprecated hash functions.
- Password-based authentication services should not store passwords in plaintext, so that if an adversary gains access to the user:password directory they will not immediately know the passwords for all users. Instead, user passwords should be hashed and the hash stored in a database. When a user enters their password, it is hashed, and the hash is compared to the hash stored on file. If the hashes match, then the user is authenticated.
- If an adversary can compromise the password of a legitimate user, and that user's organization has not enabled MFA or other authentication protections, then the adversary can act within that organization with all the access and rights available to the user.
- Password attacks can be classified as online or offline.
- Many users reuse the same passwords (or variations of the same password) for all the services and accounts they have, despite warnings not to. When an organization's user database is stolen, the usernames, emails, and passwords are sold to adversaries or posted online. Adversaries often begin an attempt to compromise an account by trying stolen or leaked credentials for a target individual.
- Authentication mechanisms are technical controls that verify the identity of a user to ensure that only authorized users access a system. The proof the user provides to identify themselves is called a factor.
- Requiring complexity in passwords is a login setting that can be configured. When enabled, users setting a new password must include at least one character from each character set. Passwords

with characters from each character set are significantly harder for an adversary to crack than passwords that use characters from only one or two character sets.

- An acceptable use policy will describe the range of activities that are permissible, prohibited, or required by users on devices owned by an organization.
- Anti-malware software (sometimes called antivirus software) has tools to quarantine and remove malware that can corrupt, spy on, or destroy a system. Malware contains indicators that make it detectable; these indicators are called signatures.
- When vulnerabilities in operating systems and software are found, the vendor or organization that maintains the operating system software will fix it and send an update. A small update is called a patch.
- Host-based firewalls allow or deny traffic into or out of a single device. This provides an extra layer of security in case a host is connected to a compromised network.
- System processes and settings, login attempts, file download attempts, and user actions are logged by computing systems. These logs can be used to reconstruct circumstances leading up to and during a cyber incident.
- Performance is a criterion for determining a detection method. Detection tools use system memory and processing power and can impact the performance of a device. Anomaly-based detection tools use more system resources than signature-based tools. Signature-based detection is a better option for devices with less powerful system resources. Many embedded devices do not have enough system resources to run any detection tools on the device.
- Cost is a criterion for determining a detection method. Organizations that purchase detection software need to consider the cost of purchasing enough software licenses for the number of devices they need to monitor. Some organizations purchase an endpoint detection and response (EDR) service from a third-party vendor. Although these services are expensive, they provide a holistic, unified approach to threat detection for an organization's devices; they typically include a centralized alert platform for monitoring possible attacks on devices.
- Sensitivity or criticality of the device is a criterion for determining a detection method. Devices that store or process sensitive information or provide critical services are more likely to be targeted by adversaries and benefit from a hybrid-detection model to offer maximum protection, when possible.
- Online password attacks can be detected in authentication logs. A single user attempting many wrong passwords is an indicator of an online password attack. If a user:password hash database has been compromised, all the user passwords in the database should be considered insecure and all users should be forced to reset their passwords.

### **Knowledge:**

*Students will know...*

- Definitions: Server, DNS, DHCP, FTP, personal computer, desktop, laptop, handheld computer, mobile computer, tablet, smartphone, wearable technology, embedded computer, Internet of Things (IoT), malware, patch, firewall, host-based firewall, anti-malware software, signature, cryptographic hash function, hash, collision, MD5, SHA1, password-based authentication, multifactor authentication (MFA), password attack, online password attack, offline password attack, authentication factor, acceptable use policy, system logs, anomaly-based detection, signature-based detection, endpoint detection and response (EDR), performance impact, cost analysis, authentication logs.

### **Skills:**

*Students will be able to...*

- Evaluate, with and without the support of AI, the likelihood and impact of risks.
- Document, with and without the support of AI, the likelihood and impact of risks.
- Identify security controls, and explain how they mitigate risks.
- Determine layered security controls that address vulnerabilities.
- Evaluate, with and without the support of AI, the impact of protective risk management strategies.
- Implement and log mitigations with and without the support of AI.
- Determine strategies and methods to detect attacks.
- Detect and classify cyberattacks by analyzing digital evidence with and without the support of AI.

### **Computer Science Standards:**

#### **CSTA K-12 Computer Science Standards**

- 2-NI-05 Explain how physical and digital security measures protect electronic information. (P7.2)  
3A-NI-05 Give examples to illustrate how sensitive data can be affected by malware and other attacks.
- 2-NI-06 Apply multiple methods of encryption to model the secure transmission of information.
- 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
- 3A-NI-07 Compare various security measures, considering tradeoffs between the usability and security of a computing system.
- 3A-NI-08 Explain tradeoffs when selecting and implementing cybersecurity recommendations.
- 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure.
- 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
- 3A-IC-30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

#### **AP Cybersecurity Computational Thinking Practices**

- 4.1.A Identify types of computing devices.
- 4.1.B Identify the type of malware used in a cyberattack.
- 4.1.C Explain how adversaries can exploit common device vulnerabilities to cause loss, damage, disruption, or destruction.
- 4.1.D Assess and document risks from device vulnerabilities.
- 4.2.A Explain why hashes (also called hash outputs, checksums, message digests, or digests) are used to store passwords.
- 4.2.B Explain how password attacks exploit vulnerabilities.
- 4.2.C Determine the type of authentication used to verify the identity of a user.
- 4.2.D Configure login settings to make a device more secure.
- 4.3.A Identify managerial controls related to device security.
- 4.3.B Explain how anti-malware software can make a device more secure.
- 4.3.C Explain why keeping a device's operating system and software updated makes it more secure.
- 4.3.D Configure a host-based firewall.
- 4.4.A Explain how to detect attacks against devices.

- 4.4.B Determine controls for detecting attacks against a device.
- 4.4.C Evaluate the impact of a device detection method.
- 4.4.D Apply detection techniques to identify indicators of password attacks by analyzing log files.

## **Acceptable Evidence**

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessment**

- Warm-ups
- Check point assignments
- Class work
- Homework
- Exit slips
- Keep a notebook
- Current Event Reports
- Quizzes
- Canvas Quizzes
- Programming Assignments
- Unit Quiz

#### **Summative Assessment**

- Unit Test

## **Suggested learning experiences and instruction**

### **Learning Experiences:**

- AP Classroom: Personal Progress Check for Unit 4
- AP Classroom Scenario: Designing Secure Connected Farm Equipment
- AP Classroom Scenario: Configuring Authentication Settings
- AP Classroom Scenario: Analyzing Log Files for Indicators of Compromise

### **Instructional Strategies:**

- Use a presentation to demonstrate new material.
- Use PowerPoint slides to present concepts and terminology.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension related to cybersecurity concepts and practices.
- Provide additional scaffolds such as guided notes, network diagrams, templates, structured lab procedures, and step by step protocols for students who need support.
- Provide opportunities for students ready for additional challenge to apply advanced concepts, evaluate emerging threats, and design secure solutions to authentic cybersecurity problems.

### **For Language Development:**

- Create and maintain a student generated cybersecurity glossary that includes terminology, definitions, examples, and real-world applications.
- Provide opportunities for students to explain cybersecurity concepts, threats, and mitigation strategies using appropriate technical vocabulary in both written and verbal formats.
- Use graphic organizers, diagrams, and visual models to connect terminology with concepts such as network security, encryption, authentication, risk management, and incident response.
- Develop study guides with clear definitions, case studies, and opportunities to practice cybersecurity communication and analysis.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced cybersecurity topics followed by challenging extension activities.
- Allow students to engage in more rigorous investigations, simulations, and problem-solving tasks that require deeper analysis of cybersecurity threats and defenses.
- Provide opportunities for students to explore specialized areas such as ethical hacking, digital forensics, cloud security, artificial intelligence security, cryptography, or security operations.
- Encourage students to complete enrichment projects involving security assessments, threat analysis, cyber defense strategies, policy development, or research on emerging cybersecurity issues that extend the core content while maintaining alignment with course objectives.

## Central Bucks School District – Course of Study

### Unit 5: Securing Applications and Data

#### Desired Results

##### Essential Questions:

- Why is encryption critical for protecting data stored on devices and drives, and what risks arise when files remain unencrypted?
- How can weak access control settings lead to security breaches, and what strategies can organizations use to prevent these vulnerabilities?
- What is the difference between local applications and web applications, and how does this distinction impact security risks?
- Why does accepting unvalidated or unsanitized user input pose a threat to database security, and how can developers mitigate this risk?
- How do SQL injection and cross-site scripting (XSS) attacks exploit application vulnerabilities, and what are the potential consequences for confidentiality, integrity, and availability?
- What is a buffer overflow, and why does exceeding a buffer's size create opportunities for adversaries to compromise a system?
- Why do organizations classify data and implement cryptography policies, and how do these measures help meet legal and regulatory requirements?
- How do access control models like RBAC and RuBAC enforce security, and why is the principle of least privilege essential for reducing risk?
- Why is encryption necessary for secure communication, and how do symmetric and asymmetric encryption differ in terms of key management and security strength?
- How do detective controls such as log analysis, honeypots, and cryptographic hash functions help identify and respond to malicious activity in real time?

##### Enduring Understandings:

*Students will understand that...*

- An adversary can read any unencrypted files if they have access to the device or drive storing the files.
- Computers have standard users and administrative users. Administrative users have access to control system settings and can typically access any files or applications on a system. If regular users are given administrative privileges on a computer, and an adversary can compromise a user's account, then the adversary will have elevated privileges on the system.
- When access control settings are weakly configured, many users often have permission to view and sometimes even edit files on a system. Adversaries can take advantage of weak access control settings to steal or destroy files or disrupt an application.
- Applications are programs that run instructions on computers; they are executable data. Some applications run locally on a user's computer, while other applications, like web applications, run on a server and are accessed by users through a network.
- Structured Query Language (SQL) is a computer language used to request information from databases and make changes to databases or entries in databases. Applications that query a database using unvalidated or unsanitized input from users are vulnerable.
- An SQL-injection attack places SQL commands and control characters into a user-input field in an application, which can lead to a breach of confidentiality by causing the application to return



more information than it should, or a breach of integrity by modifying or deleting data in the database.

- Websites are written using Hypertext Markup Language (HTML), and many websites use JavaScript to create dynamic content on websites or web applications. Because JavaScript commands run in the browser of the user visiting the website, those commands can access sensitive data stored in the browser, such as usernames, passwords, and cryptographic keys.
- A cross-site scripting (XSS) attack injects malicious code into a website that a user's browser then executes. The malicious code can be embedded in a link the user clicks (a Type I or Reflected XSS attack), or it can be inserted onto a website through a comment field, forum post, or visitor log, which would affect any user visiting that website (a Type II or Stored XSS attack).
- When applications take user input, that input is written to a buffer. A buffer is a designated section of computer memory with a fixed size. If the amount of data the user enters exceeds the size of the buffer, it can overflow into adjacent memory locations and overwrite other parts of the computer's memory.
- A buffer overflow attack feeds more data into memory than was allotted, which can cause a system to crash or to execute code outside the scope of a program's security policy, effectively allowing the adversary to perform unauthorized actions on a computer, such as accessing, modifying, or deleting files.
- Data security risks can involve a compromise of confidentiality when unauthorized persons can access sensitive data, integrity when data can be manipulated or altered from its intended state, and availability when data can be destroyed or encrypted to prevent others from accessing it.
- Organizations implement specific security controls to comply with legal requirements based on the types of data they collect, store, process, and transmit.
- Laws and regulations can require certain types of data to be stored, transmitted, and handled according to specific rules.
- Organizations that collect regulated data will label them and have policies that comply with the legal or regulatory requirements for the safe storage, transmission, and handling of these data.
- A cryptography policy describes the acceptable encryption protocols and key parameters for an organization.
- A web application security policy outlines the requirements and parameters for testing and mitigating web application vulnerabilities in an organization.
- Access control enforces which users or applications (called subjects) can access, modify, add, or remove (called operations) which files or applications (called objects). Access control models describe how to determine which subjects have what type of access to which objects.
- Role-based access control (RBAC) assigns every subject to a role and defines which roles have which types of access to which objects.
- Rule-based access control (RuBAC) checks a set of rules to determine what type of access a subject should have for a specific object and then allows or denies types of access based on the rules. This access control model is typically layered on top of another access control model.
- The principle of least privilege is the idea that entities should be given exactly as much access as they need to perform their function and no more.
- Authorization is when an entity is granted permission to have a certain type of access to a resource. Access controls are put in place to control which users have what types of access to which data.
- Linux commands can be used to set and change file access permissions.

- The purpose of cryptography is to hide information. A cryptographic algorithm defines a process for encrypting and decrypting information. Encryption is the process of hiding the information, and decryption is the process of reversing the encryption to retrieve the original information.
- An encryption algorithm defines a process for combining the information to be encrypted with a predefined key. The information to be encrypted is called the plaintext. The output of the encryption algorithm is called the ciphertext.
- Computer-based encryption algorithms operate on binary data. The most common symmetric encryption algorithm is the Advanced Encryption Standard (AES). AES encryption is used to secure Wi-Fi transmissions, internet browsing, file encryption on disks, and hardware-level encryption on processors.
- AES is a symmetric key block cipher that encrypts data in 128-bit blocks (16 bytes). AES can operate with keys of varying lengths. Longer keys produce more secure encryption but require more time to encrypt and decrypt.
- Symmetric encryption and decryption can be performed using the command line, specialized software, or web-based tools.
- Using OpenSSL in a CLI, a user can encrypt and decrypt a file.
- Asymmetric encryption allows users to communicate securely without prearranging a shared secret key.
- Longer keys result in larger keyspaces. For binary keys, an  $n$ -bit length key has a keyspace of  $2^n$ .
- Using an application to randomly guess an  $n$ -bit length encryption key means that on average an adversary will be able to guess the correct key in  $2^n / 2$  or  $2^{n-1}$  guesses.
- Computational processing power and efficiency continue to improve, allowing software to guess keys faster. Key-length recommendations for both symmetric and asymmetric encryption algorithms are periodically increased to account for increased processing power.
- Common asymmetric encryption algorithms include RSA and elliptic curve cryptography (ECC). Asymmetric algorithms are used in many applications, including digital signatures and digital certificates.
- As with symmetric encryption, asymmetric encryption and decryption can be performed using the command line, specialized software, or web-based tools.
- Secure by design is an initiative that encourages companies to include security in all phases of product development including design. When organizations implement secure by design, security is a design principle not just a technical feature.
- When users enter input into an application, the application typically encases that input in special characters to process it. The characters that encase the user input are called control characters and include the single quote, the double quote, and the semicolon.
- Devices track and log when data are accessed and by whom. The process of recording and monitoring user activities is called accounting. Analysis of these logs can reveal malicious activity when an adversary attempts to access, copy, move, or delete data.
- Cost is a criterion in determining detective controls. Detective controls like honeypots and using hash values to check data integrity are inexpensive. Some organizations invest in third-party data loss prevention (DLP) services, which monitor data access, usage, and transmission by users throughout the organization to detect suspicious activity; DLP services provide strong detection capabilities at a higher cost.
- To operate at an effective speed, log analysis needs to be augmented with some automation. Honeypots offer near instantaneous detection capabilities.
- Cryptographic hash functions can help identify changes in a file because they are repeatable: the same input always produces the same output for a given hash function.

- SQL injection attacks can be detected by reviewing application and server logs of user input for SQL control words and symbols.
- XSS attacks can be detected by reviewing user input for suspicious tags.
- For web applications, buffer overflows can be detected by checking the amount of data the user is sending to the web application in their request.
- Directory traversal attacks can be detected by reviewing application and server logs. HTTP GET requests that include paths with sequences of ../ are indicators of an adversary attempting a directory traversal.

### **Knowledge:**

*Students will know...*

- Definitions: Adversary, unencrypted files, access control, access control settings, weak access control, executable data, local application, web application, Structured Query Language (SQL), database, unvalidated input, unsanitized input, SQL injection, control characters, cross-site scripting (XSS), Reflected XSS (Type I), Stored XSS (Type II), buffer, buffer overflow, security controls, data classification, cryptography policy, web application security policy, access control model, Role-Based Access Control (RBAC), Rule-Based Access Control (RuBAC), principle of least privilege, authorization, Linux file permissions, cryptography, encryption, decryption, encryption algorithm, plaintext, ciphertext, Advanced Encryption Standard (AES), symmetric encryption, asymmetric encryption, key length, keyspace, RSA, Elliptic Curve Cryptography (ECC), digital signature, digital certificate, OpenSSL, accounting (in cybersecurity), log analysis, honeypot, Data Loss Prevention (DLP), cryptographic hash function, directory traversal attack, HTTP GET request.

### **Skills:**

*Students will be able to...*

- Evaluate, with and without the support of AI, the likelihood and impact of risks.
- Document, with and without the support of AI, the likelihood and impact of risks.
- Evaluate, with and without the support of AI, the impact of protective risk management strategies.
- Implement and log mitigations with and without the support of AI.
- Determine layered security controls that address vulnerabilities.
- Identify security controls, and explain how they mitigate risks.
- Determine strategies and methods to detect attacks.
- Detect and classify cyberattacks by analyzing digital evidence with and without the support of AI.

### **Computer Science Standards:**

#### **CSTA K-12 Computer Science Standards**

- 2-NI-05 Explain how physical and digital security measures protect electronic information. (P7.2)
- 3A-NI-05 Give examples to illustrate how sensitive data can be affected by malware and other attacks.
- 2-NI-06 Apply multiple methods of encryption to model the secure transmission of information.
- 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
- 3A-NI-07 Compare various security measures, considering tradeoffs between the usability and security of a computing system.

- 3A-NI-08 Explain tradeoffs when selecting and implementing cybersecurity recommendations.
- 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure.
- 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
- 3A-IC-30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

### **AP Cybersecurity Computational Thinking Practices**

- 5.1.A Explain how adversaries can exploit application and file vulnerabilities to cause loss, damage, disruption, or destruction.
- 5.1.B Explain how application attacks exploit vulnerabilities.
- 5.1.C Assess and document risks from application and data vulnerabilities.
- 5.2.A Explain how the state or classification of data impacts the type and degree of security applied to that data.
- 5.2.B Identify managerial controls related to application and data security.
- 5.2.C Determine an appropriate access control model to protect applications and data.
- 5.2.D Configure access control settings on a Linux-based system.
- 5.3.A Explain how encryption can be used to protect files.
- 5.3.B Apply symmetric encryption algorithms to encrypt and decrypt data.
- 5.4.A Determine the appropriate asymmetric key to use when sending or receiving encrypted data.
- 5.4.B Explain why the length of a key impacts the security of encrypted data.
- 5.4.C Apply asymmetric encryption algorithms to encrypt and decrypt data.
- 5.5.A Identify the application security principles of secure by design and security by default.
- 5.5.B Explain how user input sanitization protects applications.
- 5.6.A Explain how to detect attacks on data.
- 5.6.B Determine controls for detecting attacks against applications or data.
- 5.6.C Evaluate the impact of a method for detecting attacks against an application or data.
- 5.6.D Identify whether a file has been altered by verifying its hash.
- 5.6.E Apply detection techniques to identify and report indicators of application attacks by analyzing log files.

### **Acceptable Evidence.**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- Warm-ups
- Check point assignments
- Class work
- Homework
- Exit slips
- Keep a notebook
- Current Event Reports
- Quizzes
- Canvas Quizzes
- Programming Assignments
- Unit Quiz

## **Summative Assessment**

- Unit Test

## **Suggested learning experiences and instruction**

### **Learning Experiences:**

- AP Classroom: Personal Progress Check for Unit 5
- AP Classroom Scenario: Protecting Sensitive Data
- AP Classroom Scenario: Sending Encrypted Messages

### **Instructional Strategies:**

- Use a presentation to demonstrate new material.
- Use PowerPoint slides to present concepts and terminology.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension related to cybersecurity concepts and practices.
- Provide additional scaffolds such as guided notes, network diagrams, templates, structured lab procedures, and step by step protocols for students who need support.
- Provide opportunities for students ready for additional challenge to apply advanced concepts, evaluate emerging threats, and design secure solutions to authentic cybersecurity problems.

### **For Language Development:**

- Create and maintain a student generated cybersecurity glossary that includes terminology, definitions, examples, and real-world applications.
- Provide opportunities for students to explain cybersecurity concepts, threats, and mitigation strategies using appropriate technical vocabulary in both written and verbal formats.
- Use graphic organizers, diagrams, and visual models to connect terminology with concepts such as network security, encryption, authentication, risk management, and incident response.
- Develop study guides with clear definitions, case studies, and opportunities to practice cybersecurity communication and analysis.

### **For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced cybersecurity topics followed by challenging extension activities.
- Allow students to engage in more rigorous investigations, simulations, and problem-solving tasks that require deeper analysis of cybersecurity threats and defenses.
- Provide opportunities for students to explore specialized areas such as ethical hacking, digital forensics, cloud security, artificial intelligence security, cryptography, or security operations.
- Encourage students to complete enrichment projects involving security assessments, threat analysis, cyber defense strategies, policy development, or research on emerging cybersecurity issues that extend the core content while maintaining alignment with course objectives.

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** AP Cybersecurity

**Date:** August 6, 2026

**Student Level:** High School

**Grade Level:** 9,10,11,12

### **Characterization of Course of Study:**

AP Cybersecurity introduces students to principles, practices, and tools used to secure digital systems. Through a combination of hands-on labs, real-world scenarios, and project-based learning, students explore foundational topics such as network security, cryptography, risk assessment, system vulnerabilities, and ethical hacking. The course emphasizes both the technical and human aspects of cybersecurity and prepares students for further study or careers in the field. Up to one credit from Computer Science courses may be used to fill the graduation requirements for mathematics.

### **Reasons for Proposed Adoption:**

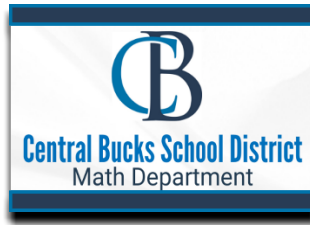
Adoption of the AP Cybersecurity Course of Study is recommended to provide a clear, consistent, and rigorous curriculum for students pursuing advanced study in computer science and cybersecurity. The course reflects the district's commitment to expanding opportunities for students in high-demand STEM fields while providing structured instruction aligned to the evolving needs of the digital world.

The proposed course of study establishes a coherent framework for teaching cybersecurity through five major units: Introduction to Security, Securing Spaces, Securing Networks, Securing Devices, and Securing Applications and Data. These units provide students with a comprehensive foundation in how cybersecurity threats emerge, how systems are protected, and how individuals and organizations make informed decisions about risk, privacy, access, detection, and response.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## Calculus 3

|                 |                                        |
|-----------------|----------------------------------------|
| Course Number:  | 2105                                   |
| Course Level:   | College Intending                      |
| Grade:          | 11 – 12                                |
| Time/Credit:    | 83 minutes daily; 18 weeks<br>1 credit |
| Revision:       | Fall 2025 – Summer 2026                |
| Board Approval: |                                        |

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## K – 12 Mathematics Program Learning Principles

### Teaching and Learning Principles:

1. Teaching mathematics for understanding requires providing experiences that stimulate students' curiosity and build confidence in investigating, problem solving, and communicating (speaking, reading, writing, representing, and listening).
2. Differentiated instruction addresses student strengths, interests, and learning styles.
3. Instruction should be appropriately paced to make the curriculum accessible to all students.
4. High expectations with strong support from teachers, parents and administrators motivate all students to achieve excellence in mathematics.
5. To create new understanding, students must be actively engaged in learning experiences designed to connect to their prior knowledge.
6. Presenting new ideas within rich and meaningful contexts helps learners to transfer and use knowledge meaningfully.
7. Making connections both within and outside of school helps learners to transfer and use knowledge meaningfully.
8. The learning process is enhanced when new ideas are presented using manipulatives, computers, calculators and real-time data collection devices.
9. Teacher collaboration and reflection enrich learning experiences for students.
10. Assessment is an ongoing process that guides instruction and monitors student progress to include mastery of mathematics content and higher level thinking skills.

### Documents Considered:

(2000). Principles and Standards for School Mathematics. Reston, VA: National Council of Teachers of Mathematics.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

## K – 12 Mathematics Program Enduring Understandings

Students will understand that:

### The Nature of Mathematics

- Mathematics is a language consisting of carefully defined terms and symbols.
- Mathematics is a tool used to make informed decisions and to solve problems in everyday life.

### Numbers and Operations

- Numbers have multiple equivalent representations.
- Numbers can be classified into various number systems.
- Calculations are performed using a predetermined order of operations.

### Measurement

- All measurements using a tool other than counting are estimates with an accepted level of error.
- All measurements consist of exactly three parts: number, unit, and precision.
- Changing a linear dimension of a figure affects the perimeter and circumference differently than it affects the area (two-dimensional shapes) and volume (three-dimensional shapes).

### Geometry

- Points, lines, and planes are the building blocks of geometry.
- Postulates, theorems, definitions, and properties are used to justify reasoning in a direct proof and to establish relationships involving two and three-dimensional figures.
- Logical thinking and critical reasoning skills are important aspects of problem solving.
- Shapes are quantified using characteristics such as dimensionality, side measures, vertices, faces, and edges, area, perimeter and volume.
- The Pythagorean theorem and trigonometric ratios are used to find missing quantities in right triangles.
- Concepts of congruency and similarity are used to relate and compare 2 and 3- dimensional figures.
- Ratios and proportions are used to model geometric similarity.

### Algebraic Concepts

- Algebraic expressions, equations, functions (linear, absolute value, quadratic, polynomial, exponential, and logarithmic), and inequalities are used to model relationships between quantities in real-world situations.
- Basic algebraic rules and properties determine how expressions are simplified and how equations are solved.
- Problems using a constant rate of change can be modeled using proportional reasoning.
- Functions are represented using: verbal models, tables, equations, and graphs.
- Systems of equations can be solved both graphically and algebraically and are used to model real-life problems.

### Data Analysis and Probability

- Data is collected, organized, and displayed as a tool for answering questions about a population.
- Interpretations and predictions are influenced by the statistical measure used to collect a set of data and by the representation that is used to display the given data.
- Probability is used to make predictions and inferences.
- Probability can be applied to geometric situations.

## K – 12 Mathematics Program Essential Questions

### The Nature of Mathematics

- Is mathematics a language?
- When is the correct solution not the answer to a problem?

### Numbers and Operations

- What is a reasonable answer?
- Why are there different number systems?
- What does it mean to be simplified?
- Is there more than one way to simplify an expression?

### Measurement

- What does it mean to be accurate?
- How do you measure?
- How does changing a dimension change a figures length, total area and volume?

### Geometry

- Why do all statements need justification?
- What is the logical progression of statements in a proof?
- How do you name a geometric figure?
- Why are points, lines, and planes so important in Euclidean geometry?
- Why are naming conventions important?
- How and when is the Pythagorean Theorem used?
- What do similarity and congruency statements tell you about polygons?

### Algebraic Concepts

- What does solve mean?
- Is your solution always the appropriate answer to a problem?
- How do expressions and equations differ?
- What makes a relationship linear?
- How can a line be used to make predictions?
- When is it necessary to use a system of equations?
- Why would you represent a function in different ways?

### Data Analysis and Probability

- What is the purpose of collecting data?
- How is data used?
- How do we make predictions based on probability?

## Central Bucks School District – Course of Study

### Calculus 3 Overview

#### Desired Results

##### 2105 Calculus 3

(18 weeks, 1 credit)

Calculus 3 will extend the concepts learned in single-variable calculus to functions of several variables and three-dimensional space. Topics will include vectors and the geometry of space, vector-valued functions, partial derivatives, and multiple integrals. Students will study vector calculus, including line and surface integrals, as well as the fundamental theorems of vector calculus, such as Green's Theorem, Stokes' Theorem, and the Divergence Theorem. Additional topics include the use of different coordinate systems (polar, cylindrical, and spherical), applications of multiple integrals, and second-order differential equations. This course parallels the third semester of most college calculus sequences and emphasizes real-world applications, mathematical reasoning, and the use of technology for visualization and problem-solving.

#### Acceptable Evidence

Final Exam: A cumulative multiple-choice exam is given at the end of the course. The final exam grade counts as 10% of the final course grade.

### Calculus 3 Pacing Guide

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Blocks    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1: Review of Single Variable Calculus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>5</b>  |
| <ul style="list-style-type: none"> <li>- The derivative of a function expresses the instantaneous rate of change of the function.</li> <li>- Rules for differentiating a function, differentiation techniques for various function types and implicit differentiation.</li> <li>- The integral of a function expresses the net change of a function over time.</li> <li>- Rules for integrating a function, integration techniques for various function types, integration by parts, tabular integration, integration by substitution.</li> <li>- Using conceptual ideas of calculus to model and explore real-world situations.</li> </ul>                                                                                                                                         | 3         |
| Remediation, enrichment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1         |
| Review and Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2         |
| <b>Unit 2: Three-Dimensional Space; Vectors (Chapter 11)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>10</b> |
| <ul style="list-style-type: none"> <li>- The geometry of three-dimensional space, representing lines and planes in three-dimensional space.</li> <li>- Constructing the equations of three-dimensional figures in space, points, lines, and planes, as well as the equations of quadric surfaces.</li> <li>- Definition of a vector and the properties of vector addition and multiplication.</li> <li>- The dot product and cross product of two vectors can be used to create orthogonal projections, determine the angle between two vectors, or create the perpendicular to the intersection of the vectors.</li> <li>- The cross product is the vector perpendicular to two given vectors, whose length is the area of the parallelogram determined by the vectors.</li> </ul> | 7         |
| Remediation, enrichment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1         |
| Review and Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2         |
| <b>Unit 3: Vector-Valued Functions (Chapter 12)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>12</b> |
| <ul style="list-style-type: none"> <li>- Use the concept and properties for determining the derivative and integral of single variable functions to determine the derivative of vector functions.</li> <li>- Use computers (graphing calculators) to draw space curves given their functions.</li> <li>- Determine the curvature and arc length of a curve.</li> <li>- Use vector functions to describe the motion of an object in space.</li> </ul>                                                                                                                                                                                                                                                                                                                                | 9         |
| Remediation, enrichment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1         |
| Review and Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2         |
| <b>Unit 4: Partial Derivatives (Chapter 13)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>12</b> |
| <ul style="list-style-type: none"> <li>- Use level curves to visualize functions of several variables.</li> <li>- Extend the ideas of implicit differentiation from single variable calculus to determine particular and partial derivatives for functions of several variables.</li> <li>- Find the limit of a multivariable function.</li> <li>- Use previous rules for differentiation, including the Chain Rule, to determine partial derivatives for functions of several variables.</li> <li>- Use fundamental concepts of limits and continuity to determine the limit and continuity for functions of several variables.</li> </ul>                                                                                                                                         | 9         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <ul style="list-style-type: none"> <li>- Determine tangent lines, planes, and linear approximations of functions of several variables.</li> <li>- Use partial derivatives to create directional derivatives and the gradient vector of a function.</li> <li>- Use partial derivatives to determine classifying characteristics of three-dimensional surfaces, including maximums, minimums, and saddle points.</li> <li>- Utilize Lagrange multipliers in addition to partial derivatives to determine classifying characteristics of three-dimensional surfaces.</li> </ul>                                                                                                                                                                                                                                                                                                          |           |
| Remediation, enrichment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1         |
| Review and Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2         |
| <b>Unit 5: Multiple Integrals (Chapter 14)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>15</b> |
| <ul style="list-style-type: none"> <li>- Extend the ideas of integration from single variable calculus to determine multiple integrals for functions of several variables.</li> <li>- Use double integrals to determine the volume of a three-dimensional shape.</li> <li>- Double integrals can be used to determine density, mass, moments, centers of mass, and probabilistic equations such as the joint density function.</li> <li>- Use iterated integrals to determine the surface area of a quadric surface.</li> <li>- The concept of multiple integrals can be extended from Cartesian coordinates to polar, cylindrical, and spherical coordinates.</li> <li>- The substitution method from single-variable calculus is extrapolated to the change-of-variables method in multiple integrals to simplify integration.</li> </ul>                                           | 12        |
| Remediation, enrichment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1         |
| Review and Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2         |
| <b>Unit 6: Topics in Vector Calculus (Chapter 15)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>20</b> |
| <ul style="list-style-type: none"> <li>- Integrating a function over a curve <math>C</math> in place of a set interval <math>[a, b]</math> produces the line integral of the function.</li> <li>- The fundamental theorem for line integrals relates a function's gradient and the integral of the function along a smooth curve. This creates the relationship that the line integral of the gradient of a function is the net change in the function.</li> <li>- Green's Theorem provides the relationship between a line integral around a simple closed curve and a double integral over the plane bounded by the curve.</li> <li>- The curl of a function is the vector field defined by the cross product of the function and its gradient.</li> <li>- The divergence of a function is the scalar field defined by the dot product of the function and its gradient.</li> </ul> | 15        |
| Remediation, enrichment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1         |
| Review and Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4         |
| <b>Unit 7: Second Order Differential Equations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>12</b> |
| <ul style="list-style-type: none"> <li>- A review of first-order differential equations, including first-order linear differential equations.</li> <li>- A second order linear differential equation is of the form <math>P(x)\left(\frac{d^2y}{dx^2}\right) + Q(x)\left(\frac{dy}{dx}\right) + R(x)y = G(x)</math> where <math>P, Q, R, G</math> are continuous functions.</li> <li>- Second-order differential equations are either homogeneous, in the case , or nonhomogeneous.</li> <li>- The method of undetermined coefficients is used to solve nonhomogeneous linear equations.</li> </ul>                                                                                                                                                                                                                                                                                   | 8         |

|                                                                                                                                                                                                                                                                                                         |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <ul style="list-style-type: none"> <li>- Second-order differential equations are used to model various real-world situations, such as vibrations of strings and electric circuits.</li> <li>- The solution to a second order differential equation can be represented as an infinite series.</li> </ul> |          |
| Remediation, enrichment                                                                                                                                                                                                                                                                                 | 1        |
| Review and Assessments                                                                                                                                                                                                                                                                                  | 3        |
| <b>Final Exam Review</b>                                                                                                                                                                                                                                                                                | <b>2</b> |
| <b>Final Exam</b>                                                                                                                                                                                                                                                                                       | <b>1</b> |

### Required and Supplementary Texts/Software

#### Required Text:

Calculus: Early Transcendentals, 12th Edition (2022), Howard Anton; Irl C. Bivens; Stephen Davis

#### Supplementary Texts/Software:

Desmos

Graphing Calculator – The graphing calculator is an essential part of this course. All students need to have access to a graphing calculator for this course.

#### Calculator Recommendation

The secondary mathematics department of Central Bucks School District recognizes the use of calculators as a valuable tool for learning in the mathematics classroom. Graphing calculators will be used daily during this course. In certain advanced courses, graphing calculators with specific capabilities are important for daily classroom performance and are required for advanced placement tests. While no specific brands are endorsed, there are restrictions on the type of calculators allowed on certain classroom tests and final exams. The teacher will use the TI-84 graphing calculator family and Desmos during instruction.

## Central Bucks School District – Course of Study

### Unit 1: Review of Single Variable Calculus

#### Desired Results

##### Essential Questions:

- What is the difference between slope and the derivative?
- How is the Fundamental Theorem of Calculus influential in the ability to solve problems?
- How do the graphs of  $f$ ,  $f'$ , and  $f''$  relate to one another?
- How is calculus used to model real-world situations?

##### Enduring Understandings:

*Students will understand that...*

- The derivative of a function expresses the instantaneous rate of change of the function.
- Rules for differentiating a function, differentiation techniques for various function types, and implicit differentiation.
- The integral of a function expresses the net change of a function over time.
- Rules for integrating a function, integration techniques for various function types, integration by parts, tabular integration, and integration by substitution.
- Using conceptual ideas of calculus to model and explore real-world situations.

##### Skills:

*Students will be able to...*

- Use a derivative as the instantaneous rate of change of a function to evaluate the slope of a function at a given value.
- Apply the rules of differentiation, including the chain rule and implicit differentiation, to derive functions.
- Use an integral as net change to determine the amount of change of a function over a specified interval.
- Construct three-dimensional shapes by revolving two-dimensional surfaces and using integration to determine the volume and surface area of the shape.
- Apply methods of integration, including substitution, integration by parts, and partial fractions, to integrate functions.

##### Standards:

###### Priority Standards

CC.2.2.HS.C.1 – Use function notation and interpret functions in context

CC.2.2.HS.C.2 – Analyze functions and multiple representations

CC.2.2.HS.C.6 – Interpret functions in context

CC.2.4.HS.B.1 – Analyze rates of change and use them to solve problems

CC.2.4.HS.B.2 – Build and refine models using functions

###### Supporting Standards

CC.2.1.HS.F.4 – Units and quantities

CC.2.2.HS.D.1–D.3 – Expression structure and manipulation

#### Acceptable Evidence

##### Acceptable Evidence

##### Performance-Based Assessments

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results



- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields
- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
- Written explanations of key theorems (e.g., Fundamental Theorem for Line Integrals, Green's Theorem) and their applications
- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

#### **Formative Assessments**

- Conceptual check-ins focusing on interpretation (not just computation)
- Error analysis of multistep calculus problems
- Peer discussion and critique of solution strategies
- Short written justifications of reasoning (e.g., existence of limits, continuity, or extrema)
- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

#### **Summative Assessments**

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

### **Suggested learning experiences and instruction**

#### **Suggested Learning Experiences and Instruction**

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations
- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations
- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts
- Incorporate error analysis and debugging of solutions, especially in multistep symbolic work

#### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.
- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds).
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

**For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.

## Central Bucks School District – Course of Study

### Unit 2: Three-Dimensional Space

#### Desired Results

##### Essential Questions:

- How can the equations of functions in three dimensions be constructed visually?
- How can we create equations for three-dimensional space?
- What are the defining characteristics for quadric surfaces and how are they determined?
- What is the right-hand rule for vectors and how does it apply in determining a solution?

##### Enduring Understandings:

*Students will understand that...*

- The geometry of three-dimensional space includes representing lines and planes in three-dimensional space.
- Constructing the equations of three-dimensional figures in space includes points, lines, and planes, as well as the equations of quadric surfaces.
- Definition of a vector and the properties of vector addition and multiplication.
- The dot product and cross product of two vectors can be used to create orthogonal projections, determine the angle between two vectors, or create the perpendicular to the intersection of the vectors.
- The cross product is the vector perpendicular to two given vectors, whose length is the area of the parallelogram determined by the vectors.

##### Skills:

*Students will be able to...*

- Determine the distance between two points in three-dimensional space.
- Use formulas for the dot product and cross product to determine missing values in a problem.
- Determine the equation for a three-dimensional object or quadric surface using defining characteristics.
- Determine the equation of a line or plane in three-dimensional space.
- Recognize that quadric surfaces are created from equations of two-dimensional conic sections.

##### Standards:

###### Priority Standards

CC.2.3.HS.A.3 – Use coordinate geometry to verify geometric relationships

CC.2.3.HS.A.5 – Apply geometric concepts in modeling situations

CC.2.3.HS.A.14 – Apply geometric concepts to real-world problems

CC.2.4.HS.B.1 – Quantitative relationships in modeling

###### Supporting Standards

CC.2.1.HS.F.2–F.4 – Quantitative reasoning and units

CC.2.2.HS.C.2 – Function representations

#### Acceptable Evidence

##### Acceptable Evidence

### **Performance-Based Assessments**

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results
- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields
- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
- Written explanations of key theorems (e.g., Fundamental Theorem for Line Integrals, Green's Theorem) and their applications
- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

### **Formative Assessments**

- Conceptual check-ins focusing on interpretation (not just computation)
- Error analysis of multistep calculus problems
- Peer discussion and critique of solution strategies
- Short written justifications of reasoning (e.g., existence of limits, continuity, or extrema)
- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

### **Summative Assessments**

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

## **Suggested learning experiences and instruction**

### **Suggested Learning Experiences and Instruction**

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations
- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations
- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts
- Incorporate error analysis and debugging of solutions, especially in multistep symbolic work

**Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.
- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds)
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

**For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.

### Unit 3: Vector-Valued Functions

#### Desired Results

##### Essential Questions:

- How are vector functions used to model motion through space?
- How are previously developed concepts of calculus applied to vector functions?
- How can vector functions be used to solve problems with real-world applications?

##### Enduring Understandings:

*Students will understand that...*

- The concepts and properties used to determine the derivative and integral of single-variable functions can be applied to determine the derivative of vector functions.
- Use computers (graphing calculators) to draw space curves given their functions.
- Determine the curvature and arc length of a curve.
- Use vector functions to describe the motion of an object in space.

##### Skills:

*Students will be able to...*

- Use rules for differentiation and integration from single-variable calculus on vector-valued functions.
- Find the tangent and normal vectors to smooth curves at a given point.
- Use algebraic operations, such as scalar multiplication, to manipulate vector functions.
- Extrapolate the formula for arc length from single-variable calculus to vector functions.
- Use the concepts of tangent and normal vectors to determine the curvature of a smooth curve.

##### Standards:

###### Priority Standards

CC.2.4.HS.B.1 – Interpret rates of change

CC.2.4.HS.B.2 – Build and use mathematical models

CC.2.2.HS.C.2 – Analyze functions across representations

###### Supporting Standards

CC.2.1.HS.F.4–F.5 – Units, precision

CC.2.2.HS.C.6 – Interpret functions in context

#### Acceptable Evidence

##### Acceptable Evidence

##### Performance-Based Assessments

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results
- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields

- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
- Written explanations of key theorems (e.g., Fundamental Theorem for Line Integrals, Green's Theorem) and their applications
- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

#### **Formative Assessments**

- Conceptual check-ins focusing on interpretation (not just computation)
- Error analysis of multistep calculus problems
- Peer discussion and critique of solution strategies
- Short written justifications of reasoning (e.g., existence of limits, continuity, or extrema)
- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

#### **Summative Assessments**

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

### **Suggested learning experiences and instruction**

#### **Suggested Learning Experiences and Instruction**

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations
- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations
- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts

#### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.

- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds).
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

**For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.



## Central Bucks School District – Course of Study

### Unit 4: Partial Derivatives

#### Desired Results

##### Essential Questions:

- What is a function of several variables?
- How do the concepts and rules of differentiation for functions of one variable extend to functions of several variables?
- How do you determine maximum, minimum, and saddle points for functions of several variables?
- What is the gradient of a function?
- How does the method of Lagrange Multipliers work?
- How can the limit of a multivariable function be shown to exist or not exist?

##### Enduring Understandings:

*Students will understand that...*

- Use level curves to visualize functions of several variables.
- Extend the ideas of implicit differentiation from single variable calculus to determine particular and partial derivatives for functions of several variables.
- Find the limit of a multivariable function.
- Use previous rules for differentiation, including the Chain Rule, to determine partial derivatives for functions of several variables.
- Use fundamental concepts of limits and continuity to determine the limit and continuity for functions of several variables.
- Determine tangent lines, planes, and linear approximations of functions of several variables.
- Use partial derivatives to create directional derivatives and the gradient vector of a function.
- Use partial derivatives to determine classifying characteristics of three-dimensional surfaces, including maximums, minimums, and saddle points.
- Utilize Lagrange multipliers in addition to partial derivatives to determine classifying characteristics of three-dimensional surfaces.

##### Skills:

*Students will be able to...*

- Sketch several levels of the curves of a function to create a visualization.
- Use a contour map to develop a rough sketch of a function of several variables.
- Use techniques of differentiation to determine tangent planes and normal lines of a given surface at a specified point or parallel to a specified direction.

##### Standards:

###### Priority Standards

CC.2.4.HS.B.1 – Analyze rates of change

CC.2.4.HS.B.2 – Build models using functions

CC.2.2.HS.C.2 – Interpret multiple representations of functions

## Supporting Standards

CC.2.1.HS.F.4 – Units and interpretation

CC.2.2.HS.C.6 – Contextual interpretation

## **Acceptable Evidence**

### **Acceptable Evidence**

#### **Performance-Based Assessments**

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results
- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields
- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
- Written explanations of key theorems (e.g., Fundamental Theorem for Line Integrals, Green's Theorem) and their applications
- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

#### **Formative Assessments**

- Conceptual check-ins focusing on interpretation (not just computation)
- Error analysis of multistep calculus problems
- Peer discussion and critique of solution strategies
- Short written justifications of reasoning (e.g., existence of limits, continuity, or extrema)
- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

#### **Summative Assessments**

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

## **Suggested learning experiences and instruction**

### **Suggested Learning Experiences and Instruction**

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations

- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations
- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts
- Incorporate error analysis and debugging of solutions, especially in multistep symbolic work

#### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.
- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds)
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

#### **For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

#### **For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.

## Central Bucks School District – Course of Study

### Unit 5: Multiple Integrals

#### Desired Results

##### Essential Questions:

- What is the definition of a multiple integral?
- How can an integral from Cartesian coordinates be converted to polar, cylindrical, or spherical coordinates?
- What are the differences between type I and type II regions?
- What are the differences among Type I, Type II, and Type III solid regions?
- How are multiple and iterated integrals applied to real-world problems?

##### Enduring Understandings:

*Students will understand that...*

- Extend the ideas of integration from single variable calculus to determine multiple integrals for functions of several variables.
- Use double integrals to determine the volume of a three-dimensional shape.
- Double integrals can be used to determine density, mass, moments, centers of mass, and probabilistic equations such as the joint density function.
- Use iterated integrals to determine the surface area of a quadric surface.
- The concept of multiple integrals can be extended from Cartesian coordinates to polar, cylindrical, and spherical coordinates.
- The substitution method from single-variable calculus is extrapolated to the change-of-variables method in multiple integrals to simplify integration.

##### Skills:

*Students will be able to...*

- When advantageous, use the ability to convert among rectangular, polar, cylindrical, and spherical coordinates to evaluate an iterated integral effectively and efficiently.
- Use iterated integrals to determine quantities, mass, density, and related measures of lamina in three-dimensional space.
- Describe the region given by a definite iterated integral and describe the volume of the solid generated by evaluating the integral.
- Use change of variables and appropriate transformations to evaluate multiple integrals.

##### Standards:

###### Priority Standards

CC.2.3.HS.A.12 – Explain and use volume formulas

CC.2.3.HS.A.13 – Analyze 2D–3D relationships

CC.2.4.HS.B.1 – Quantitative reasoning and accumulation

CC.2.4.HS.B.2 – Model real-world phenomena

## Supporting Standards

CC.2.1.HS.F.4 – Units

CC.2.2.HS.C.2 – Function representations

## **Acceptable Evidence**

### **Acceptable Evidence**

#### **Performance-Based Assessments**

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results
- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields
- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
- Written explanations of key theorems (e.g., Fundamental Theorem for Line Integrals, Green's Theorem) and their applications
- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

#### **Formative Assessments**

- Conceptual check-ins focusing on interpretation (not just computation)
- Error analysis of multistep calculus problems
- Peer discussion and critique of solution strategies
- Short written justifications of reasoning (e.g., existence of limits, continuity, or extrema)
- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

#### **Summative Assessments**

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

## **Suggested learning experiences and instruction**

### **Suggested Learning Experiences and Instruction**

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations

- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations
- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts
- Incorporate error analysis and debugging of solutions, especially in multistep symbolic work

#### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.
- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds)
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

#### **For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

#### **For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.

## Central Bucks School District – Course of Study

### Unit 6: Topics in Vector Calculus

#### Desired Results

##### Essential Questions:

- What is a vector field?
- What is the fundamental theorem for line integrals?
- What is Green's Theorem?
- What is the relationship between curl and divergence?
- What is the relationship among the Fundamental Theorem of Calculus, Fundamental Theorem for Line Integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem?

##### Enduring Understandings:

*Students will understand that...*

- Integrating a function over a curve  $C$  in place of a set interval  $[a, b]$  produces the line integral of the function.
  - The fundamental theorem for line integrals relates a function's gradient and the integral of the function along a smooth curve. This creates the relationship that the line integral of the gradient of a function is the net change in the function.
- Green's Theorem provides the relationship between a line integral around a simple closed curve and a double integral over the plane bounded by the curve.
- The curl of a function is the vector field defined by the cross product of the function and its gradient.
- The divergence of a function is the scalar field defined by the dot product of the function and its gradient.

##### Skills:

*Students will be able to...*

- Evaluate the line integral of a smooth, simple, closed plane curve of a piecewise function under basic operations.
- Evaluate the line integral of a function as applied to various geometric situations and oriented surfaces.
- Given a vector field, curve, and point, determine whether the line integral of the function is positive, negative, or zero.
- Show that  $\mathbf{F}$  is a conservative vector field and determine the function. Use a conservative vector field to evaluate a line integral.
- Use Green's Theorem, Stokes' Theorem, and the Divergence Theorem as applied to various geometric shapes and oriented surfaces.

##### Standards:

###### Priority Standards

CC.2.4.HS.B.1 – Quantitative relationships and change

CC.2.4.HS.B.2 – Mathematical modeling

CC.2.3.HS.A.5 – Geometric modeling

## Supporting Standards

CC.2.1.HS.F.4–F.5 – Units and precision

CC.2.2.HS.C.2 – Interpret functions

## **Acceptable Evidence**

### **Acceptable Evidence**

#### **Performance-Based Assessments**

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results
- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields
- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
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- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

#### **Formative Assessments**

- Conceptual check-ins focusing on interpretation (not just computation)
- Error analysis of multistep calculus problems
- Peer discussion and critique of solution strategies
- Short written justifications of reasoning (e.g., existence of limits, continuity, or extrema)
- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

#### **Summative Assessments**

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

## **Suggested learning experiences and instruction**

### **Suggested Learning Experiences and Instruction**

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations



- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations
- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts
- Incorporate error analysis and debugging of solutions, especially in multistep symbolic work

#### **Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.
- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds)
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

#### **For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

#### **For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.

## Central Bucks School District – Course of Study

### Unit 7: Second Order Differential Equations

#### Desired Results

##### Essential Questions:

- What is the general form of the auxiliary equation for a second-order differential equation?
- How do the roots of the auxiliary equations affect the form of the solution to a second-order differential equation?
- How is an initial value problem solved?
- How are power series used to solve a differential equation?

##### Enduring Understandings:

*Students will understand that...*

- A second order linear differential equation is of the form  $P(x)\left(\frac{d^2y}{dx^2}\right) + Q(x)\left(\frac{dy}{dx}\right) + R(x)y = G(x)$ , where  $P$ ,  $Q$ ,  $R$  and  $G$  are continuous functions.
- Second-order differential equations are either homogeneous, in the case , or nonhomogeneous, .
- The methods of undetermined coefficients and variation of parameters are used to solve nonhomogeneous linear equations.
- Second-order differential equations are used to model various real-world situations, such as vibrations of strings and electric circuits.
- The solution to a second order differential equation can be represented as an infinite series.

##### Skills:

*Students will be able to...*

- Solve a second-order differential equation using an auxiliary equation, characteristic equation, or method of variation of parameters for general and specific solutions.
- Apply second-order differential equations to real-world initial value problems, such as vibration and circuits, to solve for initial and approximate values.
- Use power series to approximate variable coefficients in the general-form solution of both homogeneous and nonhomogeneous second-order differential equations.

##### Standards:

###### Priority Standards

CC.2.4.HS.B.1 – Analyze rates of change

CC.2.4.HS.B.2 – Use functions to model systems

CC.2.2.HS.C.6 – Interpret functions in context

###### Supporting Standards

CC.2.1.HS.F.4 – Units and modeling

CC.2.2.HS.C.2 – Analyze functions

## Acceptable Evidence

### Acceptable Evidence

#### Performance-Based Assessments

- Multi-step problem sets requiring symbolic, numerical, and graphical solutions
- Extended-response questions requiring justification of methods and interpretation of results
- Application problems involving physical systems (motion in space, mass/density, fluid flow, etc.)
- Technology-based explorations (Desmos, graphing calculators, 3D visualization tools) analyzing multivariable functions or vector fields
- Mathematical modeling tasks requiring formulation, solution, and interpretation of real-world scenarios
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- Projects involving visualization and analysis of surfaces, vector fields, or parametric motion

#### Formative Assessments

- Conceptual check-ins focusing on interpretation (not just computation)
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- Technology-based quick tasks (graphing level curves, vector fields, parametric motion)
- Whiteboard work emphasizing explanation of methods and results
- Exit tasks requiring synthesis of concepts (e.g., connecting geometry and calculus)

#### Summative Assessments

- Unit assessments combining:
  - Analytical computation
  - Conceptual reasoning
  - Application/modeling tasks
- Free-response problems modeled after college-level or AP-style rigor
- Cumulative assessments incorporating multiple representations (graphical, algebraic, numerical)
- Projects or investigations (e.g., optimization with constraints, flux across a surface, motion in space)

## Suggested learning experiences and instruction

### Suggested Learning Experiences and Instruction

- Engage students in inquiry-based exploration of multivariable concepts (e.g., investigating level curves before formal definitions)
- Use multiple representations (graphical, algebraic, numerical, and verbal) to deepen understanding of functions of several variables
- Incorporate 3D visualization tools (Desmos 3D, graphing calculators, dynamic geometry software) to explore surfaces, vector fields, and motion in space
- Facilitate collaborative problem-solving centered on complex, multi-step applications
- Emphasize conceptual understanding alongside procedural fluency, particularly for topics such as limits in multiple variables, gradient vectors, and integrals
- Use real-world modeling tasks involving physics, engineering, and data (e.g., center of mass, circulation, optimization under constraints)
- Promote mathematical discourse, requiring students to justify reasoning, critique peers, and explain interpretations
- Integrate technology strategically to explore concepts that are difficult to visualize analytically (e.g., curl, divergence, parametric motion)
- Scaffold instruction from geometric intuition → analytic formulation → application
- Provide opportunities for productive struggle with open-ended problems and investigations

- Use case studies or applied scenarios (e.g., fluid flow, electromagnetic fields, optimization problems) to connect abstract ideas to real-world contexts
- Incorporate error analysis and debugging of solutions, especially in multistep symbolic work

**Differentiation:**

- Work with students in flexible small groups to provide targeted intervention, reteaching, enrichment, or extension.
- Provide additional scaffolds such as guided notes, visual representations, graphing technology, structured problem-solving frameworks, and worked examples for students who need support.
- Differentiate through extension tasks (proof-based reasoning, advanced applications) and targeted support (guided problem structures, visual scaffolds)
- Provide opportunities for students ready for additional challenge to explore more complex applications, alternative solution methods, and extended modeling tasks.

**For Language Development:**

- Create and maintain a student generated glossary of Calculus III terminology, symbols, definitions, and examples.
- Provide opportunities for students to explain mathematical reasoning using appropriate academic vocabulary in both written and verbal formats.
- Use graphic organizers, visual models, and structured notetaking to connect vocabulary with concepts.
- Develop study guides with clear definitions, example problems, and opportunities to practice mathematical communication.

**For Enrichment:**

- Meet in small groups with students who are ready for enrichment to provide instruction on advanced applications of course concepts followed by challenging extension activities.
- Allow students to pursue more rigorous problem sets that require deeper analysis, proof, justification, or multiple solution approaches.
- Provide opportunities for students to investigate real world applications of multivariable calculus in fields such as physics, engineering, economics, computer graphics, and data science.
- Encourage students to complete enrichment projects.

## Appendix – Table of Contents for Teacher Resources

### Intranet Resources:

- Course of Study

### Internet Resources:

- Calculus using the TI-84: [http://education.ti.com/html/t3\\_free\\_courses/calculus84\\_online/index.html](http://education.ti.com/html/t3_free_courses/calculus84_online/index.html)
- MIT Open Courseware: <http://ocw.mit.edu/courses/mathematics/18-01-single-variable-calculus-fall-2006/>
- Wolfram Demonstrations Project: <http://demonstrations.wolfram.com/>
- Wolfram Alpha – computational search engine: [www.wolframalpha.com](http://www.wolframalpha.com)
- Mathworld: [www.mathworld.wolfram.com](http://www.mathworld.wolfram.com)
- Wolfram Online Integrator: <http://integrals.wolfram.com/index.jsp?expr=Ln%5Bx%5D&random=false>

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** Calculus 3

**Date:** August 6, 2026

**Student Level:** High School

**Grade Level:** 11, 12

**Characterization of Course of Study:**

Calculus 3 is designed for students who have successfully completed coursework in single-variable calculus and are prepared for advanced study of functions of several variables and three-dimensional space. The course includes vectors and the geometry of space, vector-valued functions, partial derivatives, multiple integrals, vector calculus, and second-order differential equations.

This course aligns with the third semester of a typical college calculus sequence and provides students with continued access to rigorous mathematics while enrolled in high school. Instruction emphasizes mathematical reasoning, problem solving, visualization, multiple representations, and appropriate use of technology to support students' readiness for postsecondary mathematics coursework.

**Reasons for Proposed Adoption:**

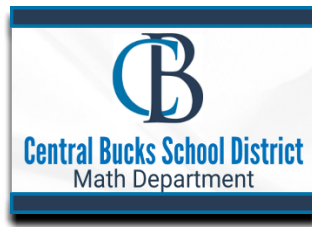
Adoption of the Calculus 3 Course of Study is recommended to provide a clear, consistent, and rigorous curriculum for students pursuing advanced mathematics beyond Calculus 2. The course reflects the district's commitment to meeting the needs of students prepared for advanced college-level mathematical study.

The course develops students' ability to analyze functions across representations, justify mathematical reasoning, use technology to model complex relationships, and apply calculus concepts to problems involving motion, geometry, optimization, density, mass, circulation, flux, and differential equations. These expectations support the district's goal of developing students who reason quantitatively, communicate mathematically, and apply mathematical models to complex situations.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## Introduction to Python

Course Number: 2000

Course Level: Standard/College Bound

Grade: 9-12

Time/Credit: 83 minutes daily: Grades 9, 10, 11, and 12  
.5 credits

Development Date: Fall 2025 - Spring 2026

Board Approval Date: \_\_\_\_\_

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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| Unit 7: Data Structures .....                                | 22  |



## **Central Bucks School District**

### **K-12 Computer Science Teaching and Learning Principles**

1. Investigating, problem-solving, and communicating about computer science (speaking, reading, writing, representing, and listening) stimulates students' curiosity, builds confidence, and leads students toward deeper conceptual understanding.
2. Lessons should address students' strengths, interests, and learning styles through differentiated instruction.
3. All students can achieve excellence in computer science when:
  - instruction is appropriately paced
  - teachers set high expectations
  - students feel supported by their teachers, parents and administrators
4. Students must be actively engaged in learning experiences designed to connect to their prior knowledge.
5. For students to transfer and use knowledge meaningfully teachers need to:
  - present new ideas within rich and meaningful contexts
  - help students to make connections to their lives both within and outside of school
6. Computer Science instruction is more effective when teachers incorporate:
  - manipulatives
  - integrated development environments, both online and device based
7. Assessment should be ongoing, diagnostic, and aligned with instruction.

#### Documents Considered:

Computer Science Teachers Association (2017). CSTA K-12 Computer Science Standards, Revised 2017. Retrieved from <http://www.csteachers.org/standards>.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press.

Marzano, R., & Pickering, D. (1997). *Dimensions of Learning*. Alexandria, VA: Association for Supervision and Curriculum Development; Aurora, CO: Mid-continent Regional Educational Laboratory.

Tomlinson, Carol Ann. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zemelman, S., Daniels, H., & Hyde, A. (1998). *Best practice: New Standards for Teaching and Learning in America's Schools*. Portsmouth, NH: Heinemann.

# **Central Bucks School District**

## **K-12 Computer Science Enduring Understandings**

**Students will understand that:**

### **Computing Systems**

- Abstractions hide the underlying implementation details of computing systems embedded in everyday objects.
- Levels of abstraction and interactions between application software, system software, and hardware layers can be compared.
- Guidelines that convey systematic troubleshooting strategies can be developed that others can use to identify and fix errors.

### **Networks and the Internet**

- There is scalability and reliability of networks, in which the relationship between routers, switches, servers, topology, and addressing can be described.
- Sensitive data can be affected by malware and other attacks.
- Security measures can address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.

### **Data and Analysis**

- There are different bit representations of real-world phenomena, such as characters, numbers, and images.
- There are tradeoffs in how data elements are organized and where data is stored.

### **Algorithms and Programming**

- Algorithms are used to solve computational problems by leveraging prior student knowledge and personal interests.
- Programmers must justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made.
- Problems can be decomposed into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- Documentation of design decisions using text, graphics, presentations, and/or demonstrations is an integral part in the development of complex programs.

### **Impacts of Computing**

- Computing affects personal, ethical, social, economic, and cultural practices.
- Computational artifacts must be tested and refined to reduce bias and equity deficits.

# **Central Bucks School District**

## **K-12 Computer Science Program Essential Questions**

### **Computing Systems**

- What is an abstraction?
- How does abstraction manage complexity?

### **Networks and the Internet**

- How do scalability and redundancy relate to reliability in the Internet?
- What is malware and how is sensitive data affected by it?
- How do efficiency, feasibility, and ethical impacts impact security measures?

### **Data and Analysis**

- What are the tradeoffs in how data elements are organized and where data is stored?
- How do we collect, visualize, and store large amounts of data?
- Why do we create computational models and how does the data we use affect those models?
- What is the purpose of creating prototypes to solve computational problems?

### **Algorithms and Programming**

- What is an algorithm?
- How do algorithms and programs differ?
- Why is the selection of specific control structures important when considering implementation, readability, and program performance?
- Why is the decomposition into smaller components in constructs such as procedures, modules, and/or objects important in the software development process?
- Why is documentation and design decisions an integral part in the development of complex programs?

### **Impacts of Computing**

- What is the purpose of collecting data?
- How is data used or abused?
- What are the ways that computing affects personal, ethical, social, economic, and cultural practices?
- Why must we test and refine computational artifacts to remove to reduce bias and equity deficits?

## Central Bucks School District Introduction to Python Overview

### Desired Results

Course Description: 2000 Introduction to Python (9 weeks, .5 credits)

Introduction to Python introduces students to the fundamentals of computer programming, with an emphasis on helping students develop logical thinking and problem-solving skills. Students begin by learning to design, code, and test their Python programs while applying mathematical concepts. Students then move to more advanced programming concepts and learn to create more powerful programs using functions, strings, data structures, file I/O operations, and objects, as time permits. Students planning to take the Advanced Placement Computer Science A Course in the future should select this course. Up to one credit from Computer Science courses may be used to fill your graduation requirements for mathematics.

**Prerequisite:** None.

**Committee Members:** Amy MacMinn, Aaron Fromal, Jenn Robinson, Matthew Quinn, Chris McGlone, Anthony Paglione, Brian Novick – Mathematics Supervisor

**Course Grading:** The final course grade is calculated as follows:

- Each marking period grade counts for 50% of the students' course grade.
- This course is an elective. There is no final exam.

## Introduction to Python Pacing Guide

| Content                                                                                                                                                                                         | Blocks   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Unit 1: Intro to Programming with Graphics</b>                                                                                                                                               | <b>8</b> |
| Introduction to Computer Science Paradigms: <ul style="list-style-type: none"> <li>Sequencing</li> <li>Selection</li> <li>Iteration</li> <li>Program Documentation</li> </ul>                   | 7        |
| Unit Assessment                                                                                                                                                                                 | 1        |
| <b>Unit 2: Introduction to Python Basics</b>                                                                                                                                                    | <b>9</b> |
| <ul style="list-style-type: none"> <li>Printing</li> <li>Variables</li> <li>User Input</li> <li>Converting Input Types</li> <li>Arithmetic Expressions</li> <li>String Operators</li> </ul>     | 8        |
| Unit Assessment                                                                                                                                                                                 | 1        |
| <b>Unit 3: Conditionals</b>                                                                                                                                                                     | <b>4</b> |
| <ul style="list-style-type: none"> <li>If Statements</li> <li>Boolean Values</li> <li>Logical Operators</li> <li>Comparison Operators</li> <li>Floating Point Numbers and “Equality”</li> </ul> | 3        |
| Unit Assessment(s)                                                                                                                                                                              | 1        |
| <b>Unit 4: Loops</b>                                                                                                                                                                            | <b>4</b> |
| <ul style="list-style-type: none"> <li>While Loops</li> <li>For Loops</li> <li>Break and Continue</li> <li>Nested Control Structures</li> </ul>                                                 | 3        |
| Unit Assessment                                                                                                                                                                                 | 1        |
| <b>Unit 5: Functions</b>                                                                                                                                                                        | <b>5</b> |
| <ul style="list-style-type: none"> <li>Functions</li> <li>Namespaces</li> <li>Parameters</li> <li>Return Values</li> <li>Exceptions</li> </ul>                                                  | 4        |
| Unit Assessment                                                                                                                                                                                 | 1        |
| <b>Unit 6: Strings</b>                                                                                                                                                                          | <b>5</b> |
| <ul style="list-style-type: none"> <li>Indexing and Slicing</li> <li>Math Operators on Strings</li> <li>For Loops Over a String</li> <li>String Methods</li> </ul>                              | 4        |
| Unit Assessment                                                                                                                                                                                 | 1        |
| <b>Unit 7: Data Structures</b>                                                                                                                                                                  | <b>5</b> |
| <ul style="list-style-type: none"> <li>Tuples</li> <li>Lists</li> <li>For Loops and Lists</li> </ul>                                                                                            | 4        |

|                                                                                                                          |           |
|--------------------------------------------------------------------------------------------------------------------------|-----------|
| • List Methods                                                                                                           |           |
| Unit Assessment                                                                                                          | 1         |
| <b>Unit 8: Artificial Intelligence (Time Permitting)</b>                                                                 | <b>5</b>  |
| <ul style="list-style-type: none"> <li>Machine Learning</li> <li>Neural Networks</li> <li>Prompt Architecture</li> </ul> | 5         |
| <b>Total Days for Course:</b>                                                                                            | <b>45</b> |

### Required and Supplementary Texts/Software

- Student Laptops
- Recommended Integrated Development Environments
  - CodeHS – Introduction to Computer Science with Python 3
  - VisualStudio for Education

## Central Bucks School District – Course of Study

### Unit 1: Introduction to Programming with Graphics

#### Desired Results

##### Essential Questions:

- How can visual programming with graphics build strong habits for problem solving and algorithm design?
- How do sequencing, loops, conditionals, and functions work together to produce meaningful visual output?
- Why are decomposition, naming, and comments important when creating programs other people can read and revise?
- How does user input make a program more interactive and flexible?

##### Enduring Understandings:

*Students will understand that...*

- Programs are precise sequences of instructions that can be combined into larger algorithms to solve problems.
- Complex problems become more manageable when they are decomposed into smaller functions or subtasks.
- Loops and conditionals allow programs to repeat actions and respond to changing conditions efficiently.
- Clear naming, comments, and visual testing support readable and maintainable code.

##### Knowledge:

*Students will know...*

- Basic graphics commands and coordinate-based movement
- The role of sequencing, selection, and iteration in visual programs
- Functions, parameters, top-down design, and decomposition
- Variables, user input, comments, and naming conventions
- Combining multiple control structures to solve larger drawing problems

##### Skills:

*Students will be able to...*

- Write Python programs that use Turtle Graphics commands to produce intended drawings.
- Use coordinates, angles, loops, and conditionals to control visual output.
- Break a larger graphics task into smaller functions with meaningful names.
- Incorporate comments and user input to improve readability and interactivity.
- Test and revise graphical programs for correctness and visual accuracy.

##### Standards:

|          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                                       |
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.                                                     |
| 3A-AP-23 | Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.                                                              |

#### Acceptable Evidence

**Acceptable evidence of learning other than Performance Tasks:****Formative Assessment**

- Warm-ups
- Check point assignments
- Read and Take Notes (RTN)
- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

**Summative Assessment**

- Unit Assessment

**Suggested learning experiences and instruction****Learning Experiences:**

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

**Instructional Strategies:**

- Emphasize the steps in problem solving and the use of algorithms.
- Emphasize the use of algorithms in problem solving.
- Emphasize the difference between a compiler and an interpreter.
- Have students compile and run a basic Python program.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

**Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

**For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

**For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.



- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 2: Introduction to Python Basics

#### Desired Results

##### Essential Questions:

- How do variables, values, and data types allow a Python program to represent information?
- How do input, processing, and output work together in a useful console program?
- Why do programmers need to understand both numeric and string operations?
- How does documentation improve the usability and readability of programs?

##### Enduring Understandings:

*Students will understand that...*

- Variables store information so a program can reuse, transform, and display data.
- Programs process user input through expressions and produce output for a purpose.
- Different data types support different operations and lead to different program behavior.
- Comments help programmers communicate intent and support debugging and revision.

##### Knowledge:

*Students will know...*

- Printing and console output
- Variables, assignment, identifiers, and data types
- User input and type conversion
- Mathematical operators, precedence, and simple computations
- String operators and string concatenation
- Comments and readable program structure

##### Skills:

*Students will be able to...*

- Write console programs that gather input and display formatted output.
- Declare, initialize, and update variables appropriately.
- Use arithmetic and string operations to solve introductory programming problems.
- Convert user input into the type needed for a computation.
- Document simple programs with appropriate comments.

##### Standards:

|          |                                                                                                                                       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.   |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. |
| 3A-AP-23 | Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.          |

#### Acceptable Evidence

##### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Warm-ups
- Check point assignments

- Read and Take Notes (RTN)
- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

#### **Summative Assessment**

- Unit Assessment

### **Suggested learning experiences and instruction**

#### **Learning Experiences:**

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

#### **Instructional Strategies:**

- Emphasize the use of algorithms in problem solving.
- Have students enter, compile, and run simple Python programs.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

#### **Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

#### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

#### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 3: Conditionals

#### Desired Results

##### Essential Questions:

- How do programs make decisions based on the data they receive?
- What is the difference between a boolean condition and the action that follows from it?
- How do comparison and logical operators help us express more complex decisions?
- Why must programmers be cautious when comparing floating-point values?

##### Enduring Understandings:

*Students will understand that...*

- Conditionals allow a program to follow different paths based on evaluated conditions.
- Boolean expressions represent true/false logic that drives program decisions.
- Logical combinations of conditions can model more realistic decision-making.
- Precision and representation affect how computers compare some numeric values.

##### Knowledge:

*Students will know...*

- Booleans and truth values
- If statements and if/else structures
- Comparison operators and logical operators
- Floating-point values, rounding, and equality concerns

##### Skills:

*Students will be able to...*

- Write conditional statements that correctly branch program flow.
- Evaluate boolean expressions and predict program behavior.
- Use comparison and logical operators to combine multiple conditions.
- Recognize and address issues that arise when comparing floating-point values.
- Revise programs to improve clarity and correctness of decision logic.

##### Standards:

|          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.                                                       |
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                                                                      |
| 3A-AP-23 | Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.                                                              |

#### Acceptable Evidence

##### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Warm-ups

- Check point assignments
- Read and Take Notes (RTN)
- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

#### **Summative Assessment**

- Unit Assessment

### **Suggested learning experiences and instruction**

#### **Learning Experiences:**

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

#### **Instructional Strategies:**

- Emphasize the use of algorithms in problem solving.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

#### **Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

#### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

#### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 4: Loops

#### Desired Results

##### Essential Questions:

- How do loops help programmers write more efficient and generalizable code?
- When is a for loop more appropriate than a while loop?
- How do break and continue affect the flow of a loop?
- Why do nested control structures increase both power and complexity in a program?

##### Enduring Understandings:

*Students will understand that...*

- Loops support efficiency by automating repeated behavior in a program.
- Different loop structures are appropriate for different programming situations.
- Loop control statements influence readability, termination, and program behavior.
- Nested control structures require careful design, testing, and tracing.

##### Knowledge:

*Students will know...*

- While loops and for loops
- Loop conditions and iteration variables
- Break and continue
- Nested loops and nested control structures
- Common loop errors such as infinite loops and incorrect boundaries

##### Skills:

*Students will be able to...*

- Write while and for loops that repeat behavior correctly.
- Trace loops to determine how many times code executes and why.
- Use break and continue strategically when appropriate.
- Combine loops with conditionals to solve more complex problems.
- Debug loop logic and refine code for readability and correctness.

##### Standards:

|          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.                                                     |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                                                                      |
| 3A-AP-23 | Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.                                                              |

#### Acceptable Evidence

##### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Warm-ups

- Check point assignments
- Read and Take Notes (RTN)
- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

### **Summative Assessment**

- Unit Assessment

## **Suggested learning experiences and instruction**

### **Learning Experiences:**

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

### **Instructional Strategies:**

- Emphasize the use of algorithms in problem solving.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

### **Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 5: Functions

#### Desired Results

##### Essential Questions:

- How do functions help programmers organize, reuse, and test code?
- What is the relationship among parameters, local scope, and return values?
- Why is decomposition essential when programs become larger or more complex?
- How do exceptions reveal assumptions and possible failure points in a program?

##### Enduring Understandings:

*Students will understand that...*

- Functions allow programmers to group related steps into reusable units.
- Parameters and return values define the input-output behavior of a function.
- Scope affects which variables are available in different parts of a program.
- Exceptions and errors are opportunities to test assumptions and improve reliability.

##### Knowledge:

*Students will know...*

- Function definitions and calls
- Parameters, arguments, and return values
- Local scope and namespaces
- Exceptions and common runtime errors

##### Skills:

*Students will be able to...*

- Define and call functions with and without parameters.
- Write functions that return useful values to other parts of a program.
- Explain the role of scope in function behavior.
- Break larger problems into smaller functional components.
- Interpret and respond to exception messages while debugging.

##### Standards:

|          |                                                                                                                                       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                  |
| 3A-AP-23 | Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.          |

#### Acceptable Evidence

##### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Warm-ups
- Check point assignments
- Read and Take Notes (RTN)



- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

#### **Summative Assessment**

- Unit Assessment

### **Suggested learning experiences and instruction**

#### **Learning Experiences:**

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

#### **Instructional Strategies:**

- Emphasize the use of algorithms in problem solving.
- Emphasize the importance of testing every function within a program.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

#### **Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

#### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

#### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 6: Strings

#### Desired Results

##### Essential Questions:

- How can strings be treated as structured data rather than just plain text?
- How do indexing and slicing help programmers extract and transform information?
- What does it mean for strings to be immutable, and why does that matter?
- How can loops and methods support efficient string processing?

##### Enduring Understandings:

*Students will understand that...*

- Strings are sequences of characters that can be inspected, traversed, and manipulated systematically.
- Indexing and slicing allow programmers to access specific portions of text precisely.
- Immutability affects how strings are updated and used in programs.
- Built-in methods and loops support powerful text-processing solutions.

##### Knowledge:

*Students will know...*

- String indexing and slicing
- Immutability
- Traversing strings with for loops
- Membership testing with the in keyword
- Common string methods and formatting ideas

##### Skills:

*Students will be able to...*

- Access and manipulate characters and substrings using indices and slices.
- Use loops to examine and process text one character at a time.
- Apply string methods to clean, transform, or analyze text.
- Explain the implications of string immutability in program design.
- Build programs that solve text-based problems accurately and efficiently.

##### Standards:

|          |                                                                                                                                       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-13 | Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.   |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. |
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                                  |

#### Acceptable Evidence

##### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Warm-ups
- Check point assignments
- Read and Take Notes (RTN)

- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

#### **Summative Assessment**

- Unit Assessment

### **Suggested learning experiences and instruction**

#### **Learning Experiences:**

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

#### **Instructional Strategies:**

- Emphasize the use of algorithms in problem solving.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

#### **Differentiation:**

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

#### **For Language Development:**

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

#### **For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

## Central Bucks School District – Course of Study

### Unit 7: Data Structures

#### Desired Results

##### Essential Questions:

- How do data structures help programmers manage larger collections of information?
- When should a programmer use a tuple, list, 2D list, or dictionary?
- How do traversal, list methods, and comprehensions simplify data processing?
- How does a culminating project demonstrate planning, testing, debugging, and revision across multiple course concepts?

##### Enduring Understandings:

*Students will understand that...*

- Data structures organize information so programs can store, retrieve, and update data efficiently.
- Different data structures are useful for different tasks and design goals.
- Traversing and transforming collections is a foundational skill in programming.
- A complete computational artifact emerges through iterative development, testing, and refinement.

##### Knowledge:

*Students will know...*

- Tuples and lists
- List methods and list traversal
- 2D lists and nested iteration
- List comprehensions
- Packing, unpacking, and mutability concepts
- Dictionaries and key-value organization
- Equivalence vs. identity
- Project planning, debugging, testing, and revision practices

##### Skills:

*Students will be able to...*

- Create and modify lists and tuples appropriately.
- Traverse collections with loops to analyze or transform stored data.
- Use list methods and comprehensions to simplify code.
- Work with 2D lists and dictionaries to represent more complex information.
- Explain the difference between equivalence and identity in Python.
- Design, build, test, and refine a culminating Python project that integrates course concepts.

##### Standards:

|          |                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-14 | Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.                                                                        |
| 3A-AP-15 | Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. |
| 3A-AP-17 | Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.                                                     |

|          |                                                                                                                              |
|----------|------------------------------------------------------------------------------------------------------------------------------|
| 3A-AP-21 | Evaluate and refine computational artifacts to make them more usable and accessible.                                         |
| 3A-AP-23 | Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs. |
| 3A-DA-09 | Translate between different bit representations of real-world phenomena, such as characters, numbers, and images.            |

## Acceptable Evidence

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Warm-ups
- Check point assignments
- Read and Take Notes (RTN)
- Class work
- Homework
- Exit slips
- Keep a notebook
- Quizzes
- Programming Assignments
- Unit Quiz

#### Summative Assessment

- Unit Assessment

## Suggested learning experiences and instruction

### Learning Experiences:

- Use of projector to demonstrate new material.
- Use of Power Point slides to present concepts and terminology.

### Instructional Strategies:

- Emphasize the use of algorithms in problem solving.
- Complete teacher-generated self-review questions, multiple-choice, true/false, and short answer problems.

### Differentiation:

- Work with students in small groups to intervene or enrich as needed
- Provide additional scaffolds for emerging learners.
- Allow on level learners to modify existing code and explain their changes.
- Provide opportunities for advanced learners to add features, variables, or additional functionality.

### For Language Development:

- Create a student-made dictionary that includes terms, definitions, and examples organized by chapter.
- Make flash cards for terms and examples, then mix and match.
- Create study guides with clear definitions and vocabulary development opportunities.

**For Advanced Learners:**

- Meet in small groups with students who need enrichment to provide instruction and learning activities on the optional skills followed up by an alternative and more complex assignment.
- Excuse the students from standard practice and use appropriately challenging practice that requires students to apply the concepts in more rigorous ways to challenge their thinking and allow students to go deeper on the same skills.
- Provide more rigorous opportunities for application of skills including enrichment projects.

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** Introduction to Python

**Date:** August 6, 2026

**Student Level:** High School

**Grade Level:** 9, 10, 11, 12

**Characterization of Course of Study:**

Introduction to Python is a high school computer science elective designed for students in grades nine through twelve. The course introduces students to the fundamentals of computer programming, with emphasis on logical thinking, problem solving, algorithmic reasoning, and the design, testing, and revision of Python programs. Students begin with introductory programming concepts and graphics-based applications before progressing to variables, input and output, conditionals, loops, functions, strings, and data structures. As time permits, students may also explore introductory artificial intelligence concepts. The course provides a foundation for continued study in computer science, including Advanced Placement Computer Science A, and may be used to fulfill up to one credit of the mathematics graduation requirement through approved computer science coursework.

**Reasons for Proposed Adoption:**

Introduction to Python provides an entry point into computer science for high school students. The course supports the district's commitment to expanding access to meaningful computer science learning while strengthening students' computational thinking, mathematical reasoning, and problem-solving skills.

Students develop skills in sequencing, selection, iteration, documentation, functions, strings, and data structures as they learn to design, test, debug, and refine computational artifacts. This progression provides practical programming experience and prepares students for future coursework in computer science.

The course aligns with the K-12 Computer Science framework reflected in the district's course of study, including enduring understandings and standards related to algorithms and programming, data and analysis, abstraction, documentation, and the impact of computing. The curriculum emphasizes active learning, differentiated instruction, ongoing assessment, and opportunities for students to connect programming concepts to prior knowledge, personal interests, and real-world applications.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



# Navigate

## Course of Study



August 2026





# Introductions



**Christopher Johnson**

Social Studies K-12 Supervisor



**Victoria Ehlinger**

Secondary Staff Developer

## Leading Contributors

- Lexi Carp\*, C.B. High School East (Math)
- John Heisey\*, C.B. High School South
- Natasha Jones\*, C.B. High School West
- Dawn Marinello\*, C.B. High School South (English Lang. Arts)
- Wei-Hua Shao\*, C.B. High School East (World Language)
- Sara Yoder\*, C.B. High School East

## Reviewers

- Christie Besack, C.B. High School West
- Kevin Cawley, C.B. High School South
- Maggie Haflett, C.B. High School West
- Jay Marsden, C.B. High School South
- Christine McLaughlin, C.B. High School East
- Brian Weaver, C.B. High School West



# Goal of Presentation



**Seek approval for the course of study for Navigate, a new course in CBSD.**



**5-10 min**

# Agenda



**Background**



**Course Overview**



**Budget**



**Next Steps**

# Background



| 2023-24                                           | 2024-25                                      | Fall 2025                                  | 2025-26                                       | Summer 2026                             |
|---------------------------------------------------|----------------------------------------------|--------------------------------------------|-----------------------------------------------|-----------------------------------------|
| Anticipation<br>of Grade-<br>Level<br>Realignment | Affirmation of<br>Graduation<br>Requirements | Teacher Input<br>and Program<br>of Studies | Drafting led<br>by Soc. St.<br>and Staff Dev. | Final Drafting<br>and Board<br>Approval |

# Overview



## **Unit 1 – Connecting (Norms for the High School Community)**

- 1.1 School Systems and Institutions
- \*1.2 Communication Practices & Tools
- \*1.3 Executive Functioning
- 1.4 Brain-Based Learning
- 1.5 Digital Citizenship

## **Unit 2 – Mapping (Academic Skills for High School)**

- 2.1 Academic Reading
- 2.2 Ethics of Scholarship
- 2.3 Notetaking
- 2.4 Academic Writing
- \*2.5 Research Norms

## **Unit 3 – Pathfinding (Planning for Success After Graduation)**

- \*3.1 Resume & Job Qualifications
- \*3.2 Occupational Outlook & Career Pathways
- \*3.3 Academic Planning

The following are optional topics available to teachers based on student need and schedule constraints.

# Overview



Navigate 9 is a required course for all 9th grade students designed to empower students as they transition into high school by fostering civic engagement and responsible citizenship. This problem-based course emphasizes the skills and knowledge needed to be productive, ethical, and informed members of the school community. Students will develop teamwork, leadership, and executive functioning skills such as organization and planning. The course equips you with a strong academic foundation by emphasizing critical thinking, respectful communication, and digital citizenship, with a focus on the ethical use of technology. Students will set personal and academic goals, reflect on their strengths, and cultivate a growth mindset and resilience.

- Tier 1 universal course that supports all learners through a shared learning experience.
- Establishes common academic systems, habits, expectations, and language across buildings and content areas.
- Instruction emphasizes practical, real-world tools and repeatable systems such as planning routines, notetaking structures, professional communication, and research practices.

# Overview



| Common Summative Assessments                                                                                                                                                                                                                                                                                                                                                                         | Relevant Standards                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"><li>1. School Communication &amp; Tech Skills Choice Board (Unit 1)</li><li>2. Time Management System &amp; Reflection (Unit 1)</li><li>3. Unit 2 – Academic Research Artifact (Unit 2)</li><li>4. Academic Resume &amp; Personal Brand Reflection (Unit 3)</li><li>5. Career Pathway Investigation (Unit 3)</li><li>6. Four-Year Academic Plan (Unit 3)</li></ol> | <ul style="list-style-type: none"><li>• Reading and Writing in History and the Social Studies</li><li>• Career Education and Work</li></ul> |

# Overview



| Common Summative Assessments                                                                                                                                                                                                                    | Naviance Tasks and Common Summative Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Central Bucks School District prepares students for life after graduation through instruction and experiences aligned to PDE's Career Education and Work standards. Navigate provides opportunities to complete many Success Plan tasks.</p> | <p>Unit 1</p> <ul style="list-style-type: none"><li>• AchieveWorks Intelligences &amp; Strengths Explorer</li><li>• Choice Board Final Product &amp; Time Management System Final Product</li></ul> <p>Unit 2</p> <ul style="list-style-type: none"><li>• AchieveWorks Personality</li><li>• Artifact from Academic Research</li></ul> <p>Unit 3</p> <ul style="list-style-type: none"><li>• AchieveWorks Skills, Career Interest Finder, &amp; Career Cluster Finder</li><li>• Resume, Career Pathway Final Product, &amp; Four-Year Academic Plan Final Product</li></ul> |





# Overview

## Unit 1 Skills: Students will be able to . . .

- **Apply organizational systems** to manage materials, deadlines, and responsibilities across physical and digital environments, including binders, planners, OneDrive, and OneNote.
- **Plan and prioritize academic tasks** by using calendars and planners across classes, activities, and flexible instructional periods (e.g., Lunch and Learn or I&E).
- **Use structured notetaking strategies** (including Cornell Notes and annotation) to record, organize, review, and study information.
- **Communicate professionally with adults and peers** by composing clear, respectful emails and messages that demonstrate appropriate grammar, tone, and purpose.
- **Demonstrate active listening and speaking skills** during discussions, presentations, and collaborative work by engaging respectfully, responding thoughtfully, and contributing productively.
- **Navigate key high school systems and expectations** by locating feedback, submitting work through Canvas, and using school structures and support time effectively.
- **Use self-management and wellness strategies** (including mindfulness, stress reduction routines, and reflection) to strengthen focus, resilience, and academic engagement.

# Overview



## Unit 2 Skills: Students will be able to . . .

- **Evaluate source credibility** by examining author expertise, bias, purpose, timeliness, relevance, and usefulness.
- **Locate and use reputable print and digital sources**, including school databases, to gather relevant information for research tasks.
- **Apply structured research processes** to develop focused questions, collect evidence, and synthesize information from multiple sources.
- **Practice academic integrity** by paraphrasing, quoting, citing, and analyzing the use of digital and AI-supported tools that can be used ethically as supports for thinking.
- **Integrate evidence into writing and discussion** by selecting relevant information and explaining how it supports a claim or point of view.
- **Engage in respectful academic discourse** by listening to differing perspectives, expressing disagreement thoughtfully, and responding with evidence and reasoning.
- **Apply credibility tests** to evaluate credibility and relevance before using a source.
- **Create and format citations and a works cited page** to credit sources accurately.
- **Use Cornell Notes** to support retrieval practice, write cue questions, and compose synthesis summaries.
- **Use ethical decision-making** in scenarios involving AI-supported tools, plagiarism, and overreliance.

# Overview



## Unit 3 Skills: Students will be able to . . .

- **Identify and explain personal strengths, interests, abilities, aptitudes, achievements, values, and goals** in order to make informed academic and career-planning decisions.
- **Create and revise an academic resume** that presents education, experiences, skills, strengths, activities, and achievements for a specific audience or opportunity.
- **Develop a personal brand reflection** that explains how selected evidence communicates strengths, growth, effort, and future goals.
- **Research career pathways using reputable sources** to examine qualifications, postsecondary options, employment outlook, labor market trends, potential earnings, competition, and personal fit.
- **Compare career and postsecondary options**, including college, technical training, apprenticeships, employment, military service, entrepreneurship, and self-employment.
- **Analyze how school and community experiences**, including coursework, electives, extracurricular activities, MBIT, work-based learning, and service opportunities, support career preparation.
- **Create a realistic, balanced, and flexible four-year academic plan** that accounts for graduation requirements, prerequisites, course sequencing, workload, interests, and future goals.

# Overview



| ▼ School Systems and Institutions |                                                                         | ⊘ ▼ + ⋮ |
|-----------------------------------|-------------------------------------------------------------------------|---------|
| ⋮                                 | <a href="#">Module Introduction for School Systems and Institutions</a> | ⊘ ⋮     |
| ⋮                                 | <a href="#">School Systems and Institutions Powerpoint</a>              | ⊘ ⋮     |
| ⋮                                 | <a href="#">School Website Scavenger Hunt</a><br>30 pts                 | ⊘ ⋮     |
| ⋮                                 | <a href="#">Resources</a>                                               | ⊘ ⋮     |

| ▼ Communication Practices and Tools |                                                                                               | ⊘ ▼ + ⋮ |
|-------------------------------------|-----------------------------------------------------------------------------------------------|---------|
| ⋮                                   | <a href="#">Module Introduction for Communication Practice and Tools</a>                      | ⊘ ⋮     |
| ⋮                                   | <a href="#">Communication Practices and Tools Powerpoint</a>                                  | ⊘ ⋮     |
| ⋮                                   | <a href="#">Nearpod: Real World Communication</a>                                             | ⊘ ⋮     |
| ⋮                                   | <a href="#">Manners Powerpoint</a>                                                            | ⊘ ⋮     |
| ⋮                                   | <a href="#">1.2 Summative – School Communication &amp; Tech Skills Choice Board</a><br>12 pts | ⊘ ⋮     |
| ⋮                                   | <a href="#">Resources</a>                                                                     | ⊘ ⋮     |



# Budget



The course will use resources in which the district has already invested.

- Canvas

- Gale (as well as other databases and tools provided by our libraries)

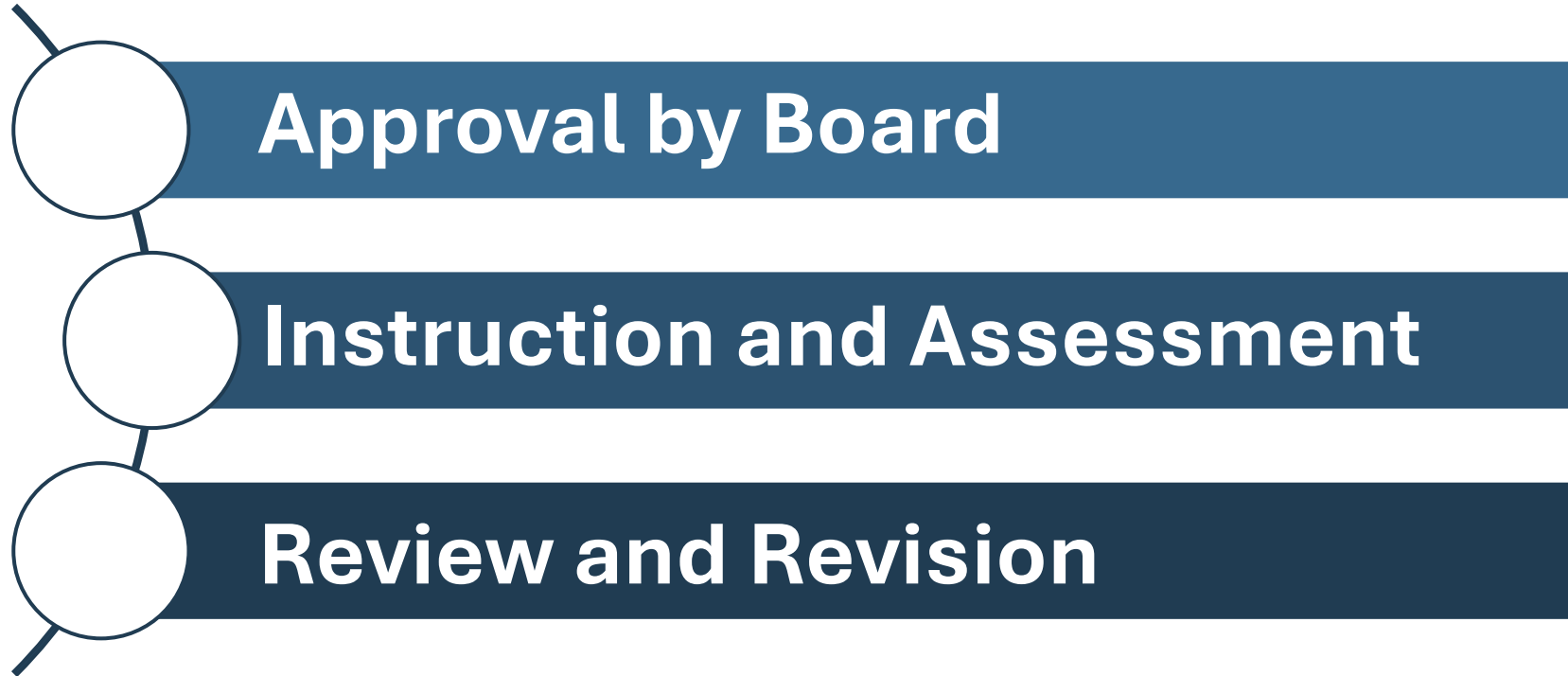
- Discovery Education

- Schools' Support Systems

There is no additional textbook or subscription for Navigate.



# Next Steps





## **Navigate**

**Course Number:** 9000 or 9000S

**Course Level:** Academic

**Grade:** 9

**Time/Credit:** 9000: Meets daily for one marking period / 0.5 Credit  
9000S: Meets every other day for one marking period for one semester/0.5 Credit

**Development Date:** 2025-26

**School Board Approval:**

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## Teaching and Learning Principles - Central Bucks School District

### Navigate

The following principles guide our teaching.

- Learning is most effective when students connect new information to prior knowledge, lived experiences, interests, strengths, and goals.
- Students benefit from active, problem-based learning.
- Technology should be an integral part of the student experience.
- Effective communication is essential for success in school, work, and community life.
- Information literacy and responsible scholarship are foundational academic skills.
- Collaboration and teambuilding support deeper learning.
- Career readiness requires students to connect self-knowledge with reliable information.
- Executive functioning, self-management, and reflection support student agency.
- Learning is most effective when instruction accommodates differences in students' prior knowledge, language development, interests, strengths, and needs.
- Assessment is an ongoing process that guides instruction and monitors growth.

These principles draw from Business Education, English Language Arts, and Social Studies courses of study.

## Enduring Understandings - Central Bucks School District

### Navigate

Students will understand that:

#### Inquiry, Evidence, and Civic Learning

1. Students use inquiry to investigate questions, solve problems, and make sense of academic, civic, career, and real-world issues.
2. Informed decisions depend on credible evidence, sound reasoning, and responsible use of sources.
3. Knowledge, communication, and responsible action help individuals and groups influence communities, institutions, and opportunities.

#### Reading, Writing, and Communication

4. Skilled readers identify central ideas, analyze structure and point of view, interpret vocabulary, and connect information across formats.
5. Effective writers develop clear claims and explanations by selecting evidence, organizing ideas for an audience, revising work, and using an appropriate tone.
6. Responsible learners use technology and AI-supported tools ethically to gather information, communicate ideas, and strengthen thinking.

#### Employability Skills and Career Readiness

7. Students build future readiness by practicing employability skills such as collaboration, communication, problem solving, technology use, and time management.
8. Career planning connects personal interests, strengths, values, and goals to realistic academic, career, and postsecondary pathways.
9. Education, training, labor markets, entrepreneurship, credentials, and community opportunities shape career and life choices.
10. Feedback, reflection, work ethic, adaptability, lifelong learning, and transferable skills help people revise plans and navigate transitions.

#### Community, Citizenship, and Interdependence

11. People participate in schools, workplaces, civic institutions, and digital spaces where rights, responsibilities, norms, and relationships shape decisions.
12. Institutions reflect their purposes, structures, functions, and participants.
13. Local, national, and global systems connect people and communities, creating both opportunities and challenges.
14. Individuals contribute to the public good by communicating respectfully, considering perspectives, collaborating, and taking informed action.

#### Growth, Identity, and Future Planning

15. Students develop agency when they understand themselves as learners, set goals, manage responsibilities, and use support systems.
16. Strong future plans are realistic, flexible, and responsive to new information, feedback, and changing circumstances.
17. Understanding the past, present conditions, and future possibilities helps people make informed choices about school, work, citizenship, and life.
18. Success beyond high school depends on continued learning, clear communication, responsible use of evidence, and transferable skills.

## Essential Questions - Central Bucks School District

### Navigate

#### Inquiry, Evidence, and Civic Learning

1. How do we ask meaningful questions and use evidence to make informed decisions?
2. How can knowledge, communication, and responsible action help people influence their communities and future opportunities?

#### Reading, Writing, and Communication

3. How do skilled readers make sense of complex information across texts, media, and formats?
4. How do writers use evidence, organization, revision, and tone to communicate clearly for a purpose and audience?
5. How can technology and AI-supported tools strengthen learning while preserving original thinking and academic integrity?

#### Employability Skills and Career Readiness

6. Which employability skills help people succeed in school, work, and community settings?
7. How do interests, strengths, values, goals, and reliable information shape career and postsecondary planning?
8. How do education, training, labor markets, entrepreneurship, and community opportunities affect career and life choices?

#### Community, Citizenship, and Interdependence

9. How do rights, responsibilities, norms, and relationships shape participation in schools, workplaces, civic institutions, and digital spaces?
10. How do institutions and systems create opportunities, challenges, and responsibilities for individuals and communities?
11. How can people contribute to the public good while considering multiple perspectives?

#### Growth, Identity, and Future Planning

12. How can students develop agency by understanding themselves as learners, setting goals, managing responsibilities, and using supports?
13. What makes a future plan realistic, flexible, and responsive to new information, feedback, and changing circumstances?
14. How do continued learning, clear communication, responsible evidence use, and transferable skills support success beyond high school?

## Course of Study Overview – Navigate

Central Bucks School District

### Desired Results

Course Description: Navigate 9 is a required course for all 9th grade students designed to empower students as they transition into high school by fostering civic engagement and responsible citizenship. This problem-based course emphasizes the skills and knowledge needed to be productive, ethical, and informed members of the school community. Students will develop teamwork, leadership, and executive functioning skills such as organization and planning. The course equips you with a strong academic foundation by emphasizing critical thinking, respectful communication, and digital citizenship, with a focus on the ethical use of technology. Students will set personal and academic goals, reflect on their strengths, and cultivate a growth mindset and resilience.

As students transition into high school, Navigate 9 serves as a Tier 1 universal course that supports all learners through a shared learning experience. The course establishes common academic systems, habits, expectations, and language across buildings and content areas. Instruction emphasizes practical, real-world tools and repeatable systems such as planning routines, notetaking structures, professional communication, and research practices. By creating transferable academic artifacts (including notes, planners, emails, and research products) students build skills and resources for use in Navigate and other high school courses.

**Prerequisite:** none

**Committee Members:** A team of Social Studies teachers drafted and reviewed this course of study. Asterisks denote teachers who participated in dedicated curriculum writing at the Educational Services Center.

- Christie Besack, C.B. High School West
- Lexi Carp\*, C.B. High School East (Math)
- Kevin Cawley, C.B. High School South
- Maggie Haflett, C.B. High School West
- John Heisey\*, Tamanend Middle School
- Natasha Jones\*, Tamanend Middle School
- Dawn Marinello\*, C.B. High School South (English Language Arts)
- Jay Marsden, C.B. High School South
- Christine McLaughlin, C.B. High School East
- Wei-Hua Shao\*, C.B. High School East (World Language)
- Brian Weaver, C.B. High School West
- Sara Yoder\*, C.B. High School East

Victoria Ehlinger (Professional Development) and Chris Johnson (Social Studies) facilitated and supported the team's work. The team used Copilot to assist with editing, formatting, and standards alignment.

## Acceptable Evidence

### Course Grading:

Because Navigate 9 supports all Grade 9 learners through a shared learning experience, grading should emphasize individual growth toward mastery of skills essential for high school success. As much as possible, teachers should assess process rather than product while following Teaching and Learning Team expectations for formative and summative assessment and gradebook composition.

### Differentiating Writing Assessments:

Promoting students' growth as academic writers is an important part of Navigate. Teachers may adjust the length and complexity of writing tasks to meet individual needs. The following table identifies common high school writing formats and can help teachers calibrate tasks for students on their roster.

Differentiation Grid for General Education Classroom (based on Webb's Depth of Knowledge)

|                                                                                             | Depth of Knowledge<br>Level 1 <i>low complexity skill</i>                            | Depth of Knowledge<br>Level 2                                                             | Depth of Knowledge<br>Level 3                                                                                             | Depth of Knowledge<br>Level 4<br><i>high complexity skill</i>                                                                                  |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                             | <b>Recall</b><br>The student recalls facts, information, procedures, or definitions. | <b>Application</b><br>The student uses information, conceptual knowledge, and procedures. | <b>Strategic Thinking</b><br>Students use reasoning and develop a plan or sequence of steps; process has some complexity. | <b>Extended Thinking</b><br>The student conducts an investigation; needs time to think and process multiple conditions of the problem or task. |
| <b>Writing Tasks</b>                                                                        |                                                                                      |                                                                                           |                                                                                                                           |                                                                                                                                                |
| Constructed Response of one or more sentences.                                              | ✓                                                                                    | ✓                                                                                         |                                                                                                                           |                                                                                                                                                |
| Constructed Response of one or more sentences featuring some advanced sentences structures. | ✓                                                                                    | ✓                                                                                         | ✓                                                                                                                         |                                                                                                                                                |
| Constructed Response of several connected sentences.                                        | ✓                                                                                    | ✓                                                                                         | ✓                                                                                                                         |                                                                                                                                                |
| Constructed Response of one or more paragraphs.                                             |                                                                                      | ✓                                                                                         | ✓                                                                                                                         | ✓                                                                                                                                              |
| Essay (four paragraphs or more in length).                                                  |                                                                                      |                                                                                           | ✓                                                                                                                         | ✓                                                                                                                                              |
| Extended essay incorporating evidence from multiple sources.                                |                                                                                      |                                                                                           | ✓                                                                                                                         | ✓                                                                                                                                              |

**Success Plan Completion**

Central Bucks School District prepares students for life after graduation through instruction and experiences aligned to PDE's Career Education and Work standards. Success Plan is the process through which students earn graduation credit while demonstrating progress toward these standards. Navigate provides opportunities to complete as many Success Plan tasks as possible, including all Grade 9 and 10 tasks. Students are expected to complete these tasks during Navigate and upload required artifacts to Naviance.

**Commented [CJ1]:** Recommendation: Set these as tasks with point values.

| Unit and Task                                            | Relevant CEW Standards                               | Required Naviance Artifacts                                                                                                                                                                                 |
|----------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| School Communication & Tech Skills Choice Board (Unit 1) | 13.2.9-12.A-E<br>13.3.9-12.C-D                       | Complete: AchieveWorks Intelligences<br>Upload: Choice Board Final Product                                                                                                                                  |
| Time Management System & Reflection (Unit 1)             | 13.2.9-12.A-E<br>13.3.9-12.C-D                       | Complete: Strengths Explorer<br>Upload: Time Management System Final Product                                                                                                                                |
| Unit 2 – Academic Research Artifact (Unit 2)             | 13.2.9-12.A-E                                        | Complete: AchieveWorks Personality<br>Upload: Artifact from Academic Research (Source Evaluation Check or Using Evidence Responsibly; teachers may also use Summary Paragraph, an optional assessment task) |
| Academic Resume & Personal Brand Reflection (Unit 3)     | 13.1.9-12.A-E<br>13.3.9-12.A-D<br>13.4.9-12.A        | Complete: Achieveworks Skills<br>Upload or Build: Resume                                                                                                                                                    |
| Career Pathway Investigation (Unit 3)                    | 13.1.9-12.A-E<br>13.3.9-12.B<br>13.4.9-12.B-D        | Complete: Career Interest Finder<br>Complete: Career Cluster Finder<br>Upload: Career Pathway Final Product                                                                                                 |
| Four-Year Academic Plan (Unit 3)                         | 13.1.9-12.A, E<br>13.3.9-12.A-B, D<br>13.4.9-12.A, D | Upload: Four-Year Academic Plan Final Product                                                                                                                                                               |

## Pacing Guide – Navigate

| Content                                                                                                                                                                                                                                                          | Time / Pacing     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>Unit 1 – Connecting</b>                                                                                                                                                                                                                                       | 3 wks (approx.)   |
| Norms for the High School Community                                                                                                                                                                                                                              |                   |
| 1.1 School Systems and Institutions                                                                                                                                                                                                                              | 2 days            |
| <b>*1.2 Communication Practices &amp; Tools</b>                                                                                                                                                                                                                  | 2 days            |
| <b>*1.3 Executive Functioning</b>                                                                                                                                                                                                                                | 3 days            |
| 1.4 Brain-Based Learning                                                                                                                                                                                                                                         | 3 days            |
| 1.5 Digital Citizenship                                                                                                                                                                                                                                          | 3 days            |
| Unit 1 intervention, enrichment, and review.                                                                                                                                                                                                                     | 1-2 days          |
| <b>*Success Plan Items uploaded into Naviance:</b> Artifact(s) from the following topics: <ul style="list-style-type: none"> <li>Communication Practices &amp; Tools</li> <li>Executive Functioning</li> </ul>                                                   |                   |
| <b>Unit 2 – Mapping</b>                                                                                                                                                                                                                                          | 4 wks (approx.)   |
| Academic Skills for High School                                                                                                                                                                                                                                  |                   |
| 2.1 Academic Reading                                                                                                                                                                                                                                             | 2 days            |
| 2.2 Ethics of Scholarship                                                                                                                                                                                                                                        | 3 days            |
| 2.3 Notetaking                                                                                                                                                                                                                                                   | 3 days            |
| 2.4 Academic Writing                                                                                                                                                                                                                                             | 3 days            |
| <b>*2.5 Research Norms</b>                                                                                                                                                                                                                                       | 3 days            |
| Unit 2 intervention, enrichment, and review.                                                                                                                                                                                                                     | 1-2 days          |
| <b>*Success Plan Items uploaded into Naviance:</b> One artifact from Research Norms                                                                                                                                                                              |                   |
| <b>Unit 3 – Pathfinding</b>                                                                                                                                                                                                                                      | 2 wks (approx.)   |
| Planning for Success After Graduation                                                                                                                                                                                                                            |                   |
| <b>*3.1 Resume &amp; Job Qualifications</b>                                                                                                                                                                                                                      | 2-3 days          |
| <b>*3.2 Occupational Outlook &amp; Career Pathways</b>                                                                                                                                                                                                           | 3 days            |
| <b>*3.3 Academic Planning</b>                                                                                                                                                                                                                                    | 2-3 days          |
| The following are optional topics. Teachers will select topics based on schedule constraints as well as students' needs and interests.                                                                                                                           |                   |
| 3.4 Guest Speakers (Career, Community and Public Service, Student Services)                                                                                                                                                                                      | 1-3 days          |
| 3.5 Odyssey Planning (Long-Term Career and Personal Life Planning)                                                                                                                                                                                               | 1-3 days          |
| 3.6 Service Learning                                                                                                                                                                                                                                             | 1-3 days          |
| 3.7 Internship/Job Search and Interview Skills                                                                                                                                                                                                                   | 1-3 days          |
| Unit 3 intervention, enrichment, and review.                                                                                                                                                                                                                     | 1-2 days          |
| <b>*Success Plan Items uploaded into Naviance:</b> Artifacts from the following topics: <ul style="list-style-type: none"> <li>Academic Resume &amp; Personal Brand Reflection</li> <li>Career Pathway Investigation</li> <li>Four-Year Academic Plan</li> </ul> |                   |
| <b>Instructional Time for the Course</b>                                                                                                                                                                                                                         | <b>39-45 days</b> |

**Commented [CJ2]:** Watch out for redundancy with 2.2 Ethics of Scholarship.

**Commented [JN3]:** Would these two topics make more sense in the Norms for the High School Community since they relate to more to etiquette and norms?

**Commented [CJ4]:** A robust facilitator guide is likely not needed for 3.1-3.3, task-oriented learning.

### NOTES:

- Modules marked with asterisks include a common summative assessment. The final product, or a checkpoint completed during the assessment, serves as a Success Plan artifact.
- Teachers will provide additional remediation in grade-level or prerequisite standards/content when students have not yet demonstrated mastery. Enrichment opportunities will be provided for students who demonstrate understanding more quickly.

## Required Texts and Software

### Student Resources

Canvas

Microsoft Office Suite of products (Word, PowerPoint, Excel, Outlook, and OneNote)

Canva

Subscription Databases through Gale and Discovery Education

Naviance

### Teacher Resources

The following resources informed this curriculum. Teachers may refer to them for content and best practices; some may also be appropriate for students.

#### College Readiness Program from Bucks County Community College

- COLL-101: [Workshops and Digital Badges | Bucks County Community College](#)
  - [Nearpod - SP Real World Communication](#)
  - [Nearpod - SP Time Management](#)
- Online Textbook: [Orientation to College for Your Success – Simple Book Publishing](#)
  - Ch. 2 Knowing Yourself as a Learner
  - Ch. 3 Managing Your Time and Priorities
  - Ch. 5 Reading and Notetaking
  - Ch. 8 Communicating
- COLL-105: Strategic Learning Seminar: [Master Course Outlines | Bucks County Community College](#)

#### Professional Development Platforms

- CASEL SEL Competencies (<https://casel.org/fundamentals-of-sel/>)
- Civic Online Reasoning (from Digital Inquiry Group): [Home | Civic Online Reasoning](#)
- Common Sense Media
  - [Lesson Browse | Common Sense Education](#)
  - [AI Literacy Lessons for Grades 6–12 | Common Sense Education](#)
- CTRL-F: [Home - CTRL-F: Digital Media Literacy](#)
- Purdue OWL Email Etiquette ([https://owl.purdue.edu/owl/general\\_writing/academic\\_writing/email\\_etiquette.html](https://owl.purdue.edu/owl/general_writing/academic_writing/email_etiquette.html))

#### Research Best Practices and Professional Development

- Purdue OWL MLA Guide ([https://owl.purdue.edu/owl/research\\_and\\_citation/mla\\_style/](https://owl.purdue.edu/owl/research_and_citation/mla_style/))
- CRAAP Test overview ([https://libguides.cmich.edu/web\\_research/craap](https://libguides.cmich.edu/web_research/craap))
- Harvard Guide to Using Sources (<https://usingsources.fas.harvard.edu/>)
- OSLIS Secondary Research at [I Need to... Learn How to Do Research — Secondary](#)

**Commented [CJ5]:** Vic-Chris: consider SRSD lite materials.



## Unit 1 – Connecting

Norms for the High School Community  
Central Bucks School District – Course of Study – Navigate

Unit 1 helps students and families understand the expectations, systems, and habits that support a successful transition into high school. Students learn to use school resources—including Canvas, Outlook, OneDrive, OneNote, planners, calendars, and flexible learning time—to manage responsibilities and advocate for themselves. The unit emphasizes practical routines for organization, time management, communication, digital citizenship, active listening, respectful disagreement, and self-management. Through realistic high school scenarios, students practice communicating clearly, making responsible decisions, reflecting on work ethic, and responding productively to challenges and feedback. Common performance tasks ask students to create transferable artifacts for use in Navigate, other high school courses, and future school or workplace settings.

### Desired Results

#### Essential Questions:

1. How can students use high school systems and supports to manage responsibilities and advocate for themselves?
2. How do organization, planning, and time management routines help students meet academic and personal responsibilities?
3. How can students communicate professionally and respectfully with adults and peers in a high school community?
4. How can students use digital tools, learning strategies, and self-management practices to grow as learners?

#### Enduring Understandings:

1. Students participate more successfully in high school when they use school systems, supports, and flexible learning time appropriately.
2. Organization, planning, prioritization, and time-management routines help students manage academic, personal, and extracurricular responsibilities.
3. Professional communication requires attention to audience, purpose, tone, etiquette, and context.
4. Responsible use of digital tools supports productivity, organization, communication, and learning.
5. Effective learners use strategies such as note-taking, retrieval practice, reflection, and self-management to improve understanding and performance.
6. Growth, resilience, and responsible decision-making help students respond productively to challenges, feedback, stress, and competing demands.

#### Students will understand that...

Successful participation in high school requires students to apply academic, organizational, and communication skills in real situations.

#### Knowledge: Students will know...

##### 1) School Systems and Institutions

- Using flexible learning time, such as Lunch and Learn or I&E, to sign up for support, prioritize tasks, and work productively.
- Canvas navigation, including locating feedback and submitting work.
- School resources, including Student Services, the library, main office, house offices, and tech help desk.
- Work and postsecondary services, including working papers, transcripts, and college application procedures.
- Basic labor laws, including workers' rights and restrictions for minors.

##### 2) \*Communication Practices and Tools

- Communicating with adults in school, including when, why, and how to ask questions, seek help, and follow up.

**Commented [CJ6]:** Don't overlook the tech. help.

**Commented [CJ7]:** Address 13.2.9-12.B "Use professional etiquette and observe social protocols when communicating verbally, nonverbally, and in writing" and 13.2.9-12.D "Use job-specific technologies to accomplish work responsibilities in a productive manner."

- Professional email writing, including audience, purpose, grammar, tone, etiquette, and context.
- Public speaking, active listening, and group discussion skills.
- Disagreeing without being disagreeable.

### 3) \*Executive Functioning

- Organization & Systems
  - Organizing binders and folders.
  - Locker logistics and general preparedness.
  - Class notebook hygiene and closing old notebooks.
  - Consistent physical and digital organization routines, including binders, folders, lockers, OneDrive, and OneNote.
- Time Management & Planning
  - Using planners, calendars, and schedules to plan across class periods, block schedules, and longer-term assignments.
  - Prioritizing tasks and allocating time across classes, activities, and flexible learning periods.

### 4) Brain-Based Learning

### 5) Digital Citizenship

- Digital organization in OneDrive and OneNote, including file hygiene and consistent systems.
- Internet etiquette and safe online behavior.
- Scenario-based discussions of academic integrity, paraphrasing, citation, and responsible use of digital and AI-supported tools.
- AI literacy, based on Common Sense Media's AI Literacy Lessons for Grades 6–12.
  - AI bias: what it is, how it happens, how it affects people, and how it can be reduced.
  - Recommendation algorithms: how they are trained, how they make decisions, and how they shape online experiences.
  - Facial recognition: what it is and the benefits and risks associated with its use.
  - Responsible decision-making when using AI-supported tools.

#### Vocabulary:

- Active Listening - Listening to understand by paying attention, avoiding interruption, asking clarifying questions, and responding thoughtfully.
- Academic Support - A school resource, person, or structure that helps students meet learning goals, complete work, or solve problems.
- Appropriate Communication - Communication that fits the audience, purpose, setting, and situation.
- Canvas - The online learning platform students use to access assignments, submit work, view feedback, and manage course expectations.
- Digital Citizenship - Responsible, respectful, safe, and ethical behavior when using digital tools, platforms, and online spaces.
- Digital Organization - Keeping digital files, folders, notes, and materials arranged so they can be found, used, revised, and submitted efficiently.
- Executive Functioning - The mental skills that help students plan, organize, start tasks, manage time, stay focused, and follow through on responsibilities.
- Feedback - Information from a teacher, peer, or self-assessment that helps a student recognize strengths, revise work, and improve.
- Flexible Learning Time - School time, such as Lunch and Learn or I & E, that students use for help, independent work, enrichment, make-up tasks, or planning.
- High School Community - The people, places, expectations, routines, and relationships that shape how students learn, communicate, and participate in school.

- Learning Strategy - A method for improving understanding, memory, focus, or performance, such as retrieval practice, annotation, or spaced review.
- OneDrive - A digital storage space where students save, organize, and access school files online.
- OneNote - A digital notebook used for taking notes, organizing class materials, and maintaining academic records.
- Planning System - A tool or method, such as a calendar, planner, checklist, task board, or reminder system, used to manage responsibilities over time.
- Professional Communication - Clear, respectful, audience-appropriate communication in school, community, or workplace settings.
- Professional Tone - Polite, clear, respectful language appropriate to the audience and purpose.
- Resilience - The ability to respond productively to challenges, stress, mistakes, feedback, or setbacks.
- Respectful Disagreement - Expressing a different opinion while listening carefully, using evidence or reasoning, and maintaining respect for others.
- Routine - A habit or repeated system students use to stay organized, prepared, and consistent.
- Self-Advocacy - Speaking up appropriately for your needs by asking questions, seeking help, communicating concerns, or using available supports.
- Self-Management - Using strategies to manage emotions, focus, behavior, time, and responsibilities in order to meet goals.
- Time Management - Planning and using time effectively by estimating how long tasks will take, setting priorities, and meeting deadlines.
- Work Ethic - The habits, effort, reliability, responsibility, and persistence a student demonstrates when completing work and pursuing goals.

*Skills: Students will be able to...*

- **Apply organizational systems** to manage materials, deadlines, and responsibilities across physical and digital environments, including binders, planners, OneDrive, and OneNote.
- **Plan and prioritize academic tasks** by using calendars and planners across classes, activities, and flexible instructional periods (e.g., Lunch and Learn or I&E).
- **Use structured notetaking strategies** (including Cornell Notes and annotation) to record, organize, review, and study information.
- **Communicate professionally with adults and peers** by composing clear, respectful emails and messages that demonstrate appropriate grammar, tone, and purpose.
- **Demonstrate active listening and speaking skills** during discussions, presentations, and collaborative work by engaging respectfully, responding thoughtfully, and contributing productively.
- **Navigate key high school systems and expectations** by locating feedback, submitting work through Canvas, and using school structures and support time effectively.
- **Use self-management and wellness strategies** (including mindfulness, stress reduction routines, and reflection) to strengthen focus, resilience, and academic engagement.

**Standards:**

*Reading and Writing in History and Social Studies*

- CC.8.5.9-10.A: Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
- CC.8.5.9-10.D: Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.
- CC.8.6.9-10.C: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CC.8.6.9-10.D: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

- CC.8.6.9-10.E: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

#### *Career Education and Work*

- 13.1.9-12.E: Utilize school- and community-based opportunities for career awareness/preparation.
- 13.1.9-12.F Examine basic labor laws to determine the rights and responsibilities of both employers and employees.
- 13.2.9-12.A: Identify solutions to existing conditions or problems using critical thinking skills.
- 13.2.9-12.B: Use professional etiquette and observe social protocols when communicating verbally, nonverbally, and in writing.
- 13.2.9-12.D: Use job-specific technologies to accomplish work responsibilities in a productive manner.
- 13.2.9-12.E: Evaluate time and project management strategies and their application to both personal and work situations.
- 13.3.9-12.D: Analyze and reflect upon the efficacy of your work ethic.

### Acceptable Evidence

#### Performance Tasks –

Two common summative assessments serve as performance tasks for unit 1. These assessments will also provide artifacts that students can upload to Naviance and submit for satisfaction of Success Plan requirements.

|                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| School Communication & Tech Skills Choice Board<br>(Module 1.2) | Students complete a choice-board project that applies school-appropriate communication and digital tools to a realistic high school scenario. Students select one role—Peer-to-Peer Mentor, Self-Advocate, or Team Leader—and create a product, such as an infographic, formal email, or structured document, that demonstrates professional etiquette in verbal, nonverbal, and written communication. The final product uses an appropriate tool, such as Canva, Outlook, or Word, and shows clear organization, respectful tone, effective design, and productive use of student-specific technologies.                   |
| Time Management System & Reflection<br>(Module 1.3)             | Students implement and document a personalized time-management system for current responsibilities across school, extracurriculars, home, work, and other commitments. Their submission includes visual evidence, such as a screenshot or photo of a digital calendar, planner, task board, whiteboard, or checklist, showing real dates, tasks, and commitments beyond class periods. Students also explain what prompted them to adopt or refine the system, how mapping commitments changed their understanding of available time, and how the system reduces mental clutter while improving work quality and efficiency. |

#### Acceptable evidence of learning other than Performance Tasks:

Formative Assessment: Modules typically include checks for understanding that may count as formative assessments.

Summative Assessment: Two common summative assessments are listed as performance tasks. Teachers may select additional summative tasks for other Unit 1 modules based on student need, interest, and schedule constraints.

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Students complete Naviance activities that help them identify learning preferences, strengths, and intelligences, including AchieveWorks Learning and Productivity, AchieveWorks Intelligences, and Strengths Explorer.
- Students explore high school systems and supports by locating key resources, practicing Canvas and Microsoft tool navigation, identifying appropriate uses of flexible learning time, and determining when and how to seek support.
- Students analyze realistic high school scenarios involving missed assignments, teacher feedback, scheduling conflicts, technology issues, collaboration, or requests for help, then select appropriate next steps and communication strategies.
- Students practice professional communication by drafting, revising, and role-playing school-appropriate emails, messages, conversations, discussion responses, and respectful disagreement for different audiences and purposes.
- Students create, test, and reflect on organization and planning routines using planners, calendars, task lists, OneDrive folders, OneNote sections, binders, or other systems to manage current academic, personal, and extracurricular responsibilities.
- Students apply brain-based learning and self-management strategies by practicing retrieval, spaced review, Cornell Notes, mindfulness, stress-reduction routines, and reflection, then identifying which strategies support their own focus, resilience, and academic growth.
- Students examine digital citizenship and AI literacy through scenarios involving academic integrity, paraphrasing, citation, safe online behavior, digital organization, AI bias, recommendation algorithms, and responsible use of digital and AI-supported tools.

**Instructional Strategies:**

- Teachers provide brief direct instruction and modeling to introduce key tools, routines, vocabulary, and expectations before students apply them in realistic tasks.
- Teachers use think-alouds and demonstrations to model processes such as planning, prioritizing, reading directions, composing a professional message, evaluating a source, or revising a product.
- Teachers use scenario-based instruction and guided inquiry to help students analyze authentic school, academic, digital, and career-planning situations before selecting appropriate next steps.
- Teachers facilitate structured discussion protocols, partner routines, and cooperative learning tasks that support active listening, respectful disagreement, shared responsibility, and evidence-based explanation.
- Teachers provide exemplars, rubrics, checklists, and success criteria so students can understand expectations, evaluate their work, and revise academic or performance-based products.
- Teachers build in formative checks, reflection routines, and feedback cycles that help students monitor progress, identify strengths and needs, revise work, and transfer strategies to other courses or contexts.

**Differentiation/Intervention/Enrichment Options:**

- Teachers provide scaffolded task directions, checklists, exemplars, and graphic organizers to help students understand expectations, plan their work, and complete multi-step products.
- Teachers offer small-group instruction, guided practice, and targeted reteaching for students who need additional support with key skills, tools, routines, or concepts.
- Teachers adjust pacing, task length, source sets, or product requirements while maintaining the core learning goal and success criteria.
- Teachers use sentence frames, word banks, discussion stems, visual models, and vocabulary supports to help students communicate ideas clearly in writing, discussion, reflection, or presentation.
- Teachers provide structured choice through choice boards, role options, product formats, or topic selections so students can demonstrate learning in ways that reflect their strengths, interests, and needs.
- Teachers offer enrichment through extension research, advanced sources, independent inquiry, leadership roles, peer mentoring, or more complex applications of unit skills to authentic school, academic, digital, or career-planning situations.

**For Language Development:**

- Teachers reinforce language development through recurring vocabulary and academic language supports, such as word banks, student-friendly definitions, glossaries, bilingual supports, translation tools, sentence frames, discussion stems, and visual vocabulary.
- Teachers may explicitly teach unit-specific academic and disciplinary terms such as the following.
  - access
  - advocate
  - allocate
  - appropriate
  - clarify
  - consistent
  - demonstrate
  - effective
  - engage
  - evaluate
  - implement
  - prioritize
  - productive
  - reflect
  - responsible

## Unit 2 – Mapping

### Academic Skills for High School Central Bucks School District – Course of Study – Navigate

Unit 2 helps students build the academic habits and information-literacy skills needed for high school success. Students read academic texts with purpose, monitor understanding, identify main ideas, claims, and evidence, and use strategies such as annotation, summarizing, and Cornell Notes to organize information for review, discussion, and writing. The unit emphasizes responsible scholarship as students ask focused research questions, locate reputable sources, evaluate credibility and relevance, and integrate evidence to support clear thinking and academic discourse. Students also practice academic integrity, citation, paraphrasing, summarizing, quoting, and analyze the ethical use of digital and AI-supported tools so technology supports original thinking rather than replacing it. Through common performance tasks connected to the Curricular Inquiry Framework, students create transferable artifacts for reading, research, writing, and responsible participation across Navigate, other high school courses, and future academic settings.

#### **Desired Results:**

##### **Essential Questions:**

1. How can students read academic texts with purpose, monitor understanding, and use evidence to support thinking?
2. How can students take and organize notes so information can be reviewed, remembered, and used effectively?
3. How can students evaluate sources for credibility, bias, timeliness, and usefulness when conducting research?
4. How can students use information, digital tools, and AI-supported tools ethically while producing clear academic writing?

##### **Enduring Understandings:**

1. Academic reading requires students to set a purpose, monitor understanding, identify claims and evidence, and use strategies when meaning breaks down.
2. Effective note-taking helps students organize information, practice retrieval, and use notes for studying, writing, and discussion.
3. Responsible researchers ask focused questions, locate reputable sources, and evaluate information for credibility, bias, timeliness, usefulness, and relevance.
4. Academic integrity requires students to quote, paraphrase, summarize, cite, and analyzing the use of digital and AI-supported tools that can be used ethically as supports for thinking.
5. Strong academic writing develops through planning, organizing, using evidence, revising, editing, and communicating ideas in a clear academic tone.
6. Learning improves when students synthesize information from multiple sources, consider different perspectives, and explain their thinking with evidence.

##### **Students will understand that...**

Successful academic work in high school requires students to think critically about information, use evidence responsibly, and engage ethically with digital tools and sources.

##### *Knowledge: Students will know...*

##### **1) Academic Reading**

- Purposes and expectations for academic reading in high school, including reading to learn, build background knowledge, use evidence, develop vocabulary, and consider perspective.
- Previewing texts and setting a purpose by using text features such as titles, headings, captions, graphs, and bolded terms.
- Active reading strategies, including annotation, chunking, pausing to summarize, and using context clues.
- Comprehension monitoring, including recognizing when meaning breaks down and using fix-up strategies such as rereading, slowing down, paraphrasing, asking for help, or using a glossary.

- Finding and recording key information, including main ideas, supporting details, claims, evidence, and notes from reading.
- Reading across high school formats, including textbook sections, articles, primary and secondary sources, directions, rubrics, charts, tables, and infographics.
- Responding to reading through evidence-based speaking, writing, and questioning.

## 2) Ethics of Scholarship

- Plagiarism and academic integrity.
- Attribution for quoting, paraphrasing, and summarizing.
- Artificial intelligence and generative AI.
- Potential impacts of generative AI.
- Responsible use of AI as a support for thinking, not a replacement.
- Integrity expectations when using AI-supported tools.
- Ethical decision-making through scenarios, guided practice with paraphrasing and citation, and responsible use of emerging technologies.

## 3) Notetaking

- Cornell Notes as a shared Navigate framework.
  - Setting up the page with a cue column, notes section, and summary.
  - Writing cue questions that support retrieval practice.
  - Writing a synthesis summary.
- Active listening and capturing key ideas during instruction.
  - Main ideas, supporting details, signal words, examples, and teacher emphasis.
  - Abbreviations, symbols, and formatting for speed and clarity.
- Notetaking from texts and media.
  - Annotation habits, including questions, connections, and key terms.
  - Paraphrasing into one's own words.
  - Recording quotes and page or paragraph numbers when needed.
- Organizing notes for retrieval.
  - Consistent titles, dates, topic labels, sections, pages, and naming conventions.
  - Connecting notes to assignments, study guides, and assessments.
- Review routines that make notes useful.
  - Quick daily or weekly review, including rereading, highlighting, and adding cues.
  - Self-quizzing from cue questions.
  - Using notes to build a study guide or practice response.

## 4) High School Academic Writing

- Clarity and academic tone.
- Organizational frameworks such as TIDE and TREE.
- Revision, editing, and polished academic writing.

## 5) \*Research Norms

- Finding sources, including topics, research questions, databases, library tools, search engines, and appropriate uses of AI in research.
- Evaluating sources, including bias, objectivity, lateral reading, and second-sourcing.
- Reading, quoting, paraphrasing, and summarizing informational nonfiction.
- Selecting and using evidence appropriately.
- Citation and Works Cited, including crediting sources, using databases or citation tools, and avoiding plagiarism.
- Academic presentation skills as an optional topic, including presentation tools, visual support, articulation, pacing, and volume.

**Commented [CJ8]:** Address 13.2.9-12.A: "Identify solutions to existing conditions or problems using critical thinking skills."



**Vocabulary:**

- Academic Integrity - Following expectations for honest scholarship by doing your own work, crediting sources, and using tools responsibly.
- Academic Reading - Reading with a purpose in order to build knowledge, identify key ideas, understand vocabulary, and use evidence.
- Academic Tone - Clear, respectful, and appropriately formal language used for school writing, discussion, and presentation.
- AI-Supported Tool - Technology that can help with brainstorming, organizing, revising, studying, or checking understanding without replacing original thinking.
- Annotation - Notes, marks, or comments added to a text to show questions, key ideas, connections, vocabulary, or evidence.
- Bias - A preference, perspective, or point of view that influences how information is selected, presented, or interpreted.
- Citation - Information that identifies where facts, ideas, words, images, or evidence came from so the source receives credit.
- Claim - A statement, answer, or position that can be supported with reasons and evidence.
- Context - The background information, situation, time, place, audience, or circumstances needed to understand a source, idea, event, or issue.
- Corroboration - Checking information against other sources to confirm, challenge, or deepen understanding.
- Credibility - The trustworthiness of a source based on factors such as author expertise, accuracy, purpose, evidence, and reputation.
- Discourse - A respectful exchange of ideas through discussion, writing, questioning, or debate.
- Ethical Use - Using information, technology, and AI-supported tools in honest, responsible ways that support learning.
- Evidence - Facts, data, examples, quotations, or details used to support a claim, explanation, or point of view.
- Lateral Reading - Leaving a source to check reliable sources for information about the author, organization, claim, or context.
- Main Idea - The central message or most important point of a text, section, paragraph, or source.
- Paraphrase - To restate information in your own words while keeping the original meaning and giving credit when needed.
- Plagiarism - Using someone else's words, ideas, images, or work without proper credit, whether intentionally or unintentionally.
- Research Question - A focused question that guides investigation and helps determine what information is needed.
- Source Evaluation - The process of judging whether a source is credible, useful, current, relevant, and appropriate for a task.
- Supporting Detail - A fact, example, reason, quotation, or explanation that helps develop or prove a main idea or claim.
- Summarize - To briefly explain the main ideas of a text or source in your own words.
- Synthesize - To combine information from multiple sources to form a clearer understanding, explanation, or conclusion.
- Timeliness - How current information is and whether its age affects its usefulness for a specific purpose.
- Works Cited - A formatted list of sources used in a project that helps others locate the original information.

*Skills: Students will be able to...*

- **Evaluate source credibility** by examining author expertise, bias, purpose, timeliness, relevance, and usefulness.
- **Locate and use reputable print and digital sources**, including school databases, to gather relevant information for research tasks.
- **Apply structured research processes** to develop focused questions, collect evidence, and synthesize information from multiple sources.

- **Practice academic integrity** by paraphrasing, quoting, citing, and using digital and AI-supported tools ethically as supports for thinking.
- **Integrate evidence into writing and discussion** by selecting relevant information and explaining how it supports a claim or point of view.
- **Engage in respectful academic discourse** by listening to differing perspectives, expressing disagreement thoughtfully, and responding with evidence and reasoning.
- **Apply the CRAAP Test or a similar tool** to evaluate credibility and relevance before using a source.
- **Create and format citations and a works cited page** to credit sources accurately.
- **Use Cornell Notes** to support retrieval practice, write cue questions, and compose synthesis summaries.
- **Use ethical decision-making** in scenarios involving AI-supported tools, plagiarism, and overreliance.

#### Standards:

##### *Reading and Writing in History and Social Studies*

- CC.8.5.9-10.A: Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
- CC.8.5.9-10.D: Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.
- CC.8.5.9-10.G: Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.
- CC.8.6.9-10.B: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- CC.8.6.9-10.F: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- CC.8.6.9-10.G: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
- CC.8.6.9-10.H: Draw evidence from informational texts to support analysis, reflection, and research.

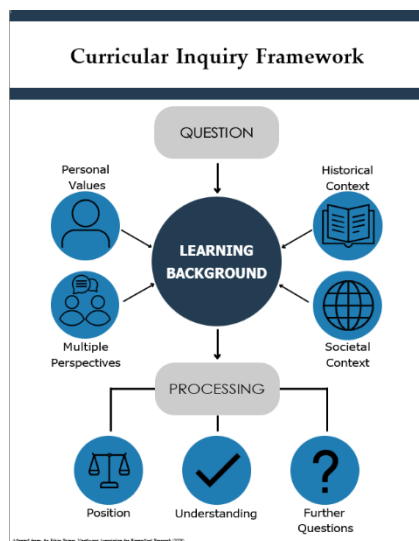
##### *Career Education and Work*

- 13.2.9-12.A: Identify solutions to existing conditions or problems using critical thinking skills.
- 13.2.9-12.C: Demonstrate shared responsibility for collaborative work and the value of contributions made by team members with various perspectives.
- 13.2.9-12.E: Evaluate time and project management strategies and their application to both personal and work situations.

#### Acceptable Evidence:

##### Performance Tasks –

Unit 2 uses the Curricular Inquiry Framework to help students practice academic reading, research, notetaking, ethical scholarship, and writing. Across the unit, students complete five module-level performance tasks connected to academic reading, ethics of scholarship, notetaking, research norms, and academic writing. These tasks ask students to build background around a teacher-provided or student-generated question, consider personal values, examine historical and societal context, account for multiple perspectives, and process learning through evidence-based writing and reflection. Students apply reading and notetaking strategies, evaluate sources, paraphrase and quote responsibly, cite information ethically, and synthesize learning by explaining their current position, developing understanding, and identifying further questions. One artifact from the Research Norms task will be uploaded to Naviance to satisfy Success Plan requirements.



#### Acceptable evidence of learning other than Performance Tasks:

Formative Assessment: Modules typically include checks for understanding that may count as formative assessments.

Summative Assessment: Modules in this unit conclude with small summative assessments. At least one will serve as a Naviance artifact for Success Plan requirements.

#### Suggested Learning Experiences and Instruction

##### Learning Experiences:

- Students complete the AchieveWorks Personality task in Naviance and reflect on how their learning preferences, habits, and strengths may influence their approach to reading, research, writing, and academic collaboration.
- Students practice academic reading strategies by previewing texts, setting a purpose for reading, annotating key ideas, identifying claims and evidence, using context clues, and applying fix-up strategies when comprehension breaks down.
- Students use Cornell Notes as a shared notetaking framework by recording main ideas and supporting details, writing cue questions, summarizing key takeaways, and using notes for retrieval practice, study guides, discussion, or written responses.
- Students examine ethical scholarship through scenarios involving plagiarism, paraphrasing, summarizing, quoting, citation, AI-supported tools, and responsible academic decision-making.

- Students conduct short research tasks using school databases, library tools, search strategies, and selected digital resources to develop focused questions, locate reputable sources, and gather relevant information.
- Students evaluate sources for credibility, bias, purpose, timeliness, usefulness, and relevance by applying tools such as the CRAAP Test, lateral reading, corroboration, and second-sourcing before using evidence in academic work.
- Students create academic writing or research artifacts that integrate evidence responsibly, explain claims clearly, use an appropriate academic tone, and include accurate attribution through citations or a Works Cited entry.

#### **Instructional Strategies:**

- Teachers provide brief direct instruction and modeling to introduce key tools, routines, vocabulary, and expectations before students apply them in realistic tasks.
- Teachers use think-alouds and demonstrations to model processes such as planning, prioritizing, reading directions, composing a professional message, evaluating a source, or revising a product.
- Teachers use scenario-based instruction and guided inquiry to help students analyze authentic school, academic, digital, and career-planning situations before selecting appropriate next steps.
- Teachers facilitate structured discussion protocols, partner routines, and cooperative learning tasks that support active listening, respectful disagreement, shared responsibility, and evidence-based explanation.
- Teachers provide exemplars, rubrics, checklists, and success criteria so students can understand expectations, evaluate their work, and revise academic or performance-based products.
- Teachers build in formative checks, reflection routines, and feedback cycles that help students monitor progress, identify strengths and needs, revise work, and transfer strategies to other courses or contexts.

#### **Differentiation/Intervention/Enrichment Options:**

- Teachers provide scaffolded task directions, checklists, exemplars, and graphic organizers to help students understand expectations, plan their work, and complete multi-step products.
- Teachers offer small-group instruction, guided practice, and targeted reteaching for students who need additional support with key skills, tools, routines, or concepts.
- Teachers adjust pacing, task length, source sets, or product requirements while maintaining the core learning goal and success criteria.
- Teachers use sentence frames, word banks, discussion stems, visual models, and vocabulary supports to help students communicate ideas clearly in writing, discussion, reflection, or presentation.
- Teachers provide structured choice through choice boards, role options, product formats, or topic selections so students can demonstrate learning in ways that reflect their strengths, interests, and needs.
- Teachers offer enrichment through extension research, advanced sources, independent inquiry, leadership roles, peer mentoring, or more complex applications of unit skills to authentic school, academic, digital, or career-planning situations.

#### **For Language Development:**

- Teachers reinforce language development through recurring vocabulary and academic language supports, such as word banks, student-friendly definitions, glossaries, bilingual supports, translation tools, sentence frames, discussion stems, and visual vocabulary.
- Teachers may explicitly teach unit-specific academic and disciplinary terms such as the following.
  - accurate
  - analyze
  - appropriate
  - clarify
  - compare
  - develop
  - determine
  - evaluate

- identify
- integrate
- relevant
- responsible
- revise
- support
- useful

## Unit 3 – Pathfinding

Planning for Success After Graduation  
Central Bucks School District – Course of Study – Navigate

Unit 3 helps students connect self-knowledge, career exploration, and academic planning to support success after graduation. Students identify interests, strengths, abilities, aptitudes, achievements, values, and goals, then use that information to develop a personal brand, create and revise an academic resume, and communicate their education, experiences, skills, and strengths for a specific audience or opportunity. Students research career pathways using reputable sources to examine qualifications, postsecondary options, employment outlook, labor market trends, potential earnings, competition, entrepreneurship, self-employment, military service, and personal fit. The unit asks students to connect research to realistic planning by considering graduation requirements, prerequisites, course sequencing, electives, extracurricular activities, MBIT, work-based learning, service opportunities, lifelong learning, and industry-recognized credentials. Students also consider how feedback, reflection, transferable skills, work ethic, and responsible decision-making help people navigate career and life transitions. Common performance tasks ask students to create transferable artifacts they can upload to Naviance and use as they continue planning for high school, postsecondary learning, work, and life transitions.

### Desired Results:

#### Essential Questions:

1. How can students use interests, strengths, abilities, aptitudes, achievements, values, and goals to plan for future opportunities?
2. How can students present their education, experiences, skills, and strengths effectively for a specific audience or opportunity?
3. How can students evaluate career pathways using reliable information about qualifications, postsecondary options, employment outlook, labor market trends, and personal fit?
4. How can students create a realistic, balanced, and flexible academic plan that connects coursework, electives, extracurricular activities, and future goals?

#### Enduring Understandings:

1. Students make stronger future plans when they understand their interests, strengths, abilities, aptitudes, achievements, values, and goals.
2. A personal brand helps students communicate their education, experiences, skills, and strengths clearly for a specific audience or opportunity.
3. Career planning requires reliable information about qualifications, postsecondary options, employment outlook, labor market trends, potential earnings, job growth, and personal fit.
4. High school coursework, electives, extracurricular activities, work-based learning, and community experiences can help students prepare for career pathways and postsecondary opportunities.
5. Academic and career plans should be realistic, balanced, flexible, and responsive to new information, feedback, and changing goals.
6. Transferable skills, lifelong learning, entrepreneurship, work ethic, and responsible decision-making help students navigate future school, career, and life transitions.

#### Students will understand that...

Planning for life after graduation requires students to understand themselves, research realistic pathways, and use that information to make flexible academic and personal decisions.

#### *Knowledge: Students will know...*

##### 1) \*Resume & Personal Brand

- Tools for identifying talents, abilities, interests, strengths, values, and goals.
- Best practices for resumes.

- Best practices for cover letters.

## 2) \*Occupational Outlook & Career Pathways

- Career and postsecondary planning.
  - Early exposure to college and career pathways, resumes, and readiness topics.
  - Pathways beyond four-year college.
  - College readiness topics such as financial aid and applications.
  - MBIT and extracurricular opportunities aligned to future goals.
- Entrepreneurship and self-employment as possible career pathways.
- Career pathways in the armed services, including service opportunities, training, education benefits, career preparation, and long-term goals.
- Connections among personal career goals, entrepreneurship, self-employment, and corporate opportunities.
- External factors that affect employment opportunities, including competition, global influences, job growth, openings, labor supply, advancement, and earnings.
- Employment outlook information organized by in-demand occupations, career clusters, pathways, or other useful categories.
- Career and life transitions that may affect employment and advancement, including layoffs, firings, resignations, promotions, evaluations, feedback, transferable skills, and adaptation to change.

## 3) \*Academic Planning

- Relationships among career choices, preparation opportunities, course selections, and postsecondary pathways.
- Sources of lifelong learning that strengthen skills and support long-term career growth.
- Using feedback and reflection to evaluate progress toward goals and determine next steps.
- Revising career or academic plans based on electives, extracurricular activities, coursework, career interests, strengths, abilities, training opportunities, work-based learning, and industry-recognized credentials.
- Shared responsibility in collaborative planning, including contributions from counselors, teachers, family members, peers, and people with different perspectives.
- Entrepreneurial mindset characteristics that apply to school, work, extracurricular activities, and future opportunities.
- Strategies for navigating career and life transitions, including loss of employment, resignation, promotion, feedback, transferable skills, and adaptation to change.
- The role of work ethic, reflection, and responsible decision-making in setting goals and adjusting academic or career plans.
- Connections among personal interests, values, strengths, aptitudes, achievements, and realistic academic or career goals.
- How a four-year academic plan can remain realistic, balanced, flexible, and responsive to changing goals, opportunities, and new information.

### Vocabulary:

- Academic Plan - A course plan that maps a student's classes, electives, and learning opportunities across high school.
- Academic Resume - A one-page document that presents a student's education, experiences, skills, strengths, activities, and achievements for a specific opportunity.
- Aptitude - A natural ability or capacity to learn or perform a skill.
- Career Cluster - A group of related careers organized by similar skills, interests, industries, or types of work.
- Career Pathway - A sequence of courses, experiences, training, and opportunities that can prepare a person for a career field.
- Career Transition - A change in employment or career direction, such as a layoff, firing, resignation, promotion, evaluation, or move to a new role.

- Credential - A certificate, license, degree, or other recognized proof that a person has completed training or demonstrated specific skills.
- Employability Skills - Workplace skills such as communication, collaboration, problem-solving, responsibility, adaptability, and professionalism.
- Employment Outlook - Information about future job demand, job growth, openings, earnings, competition, and labor market conditions for a career.
- Entrepreneurial Mindset - A way of thinking that includes initiative, creativity, problem solving, adaptability, persistence, and responsible risk-taking.
- Entrepreneurship - Creating, organizing, or operating a business or project, often by identifying opportunities and taking responsible risks.
- Four-Year Academic Plan - A student's plan for courses and learning experiences across grades 9-12, including required courses, electives, pathways, and opportunities.
- Graduation Requirement - A course, credit, assessment, or condition a student must complete in order to earn a high school diploma.
- Industry-Recognized Credential - A credential accepted by employers or industries as evidence of preparation for a specific job or career field.
- Labor Market Trends - Patterns in employment, job growth, wages, skills, competition, labor supply, and demand for workers.
- Lifelong Learning - Continuing to learn new knowledge and skills throughout life to adapt, grow, and meet changing goals or career needs.
- MBIT - Middle Bucks Institute of Technology, a career and technical education option connected to career preparation and training.
- Personal Brand - The way a student communicates strengths, values, experiences, skills, and goals to a specific audience.
- Personal Fit - The degree to which a career, pathway, or plan aligns with a student's interests, values, strengths, abilities, aptitudes, achievements, and goals.
- Postsecondary Option - A pathway after high school, such as college, technical training, apprenticeships, employment, military service, or other learning opportunities.
- Prerequisite - A course, skill, experience, or requirement that must be completed before taking another course or entering a program.
- Program of Studies - The school district resource that explains course offerings, prerequisites, pathways, credits, and graduation requirements.
- Self-Employment - Working for oneself rather than for an employer, often by owning a business, freelancing, or providing services independently.
- Transferable Skills - Skills that can be used across many courses, jobs, activities, and life situations.
- Work-Based Learning - Learning connected to real workplace experiences, such as internships, job shadowing, apprenticeships, volunteering, or career-related projects.
- Work Ethic - The habits, effort, reliability, responsibility, and persistence a person demonstrates when completing work and pursuing goals.

The following modules are optional. Teachers will use student needs, aptitudes, interests, and available time to determine which modules to address. Teachers will use 2026–27 to explore these topics and propose others.

- 4) Guest Speakers (Career, Community and Public Service, Student Services) – Teachers may arrange guest speakers to inform student decisions related to Connecting, Mapping, and Pathfinding. Teachers should follow building procedures for scheduling and approval.
- 5) Internship/Job Search and Interview Skills – Students develop skills for finding job opportunities, using available job-search resources, initiating a search, and performing well in interviews.



- 6) Odyssey Planning – Students use long-range career and life mapping to explore three possible paths for the next five years, drawing on Stanford University’s Designing Your Life program. See [The Magic of Odyssey Planning: Prototyping Three Futures - Designing Your Life](#).
- 7) Service Learning – Students explore service opportunities in school and community settings, learn what to consider when evaluating service organizations, and examine how service can support postsecondary preparation and balanced responsibilities.

*Skills: Students will be able to...*

- **Identify and explain personal strengths, interests, abilities, aptitudes, achievements, values, and goals** in order to make informed academic and career-planning decisions.
- **Create and revise an academic resume** that presents education, experiences, skills, strengths, activities, and achievements for a specific audience or opportunity.
- **Develop a personal brand reflection** that explains how selected evidence communicates strengths, growth, effort, and future goals.
- **Research career pathways using reputable sources** to examine qualifications, postsecondary options, employment outlook, labor market trends, potential earnings, competition, and personal fit.
- **Compare career and postsecondary options**, including college, technical training, apprenticeships, employment, military service, entrepreneurship, and self-employment.
- **Analyze how school and community experiences**, including coursework, electives, extracurricular activities, MBIT, work-based learning, and service opportunities, support career preparation.
- **Create a realistic, balanced, and flexible four-year academic plan** that accounts for graduation requirements, prerequisites, course sequencing, workload, interests, and future goals.
- **Use feedback and reflection** to evaluate goals, revise academic or career plans, and identify next steps.
- **Explain strategies for navigating career and life transitions**, including feedback, evaluations, promotions, resignations, layoffs, firings, transferable skills, lifelong learning, and adaptation to change.

**Standards:***Reading and Writing in History and Social Studies*

- CC.8.5.9-10.A: Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
- CC.8.6.9-10.F: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- CC.8.6.9-10.G: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
- CC.8.6.9-10.H: Draw evidence from informational texts to support analysis, reflection, and research.

*Career Education and Work*

- 13.1.9-12.A: Analyze the relationship between career choices and career preparation opportunities to choose a path.
- 13.1.9-12.B: Analyze entrepreneurship and other self-employment opportunities as they relate to personal career goals and corporate opportunities.
- 13.1.9-12.C: Analyze external factors that impact employment opportunities, such as, but not limited to: competition, global influences, job growth, job openings, labor supply, potential advancement, potential earnings.
- 13.1.9-12.D: Describe employment outlook, organized by in-demand occupations, clusters, pathways, or other methods.
- 13.1.9-12.E: Utilize school- and community-based opportunities for career awareness/preparation.
- 13.2.9-12.C: Demonstrate shared responsibility for collaborative work and the value of contributions made by team members with various perspectives.
- 13.2.9-12.F: Apply Entrepreneurial Mindset characteristics and skills to school, work, and extracurricular environments.
- 13.3.9-12.A: Develop strategies for navigating career and life transitions, such as coping with loss of employment, resigning from a job, negotiating a raise or promotion, and employing transferable skills.
- 13.3.9-12.B: Identify sources of lifelong learning to strengthen existing skills, develop new skills, and maximize career growth.
- 13.3.9-12.C: Incorporate feedback and personal reflection to evaluate success towards completing goals and determine a next course of action.
- 13.4.9-12.A: Strategically market yourself as a job candidate.
- 13.4.9-12.B: Evaluate career options based on personal interests, abilities, aptitudes, achievements, and goals.
- 13.4.9-12.C: Use a variety of methods to research careers that align with personal interests, values, strengths, and career goals.
- 13.4.9-12.D: Evolve career plan to enact additional action steps that may include, but not be limited to: electives, extracurricular activities, coursework, career interests, strengths and abilities, educational and training opportunities, work-based learning, industry-recognized credentials.

**Acceptable Evidence:****Performance Tasks –**

Three common summative assessments serve as Unit 3 performance tasks. These assessments also provide artifacts students can upload to Naviance for Success Plan requirements.

|                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Academic Resume & Personal Brand Reflection (Module 3.1) | Students create a one-page academic resume that presents their education, experiences, skills, and strengths for a specific opportunity, such as a job, club, team, or volunteer role. After brainstorming their personal brand and evidence of their strengths, students draft the resume in Naviance, revise for clarity and professionalism, and polish the design in Canva. The task concludes with a reflection explaining how the resume presents them to a specific audience, how feedback improved the work, and what the process revealed about effort, growth, and next steps.                                                                                                                                                                                                                                   |
| Career Pathway Investigation (Module 3.2)                | Students investigate a career or career field using trusted databases such as the Occupational Outlook Handbook, O*NET OnLine, and CareerOneStop, verifying findings with at least two credible sources. Their research addresses personal interest and fit, related high school coursework and pathways, postsecondary qualifications, outside-of-class experiences, and labor market trends such as salary, job growth, competition, technology, and labor supply. Students synthesize their findings into a scannable Career Profile Artifact, such as an infographic, profile document, or slide deck, and conclude with a reflection evaluating whether the career remains a realistic fit and identifying one academic, one extracurricular, and one real-world action step for the next three years of high school. |
| Four-Year Academic Plan (Module 3.3)                     | Students complete a Four-Year Academic Plan using the CBSD Program of Studies and district planning framework, building on their personal branding work and career research. Students map courses for grades 9–12, with particular focus on grades 10–12, while checking graduation requirements, course sequencing, prerequisites, workload balance, and opportunities such as MBIT, internships, electives, and advanced coursework. Their reflection explains how course choices connect to their career pathway, interests, personal brand, and prior research, then evaluates whether the plan is realistic, balanced, flexible, and responsive to what they have learned about themselves as learners.                                                                                                               |

**Acceptable evidence of learning other than Performance Tasks:**

Formative Assessment: Modules typically include checks for understanding that may count as formative assessments.

Summative Assessment: Three common summative assessments are listed as performance tasks. Teachers may select additional summative tasks for other Unit 3 topics based on student need, interest, and schedule constraints.

### **Suggested Learning Experiences and Instruction**

#### **Learning Experiences:**

- Students complete Naviance career and self-assessment activities, including AchieveWorks Skills, Career Interest Finder, and Career Cluster Finder, then reflect on how their interests, strengths, abilities, aptitudes, values, and goals can inform academic and career planning.
- Students collaborate with counselors, teachers, family members, peers, or community partners to examine graduation requirements, course sequencing, prerequisites, electives, MBIT, advanced coursework, work-based learning, and other planning opportunities.
- Students develop a personal brand by identifying evidence of their education, experiences, skills, strengths, activities, achievements, and goals, then explaining how those qualities could be communicated to a specific audience or opportunity.
- Students create, revise, and polish an academic resume by applying best practices for resume design, professional language, audience awareness, organization, and feedback-based revision.
- Students investigate career pathways using reputable sources such as Naviance, the Occupational Outlook Handbook, O\*NET Online, CareerOneStop, MBIT resources, the CBSD Program of Studies, and other trusted career-planning tools.
- Students evaluate career and postsecondary options by comparing qualifications, education or training requirements, employment outlook, labor market trends, potential earnings, competition, entrepreneurship, military service, self-employment, and personal fit.
- Students create a career profile or pathway artifact that synthesizes research findings and identifies realistic academic, extracurricular, work-based, service, or community experiences that could support future goals.
- Students create and reflect on a four-year academic plan that connects coursework, electives, extracurricular activities, personal strengths, career research, and postsecondary possibilities while remaining realistic, balanced, flexible, and responsive to new information.

#### **Instructional Strategies:**

- Teachers provide brief direct instruction and modeling to introduce key tools, routines, vocabulary, and expectations before students apply them in realistic tasks.
- Teachers use think-alouds and demonstrations to model processes such as planning, prioritizing, reading directions, composing a professional message, evaluating a source, or revising a product.
- Teachers use scenario-based instruction and guided inquiry to help students analyze authentic school, academic, digital, and career-planning situations before selecting appropriate next steps.
- Teachers facilitate structured discussion protocols, partner routines, and cooperative learning tasks that support active listening, respectful disagreement, shared responsibility, and evidence-based explanation.
- Teachers provide exemplars, rubrics, checklists, and success criteria so students can understand expectations, evaluate their work, and revise academic or performance-based products.
- Teachers build in formative checks, reflection routines, and feedback cycles that help students monitor progress, identify strengths and needs, revise work, and transfer strategies to other courses or contexts.

#### **Differentiation/Intervention/Enrichment Options:**

- Teachers provide scaffolded task directions, checklists, exemplars, and graphic organizers to help students understand expectations, plan their work, and complete multi-step products.
- Teachers offer small-group instruction, guided practice, and targeted reteaching for students who need additional support with key skills, tools, routines, or concepts.
- Teachers adjust pacing, task length, source sets, or product requirements while maintaining the core learning goal and success criteria.
- Teachers use sentence frames, word banks, discussion stems, visual models, and vocabulary supports to help students communicate ideas clearly in writing, discussion, reflection, or presentation.
- Teachers provide structured choice through choice boards, role options, product formats, or topic selections so students can demonstrate learning in ways that reflect their strengths, interests, and needs.

- Teachers offer enrichment through extension research, advanced sources, independent inquiry, leadership roles, peer mentoring, or more complex applications of unit skills to authentic school, academic, digital, or career-planning situations.

**For Language Development:**

- Teachers reinforce language development through recurring vocabulary and academic language supports, such as word banks, student-friendly definitions, glossaries, bilingual supports, translation tools, sentence frames, discussion stems, and visual vocabulary.
- Teachers may explicitly teach unit-specific academic and disciplinary terms such as the following.
  - adapt
  - align
  - analyze
  - apply
  - articulate
  - compare
  - evaluate
  - identify
  - justify
  - plan
  - prepare
  - reflect
  - revise
  - select
  - transfer



# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** Navigate

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9

### **Characterization of Course of Study:**

According to the 2026-27 Program of Studies, “Navigate 9 is a required course for all 9th grade students designed to empower students as they transition into high school by fostering civic engagement and responsible citizenship. This problem-based course emphasizes the skills and knowledge needed to be productive, ethical, and informed members of the school community. Students will develop teamwork, leadership, and executive functioning skills such as organization and planning. The course equips you with a strong academic foundation by emphasizing critical thinking, respectful communication, and digital citizenship, with a focus on the ethical use of technology. Students will set personal and academic goals, reflect on their strengths, and cultivate a growth mindset and resilience.”

As students transition into high school, Navigate 9 serves as a Tier 1 universal course that supports all learners through a shared learning experience. The course establishes common academic systems, habits, expectations, and language across buildings and content areas. Instruction emphasizes practical, real-world tools and repeatable systems such as planning routines, notetaking structures, professional communication, and research practices. By creating transferable academic artifacts students build skills and resources for use in Navigate and other high school courses.

### **Reasons for Proposed Adoption:**

Grade-level realignment affords the opportunity to explicitly address skills pertinent to success in high school, and the Navigate course creates a forum in which teachers can teach, model, and reinforce such skills. This course also provides an opportunity to frame students’ short- and medium-term decisions regarding course selection and engagement within an understanding of long-term post-secondary goals.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



**World Languages  
Middle School Curriculum  
Approvals and Updates**

**August 2026**



# Introductions



**Stacy Gray**  
**World Languages & K-12 ELD Supervisor**



# Goal of Presentation



**Objectives:** To seek approval for the following courses of study: Passports & Perspectives, French 1A, French 1B, Spanish 1A, Spanish 1B.



10 minutes



# Agenda



**Background and Rationale**



**Courses of Study - Overview**



**Budget**



**Next Steps**



# Background



Dec 2024

CBSD decision to offer WL courses in 7<sup>th</sup> grade for realignment in 26-27

Spring 2025

French and Spanish teachers examine, rate, and decide on available resources for levels 1-4 in Spanish and 1-4H in French

Fall 2025

Spanish and French Courses of Study are rearranged to fit new trajectory for realignment which includes 1a and 1b in the middle school. Creation of the Passports & Perspective course.



# Background

## Elementary School

K - 5

Full Day K

## Middle School

6 - 8

Introduction to World Languages in 7th Grade

## High School

9 - 12

Support for Students Entering HS and Access to High School Program of Studies





# World Languages Overview

## 6<sup>th</sup> Grade

- No WL Course

## 7<sup>th</sup> Grade

- French 1A
- Spanish 1A
- Passports & Perspectives\*

\*This is a new 1-semester course that will run as a supplement in the schedule and will be taught by a WL teacher. Students will compare and contrast their own culture and language with those of other countries. This is a graded course.

## 8<sup>th</sup> Grade

- French 1A
- French 1B
- Spanish 1A
- Spanish 1B
- Passports & Perspectives

We are excited to begin offering French and Spanish in 7<sup>th</sup> grade. All Academic levels 1-5 courses have been updated & aligned with ACTFL World Readiness Standards to reflect this change.



# World Languages Overview

## Courses offered in grades 9-12

|                                               |                                               |                                                                                                                            |                                                              |                                                  |
|-----------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------|
| Chinese 1<br>French 1<br>Latin 1<br>Spanish 1 | Chinese 2<br>French 2<br>Latin 2<br>Spanish 2 | Chinese 3<br>Chinese 3 Honors<br>French 3<br>French 3 Honors<br>Latin 3<br>Latin 3 Honors<br>Spanish 3<br>Spanish 3 Honors | French 4<br>French 4 Honors<br>Spanish 4<br>Spanish 4 Honors | AP French<br>AP Spanish<br>French 5<br>Spanish 5 |
|-----------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------|

If a student completes levels 1a and 1b in MS, they will begin level 2 in HS.

All Academic levels 1-4 courses have been updated & aligned with ACTFL World Readiness Standards to reflect this change.

# Passports & Perspectives

- Introduces middle school students to the **study of countries, languages, and cultures** from around the world.
- **Develops foundational language-learning skills**, including vocabulary acquisition, pattern recognition, and basic communication strategies.
- Engages students in interactive activities/tools that **build cultural understanding and global awareness**.
- Explores how **language reflects identity, values, and cultural perspectives**.
- Encourages students to **compare their own language and culture** with those of people around the world.
- **Fosters curiosity**, respect for diversity, and appreciation for multiple perspectives.
- Prepares students **for future world language study** and intercultural experiences.

**Prerequisite** – None.

\*This course is assigned as needed and runs opposite 7<sup>th</sup> or 8<sup>th</sup> Grade Math Intervention and/or English Language Arts Intervention.



# Passports & Perspectives

Unit 1 Countries of **Africa**: Land, Language and Life

Unit 2 Countries of **Asia**: Land, Language and Life

Unit 3 Countries of **Europe**: Land, Language and Life

Unit 4 Countries of **South America**: Land, Language and Life

*\*The teacher may continue the course if there is time by adding a 5<sup>th</sup> unit focusing on North America with the same requirements as the previous units.*

## Required Texts and Software

None

## Resources

Gale Resources and other CB approved resources accessible through Classlink

Microsoft 365 Tools

**Online Tools:** Geoguessr, Google Earth, Quizlet, Blooket, Gimkit, EdPuzzle etc.

# Summative Unit Assessment Overview

## Description:

Students complete a summative portfolio project for each unit that includes geography, elements of culture (food, music, art, language, celebrations, sports etc.), demographics, and language. This is broken down into several due dates and collected throughout the unit, culminating in a presentation to the class. Each of the tasks below collectively result in the portfolio project for each unit.

## Students will:

- **Select** a country on the continent and use a graphic organizer to research.
- **Explore** and report on the **demographics and geography** of that country.
- **Research a language** spoken in their selected country and present their findings to the class. They will also teach several words and phrases from that language to the class.
- **Research a cultural topic** connected to their country (food, music, art, language, celebrations, sports etc.).
- **Conference with the teacher** about their research and findings.
- **Create a presentation** for the class encompassing all the above elements while classmates take notes with a provided note taker.

## Format options:

PowerPoint/Canva/Sway, Video, Poster

## Evidence of learning:

Students accurately research and communicate information about a selected country.  
Students present findings about a language and demonstrate effective presentation skills.  
Students create a visual product that explains a cultural element and its significance.

# Course Grading

A Special  
'Thank You' to  
Kat Eberts and  
Gina Willcox at  
Lenape!

One summative assessment per unit in the form of a **project portfolio**. The elements of the portfolio are supported by graphic organizers, templates, and teacher conferences and are due at different check points in the unit. Several formative assessments per unit as assigned by the teacher.

## Course Grading:

### Fall

**Marking Period 1** 50% - made up of daily formative assessments and unit summative assessments.

**Marking Period 2** 50% - made up of daily formative assessments and unit summative assessments.

**No Final Exam**

### Spring

**Marking Period 3** 50% - made up of daily formative assessments and unit summative assessments.

**Marking Period 4** 50% - made up of daily formative assessments and unit summative assessments.

**No Final Exam**

# Levels 1A & 1B Rationale

Research suggests that students develop stronger language proficiency when introductory language instruction is spread across **Level 1A and Level 1B** rather than compressed into a single Level 1 course.

Extended learning time allows students **more opportunities for meaningful practice in listening, speaking, reading, and writing**, which promotes long-term retention and deeper language acquisition.

Language learning research emphasizes that **proficiency develops through repeated exposure, interaction, and application over time** rather than through rapid coverage of content.

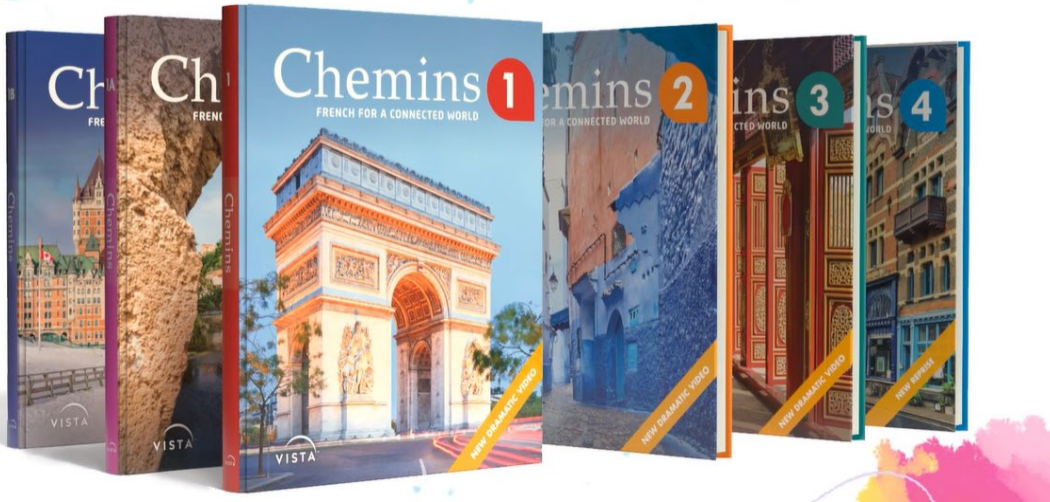
A 1A/1B sequence also allows students to **build a stronger foundation in vocabulary, grammar, and cultural understanding** before advancing to higher-level coursework, resulting in greater confidence, improved communication skills, and higher rates of success in subsequent language study.

Studies in second language acquisition consistently show that **sustained instruction and increased time on task are key factors in achieving higher levels of language proficiency and intercultural competence**.

**Sources:** ACTFL Position Statement on Time for Language Learning; American Council on the Teaching of Foreign Languages (ACTFL); Center for Applied Linguistics; National Standards Collaborative Board.



# Vista Higher Learning Resources



Take a look at  
**SIX STEPS.**

1. Context
2. Vocabulary
3. Media
4. Culture
5. Grammar
6. Synthesis



= student motivation and success.



# French 1A

Chemins 1A Book

**Preliminary Unit French Foundations-** *Greeting, Alphabet, Classroom Expressions, French-Speaking Countries and Capitals, Days, Months, Colors, Numbers 0-31, the verb être (to be)*

**Unit 1 Introductions** – *Expressions of Courtesy, Classroom Objects, People, Nouns, Articles, Numbers 0-60, Subject Pronouns with être, Adjective Agreement, Diversity of France*

**Unit 2 Academic Life** – *Everyday Activities, School Life in France and Québec, Present Tense –er Verbs, Forming Questions and Expressing Negation, The Verb avoir and Telling Time*

**Unit 3 Family & Friends** – *Family, Friends, Pets, Descriptive and Possessive Adjectives, Numbers 61-100, Prepositions, Relationships, Le Maghreb*



# French 1B

Chemins 1B Book

**French Essentials Reprise Unit** - *Students apply foundational vocabulary and grammar, including **être**, **avoir**, regular -er verbs, adjective agreement, possessive adjectives, question formation, Numbers, and expressions of location to communicate meaning. Review vocabulary, cultural information and skills from French 1A, review, incorporate new information about Haiti and the U.S.*

**Unit 4 Around Town** – *Places, Activities, Café Culture, Verbs aller, prendre and boire, regular -ir verbs, Partitives (some, any), \*La France d'outre-mer*

**Unit 5 Sports & Hobbies** – *Leisure activities, Weather, The Verb faire and expressions with faire, Irregular -ir verbs, Numbers 101 and up, Spelling Change -er verbs, Soccer in the Francophone world, Le tour de France, Loire Valley, Normandy, Brittany.*

**Unit 6 Celebrations** – *Parties for different stages of life, Clothing, Demonstrative Adjectives, Regular and Irregular -re verbs, Passé Composé with avoir, Le Carnaval, Fashion, Paris.*

*\*La France d'outre-mer* (Overseas France) is the collective name for the 13 territories of the French Republic located outside Europe, mostly remnants of the former French colonial empire. (Guadeloupe, Martinique, French Guyana etc.)

# Spanish 1A

Encuentros Level 1 Book

**Preliminary Unit First Steps** – *Greetings, Colors, Numbers, Alphabet, Days, Dates, Interrogatives, Classroom Expressions, Spanish-speaking countries, Language Learning Strategies*

**Unit 1 Family and Friends** – *People, Pets, The verbs Ser, Estar and Tener, Adjectives, Possession, Mexico*

**Unit 2 Life at Home-** *Household Items, Chores, Nouns, Articles, Adverbs of Frequency, Present Tense Regular –ar, –er and –ir verbs, Puerto Rico*

**Unit 3 Shopping and Clothing** - *Stores, Products, Stem-changing verbs, The Verbs gustar and ir, Demonstrative and Comparative Adjectives, Guatemala*

**Unit 4 Food-** *Stores, Products, Expressing Preferences, The verbs querer and preferer, Irregular verbs in the yo form, Perú*



# Spanish 1B

Encuentros Level 1 Book

**Unit 4 Food/Review of 1A** - *Stores, Products, Expressing Preferences, Numbers, The verbs querer and preferer, Irregular verbs in the yo form, Perú*

**Unit 5 Health and Wellness-** *Healthy Habits, Remedies, Advice, Reflexive Verbs, The verbs doler, sentirse, Commands (regular verbs), Spain*

**Unit 6 Pastimes-** *Hobbies, Sports, Work, Future Actions (IR), Stem Changers, Present Progressive Tense, \*Imperfect Tense (regular verbs) United States*

**Unit 7 Travel** – *Lodging, Transportation, Directions, Preterite Tense (ar, er, ir regular verbs), Preterite Tense (ser/ir), Argentina*

**Unit 8 Nature** – *Geography, Space, Irregular Verbs in the Preterite Tense (decir, hacer, estar, tener), Chile*

# Updates to HS Curriculum

- Less review time in high school because students have a solid, 2 year foundation
- Level 2 the past tense will be a review and the irregulars will be new information allowing more time to actually apply the past tense in context
- Level 3 focus on future and subjunctive tenses
- Level 4 focus on hypothetical situations using past subjunctive and conditional, putting everything together
- Still using district unit IPAs and Final IPAs for each course

# Questions?



A Special  
Thank You to  
Kat Eberts  
And Gina  
Willcox at  
Lenape!



## Passports and Perspectives

Course Number: 4078

Course Level: Middle School

Grade: 6-8

Time/Credit: 46 minutes every day for one semester  
(2 marking periods/18 weeks)  
.5 credit

Development Date: April 29, 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## **World Languages Department Learning Principles**

Students of World Languages simulate authentic experiences, compare and contrast other languages and cultures, promote tolerance, and make connections with other disciplines.

World Languages programs integrate studying and experiencing the culture(s) in which the world language is used.

The World Languages discipline connects with all the other disciplines.

The learner is at the center of effective World Languages instruction.

World Languages programs should reflect the developmental nature of language acquisition.

The complexity of teaching a World Language requires teachers to reflect on their practice and match knowledge of the discipline with appropriate teaching, while assessing strategies to achieve learning goals.

Differentiated instruction addresses student strengths, interests and learning styles.

World Language learners achieve proficiency through performance-based assessments including speaking, reading, writing, and listening.

To achieve reality-based language learning, the world language acquisition must include technology-based instruction and practice.

World language educators create awareness, incite curiosity, and encourage appreciation of the language and culture being learned.

Sources: World Languages Curriculum Framework Making Connections

### World-Readiness Standards for Learning Languages

| Goal Area     | Standard                                       | Description                                                                                                                                            |
|---------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communication | Interpersonal Communication                    | Learners interact and negotiate meaning in spoken, signed, or written conversations to share information, reactions, feelings, and opinions.           |
| Communication | Interpretive Communication                     | Learners understand, interpret, and analyze what is heard, read, or viewed on a variety of topics.                                                     |
| Communication | Presentational Communication                   | Learners present information, concepts, and ideas to inform, explain, persuade, and narrate on a variety of topics for different audiences.            |
| Cultures      | Relating Cultural Practices to Perspectives    | Learners investigate, explain, and reflect on the relationship between the practices and perspectives of the cultures studied.                         |
| Cultures      | Relating Cultural Products to Perspectives     | Learners investigate, explain, and reflect on the relationship between the products and perspectives of the cultures studied.                          |
| Connections   | Making Connections                             | Learners build, reinforce, and expand their knowledge of other disciplines while using the language to think critically and solve problems creatively. |
| Connections   | Acquiring Information and Diverse Perspectives | Learners access and evaluate information and diverse perspectives available through the language and its cultures.                                     |
| Comparisons   | Language Comparisons                           | Learners investigate, explain, and reflect on the nature of language through comparisons between the language studied and their own.                   |
| Comparisons   | Cultural Comparisons                           | Learners investigate, explain, and reflect on the concept of culture through comparisons between the cultures studied and their own.                   |
| Communities   | School and Global Communities                  | Learners use the language within and beyond the classroom to interact and collaborate in their community and the globalized world.                     |
| Communities   | Lifelong Learning                              | Learners set goals and reflect on their progress in using languages for enjoyment, enrichment, and advancement.                                        |

**Central Bucks School District**  
**World Languages Department Enduring Understandings**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.



**Central Bucks School District**  
**World Languages Department Essential Questions**

1. How does an individual express his or her basic needs and wants in the target language?
2. How are your language and culture affected by others? How are other languages and cultures affected by yours?
3. How and why can you use the target language to further your career and personal enrichment?
4. How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
5. When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

## Central Bucks School District – Course of Study Overview

### Passports & Perspectives

#### Desired Results

##### Course Description:

Passports & Perspectives is an engaging course designed to introduce middle school students to the world of countries, languages and cultures. Students will develop strategies for acquiring vocabulary, recognizing patterns, and practicing basic communication skills. Through interactive activities and cultural comparisons, students will explore how language reflects identity and values, and how their own language and culture compare with those of others around the world. This course fosters curiosity, global awareness, and appreciation for diverse perspectives, preparing students for future language study and cultural experiences.

\*This course is assigned as needed and runs opposite 7<sup>th</sup> Grade Math: Pathway to Algebra A and/or 7<sup>th</sup> Grade ELA: English Language Arts Intervention 7.

**Prerequisite:** None: assigned to students as needed.

Students will be able to:

- **Identify and use cognates and common expressions** to better understand meaning across languages.
- **Recognize how culture influences language**, including informal expressions, customs, and everyday communication.
- **Compare English with other languages** to identify similarities and differences in words, structures, and usage.
- **Explain how learning another language benefits individuals and communities**, including academic, cognitive, and social advantages.
- **Describe how world language skills connect to real-world careers**, using examples and statistics to support their ideas.
- **Research and present information about countries** focusing on culture, geography, daily life, and language use.
- **Use basic research skills** to gather, organize, and share information from reliable sources.
- **Analyze a new and unfamiliar country** through a cultural and linguistic lens.
- **Demonstrate curiosity and respect for cultures different from their own**, using appropriate language and examples.
- **Make connections between language and lived experiences**, including traditions, celebrations, routines, and perspectives.
- **Communicate ideas clearly** using visuals, presentations, and simple language appropriate for a middle school classroom.
- **Reflect on their role as global learners and citizens** in an interconnected world.

### **Acceptable Evidence.**

- One summative assessment per unit in the form of a project portfolio. The elements of the portfolio are supported by graphic organizers, templates, and teacher conferences and are due at different check points in the unit.
- Several formative assessments per unit as assigned by the teacher.

### **Course Grading:**

#### Fall

**Marking Period 1** 50% - made up of daily formative assessments and unit summative assessments.

**Marking Period 2** 50% - made up of daily formative assessments and unit summative assessments.

**No Final Exam**

#### Spring

**Marking Period 3** 50% - made up of daily formative assessments and unit summative assessments.

**Marking Period 4** 50% - made up of daily formative assessments and unit summative assessments.

**No Final Exam**

## Passports & Perspectives – Pacing Guide and Instructional Time

The times listed below are guidelines, inclusive of teaching, reviewing, conferencing, and assessing, to ensure completion of the course within the semester.

| Content                                                            | Instructional Time   |
|--------------------------------------------------------------------|----------------------|
| <b>Unit 1: Countries of Africa: Land, Language and Life</b>        | <b>Weeks 1-4.5</b>   |
| Week 1: Geography, regions, and physical features of Africa        | 5 days               |
| Week 2: Languages and communication across Africa                  | 5 days               |
| Week 3: Daily life, traditions, food, music, and culture           | 5 days               |
| Week 4: Country case studies and cultural comparisons              | 5 days               |
| Week 4.5: Summative project completion and presentations           | 2-3 days             |
| <b>Unit 2: Countries of Asia: Land, Language and Life</b>          | <b>Weeks 5-9</b>     |
| Week 5: Geography and regions of Asia                              | 5 days               |
| Week 6: Languages, writing systems, and communication              | 5 days               |
| Week 7: Daily life, traditions, and religions                      | 5 days               |
| Week 8: Country case studies and global connections                | 5 days               |
| Week 9: Summative project completion and presentations             | 5 days               |
| <b>Unit 3: Countries of Europe: Land, Language and Life</b>        | <b>Weeks 10-13.5</b> |
| Week 10: Geography and regions of Europe                           | 5 days               |
| Week 11: Languages and cultural identities                         | 5 days               |
| Week 12: Traditions, education, government, and lifestyle          | 5 days               |
| Week 13: Country case studies and cultural comparisons             | 5 days               |
| Week 13.5: Summative project completion and presentations          | 2-3 days             |
| <b>Unit 4: Countries of South America: Land, Language and Life</b> | <b>Weeks 14-18</b>   |
| Week 14: Geography and natural resources                           | 5 days               |
| Week 15: Languages and indigenous influences                       | 5 days               |
| Week 16: Daily life, traditions, food, and music                   | 5 days               |
| Week 17: Country case studies and connections to North America     | 5 days               |
| Week 18: Summative project presentations, reflection, and wrap-up  | 5 days               |

**NOTE:** Enrichment opportunities will be provided to meet the needs of students that acquire an understanding of the content faster than their peers. Enrichment will be provided after students have completed the work assigned to all students and will be an extension activity with the same theme.

*The teacher may continue the course if there is time by adding a 5<sup>th</sup> unit focusing on North America with the same requirements as the previous units.*

### Required Texts and Software

None

### Resources

- Gale Resources and other CB approved resources accessible through Classlink
- Microsoft 365 Tools
  - Geoguessr, Google Earth, Quizlet, Blooket, Gimkit, EdPuzzle etc.



# Central Bucks School District – Passports & Perspectives

## Unit 1 – *Countries of Africa: Land, Language and Life*

### **Desired Results:**

#### **Essential Questions:**

- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How does understanding language patterns and culture help us learn new languages?
- What can familiar words, expressions, and cultural practices teach us about learning a new language?
- How are language and culture connected in everyday communication?

#### **Enduring Understandings:**

Students will understand that...

- the global nature of our society requires us to negotiate meaning through a variety of modalities.
- there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- the study of languages provides the opportunity for critical examination of one's own language and culture.
- with an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### **Knowledge:**

Students will know...

- that countries within the same region or language group can have unique identities
- that many languages share similar words and patterns, such as cognates, that help learners understand meaning.
- that colloquial expressions are influenced by culture and often do not translate word-for-word.
- that language and culture are interconnected, and both play an important role in effective communication.
- how to locate countries, continents, oceans, and major landmarks on a map.
- how environmental conditions influence human activities (food, clothing, housing).
- that food, music, art, language, sports, traditions, holidays and celebrations both connect people within a culture and highlight cultural diversity and similarities around the world. These same cultural elements provide insight into how people live and what they value.

#### **Skills:**

Students will be able to...

- research and describe key cultural practices, traditions, languages, and perspectives of a country with which they were not previously familiar.
- explain how language is used in daily life within that country (school, family, community, and media).
- identify important geographic, historical, and social factors that shape life in that country.
- analyze how cultural values influence communication, behaviors, and ways of living.
- compare the country studied to others they have learned about and their own, recognizing both similarities and differences.
- reflect on how learning about unfamiliar cultures builds empathy and awareness.
- use geographic tools and technologies to understand the world around them.
- identify and explain cognates across English and other languages to support comprehension and meaning making.

- interpret common colloquial expressions and explain how their meanings are shaped by culture rather than direct translation.
- use library resources to investigate and present information about cultural traditions from around the world.
- describe connections between language and culture, using examples from everyday communication and authentic contexts.

## **Standards:**

### Priority:

- **Interpretive Communication (ACTFL: Communication)**  
Students interpret meaning in familiar and new languages by recognizing cognates, common expressions, and language patterns.
- **Presentational Communication (ACTFL Communication)**  
Students present research information about a country clearly and purposefully for a specific audience.
- **Language Comparisons (ACTFL: Comparisons)**  
Students compare English and other languages to understand similarities and differences in words, expressions, and meaning.
- **Cultural Comparisons (ACTFL Comparisons)**  
Students compare their own cultural experiences with those of the country they are studying to deepen global understanding.
- **Making Connections (ACTFL Connections)**  
Students connect language learning to other content areas and real-world contexts, including careers and global issues.
- **Acquiring Information (ACTFL Connections)**  
Students locate and use information from a variety of reliable sources to learn about another country.
- **Lifelong Learning (ACTFL Communities)**  
Students understand the value of multilingualism for personal growth, civic engagement, and future opportunities.
- **Relating Cultural Practices and Perspectives (ACTFL Cultures)**  
Students investigate and explain how cultural practices, traditions, and perspectives shape daily life in a specific country.

### Supporting:

#### **Interpretive Communication (ACTFL Communication)**

- Students interpret information from age-appropriate texts, visuals, and media related to a country's culture, geography, and daily life.

#### **Interpersonal Communication (ACTFL Communication)**

- Students engage in conversations to ask and answer questions, share information, and clarify understanding about their country of study.

#### **Language Comparisons (ACTFL Comparisons)**

- Students recognize similarities and differences between their own language and the language(s) used in the country studied.

#### **Making Connections (ACTFL Connections)**

- Students use language and cultural knowledge to deepen their understanding of geography, history, and social structures in another country.

#### **Cultural Comparisons (ACTFL Comparisons)**

- Students compare multiple cultures to recognize similarities, differences, and unique cultural identities.

## **Acceptable Evidence:**

### **Performance Tasks**

- **Cognate Detective Task**  
Students identify and categorize cognates across English and one or more other languages and explain how cognates help with understanding meaning.
- **Colloquial Expressions Comparison**  
Students analyze everyday expressions from English and another language and explain why the meaning does not translate word-for-word.
- **Culture in Language**  
Students explore examples of how culture influences language use (such as greetings, idioms, or informal expressions) using visuals or short explanations.
- **Language Comparison Reflection**  
Students write or record a reflection explaining similarities and differences between English and another language and how those comparisons support language learning.
- **Interpretive Language Task**  
Students interpret simple and authentic texts, visuals, or spoken examples containing cognates or colloquial expressions and demonstrate understanding through matching, explaining, or paraphrasing.
- **Language Learning Strategies Self-Assessment**  
Students identify strategies they used (recognizing cognates, using context, considering culture) and explain how these strategies help them learn new languages.

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- **Entrance/exit tickets**
- **Class discussions or think-pair-share responses**
- **Completed graphic organizers**
- **Reflection journals or learning logs** describing language learning strategies and cultural insights and reflecting on essential questions of the course.
- **Quick writes or short constructed responses**
- **Self-assessments or checklists** where students reflect on and evaluate their understanding/learning.
- **Vocabulary or concept quizzes**
- **Visual evidence** such as anchor charts, concept maps, or student-created posters that show understanding of language and culture.

##### **Summative Unit Assessment**

##### **Description:**

Students complete a summative portfolio project for each unit that includes geography, elements of culture (food, music, art, language, celebrations, sports etc.), demographics, and language. This is broken down into several due dates and collected throughout the unit, culminating in a presentation to the class. Each of the tasks below collectively result in the portfolio project for each unit.

##### **Students will:**

- Select a country on the continent and use a graphic organizer to research.
- Explore and report on the demographics and geography of that country.
- Research a language spoken in their selected country and present their findings to the class. They will also teach several words and phrases from that language to the class.
- Research a cultural topic connected to their country (food, music, art, language, celebrations, sports etc.).
- Confer with the teacher about their research and findings.
- Create a presentation for the class encompassing all the above elements while classmates take notes with a provided note taker.

##### **Format options:**

- PowerPoint/Canva/Sway



- Video
- Poster

#### **Evidence of learning:**

- Students accurately research and communicate information about a selected country.
- Students present findings about a language and demonstrate effective presentation skills.
- Students create a visual product that explains a cultural element and its significance.

## **Suggested Learning Experiences and Instruction**

### **Learning Experiences:**

#### **Cognate Discovery Activity**

Students examine words from English and another language to identify cognates and discuss how those words help them understand meaning.

#### **Colloquialisms in Context**

Students explore everyday expressions (phrases, idioms, greetings) and determine how meaning changes when culture is considered.

#### **Language Comparison Stations**

Students rotate through stations that highlight similarities and differences between English and other languages (words, expressions, sentence patterns).

#### **Culture and Language Case Study**

Students analyze short examples (videos, images, dialogue samples) showing how culture influences how people speak and interact.

#### **Language Learning Reflection**

Students reflect on what they notice about how languages work and which strategies help them make meaning.

#### **Launching Curiosity: What Do We Know / Need to Know?**

Students examine the name, location, images, or symbols of an unfamiliar country and generate initial questions to guide learning.

#### **Country Context Model-Lessons**

Teacher models by introducing key background elements such as geography, history, government, and regional context to support understanding.

#### **Guided Source Evaluation Workshop**

Students learn how to identify reliable sources and practice evaluating texts, videos, maps, and visuals for accuracy and relevance.

#### **Culture Through Daily Life Exploration**

Students explore school routines, family life, food, celebrations, transportation, and media to understand how culture shapes everyday experiences.

#### **Language in Action Analysis**

Students examine how language is used in authentic contexts (signs, media clips, school schedules, menus) to see how language functions in daily life.

#### **Think-Pair-Share Checkpoints**

Regular opportunities for students to share new insights, ask questions, and clarify misunderstandings with peers.

#### **Perspective-Taking Activities**

Students consider questions such as *“What might feel unfamiliar to me, and why?”* or *“How would daily life be different if I lived here?”*

#### **Comparative Discussions**

Students compare the unfamiliar country to countries previously studied, focusing on values, practices, and ways of living.

#### **Reflection**

Students journal or discuss how their thinking changes as they learn more about a culture different from their own.

**Instructional Strategies:****Inquiry-Driven Instruction**

Students investigate guiding questions about an unfamiliar country to promote curiosity, problem-solving, and deeper understanding.

**Scaffolded Research Support**

Teachers break the research process into manageable steps (questioning, sourcing, note-taking, synthesizing) with clear checkpoints.

**Modeling and Think-Alouds**

Teachers demonstrate how to analyze sources, identify cultural perspectives, and draw conclusions from information.

**Explicit Culture-Perspective Instruction**

Instruction and facilitating conversations based on essential questions highlights how values, beliefs, and perspectives influence daily life, communication, and behaviors.

**Use of Graphic Organizers and Visual Tools**

Visual supports help students organize information about geography, culture, language use, and daily life.

**Collaborative Learning Structures**

Partner and small-group discussions allow students to share findings, ask questions, and refine understanding.

**Explicit instruction with modeling**

Teachers model how to identify cognates, use context clues, and think aloud when interpreting unfamiliar language.

**Guided discussion and questioning**

Students explain their thinking and respond to questions that emphasize language–culture connections.

**Visual supports and graphic organizers**

Charts, Venn diagrams, and anchor charts support comparisons and pattern recognition.

**Collaborative learning**

Students work in pairs or small groups to analyze language examples and share perspectives.

**Reflection**

Students regularly reflect individually and together on how they are learning language and which strategies are effective. Students reflect on how their thinking evolves as they learn about an unfamiliar cultures, building empathy, and self-awareness.

**Student Choice Within Structure**

While the country is unfamiliar, students have flexibility in focus topics, sources, and presentation formats to increase engagement.

**Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**

- Support: Provide students with templates, organizers, and conference time. Collaborate with the librarian to explore the resources through the library.
- Challenge: Offer more complex sentence translations, creative writing prompts, or research projects on specific linguistic elements.
- Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing a map, creating graphic organizers / timelines, participating in pronunciation drills or debates).

- **Intervention:**

- Teacher/Student Conferencing
- Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups. Utilize peer-tutoring or pair students with stronger understanding to support each other.
- Targeted Practice: Using feedback from formative assessments, offer additional practice opportunities targeting specific areas where students show difficulty or lack of understanding.

- **Enrichment:**

- Independent Projects: Allow advanced students to complete enrichment activities related to the unit with teacher guidance/approval.

**General strategies for Language Development:** Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures. Draw connections to L1 (first language).

## Central Bucks School District – Passports & Perspectives

### Unit 2 – *Countries of Asia: Land, Language and Life*

#### **Desired Results:**

##### Essential Questions:

- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How does understanding language patterns and culture help us learn new languages?
- What can familiar words, expressions, and cultural practices teach us about learning a new language?
- How are language and culture connected in everyday communication?

##### **Enduring Understandings:**

Students will understand that...

- the global nature of our society requires us to negotiate meaning through a variety of modalities.
- there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- the study of languages provides the opportunity for critical examination of one's own language and culture.
- with an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

##### **Knowledge:**

Students will know...

- that countries within the same region or language group can have unique identities
- that many languages share similar words and patterns, such as cognates, that help learners understand meaning.
- that colloquial expressions are influenced by culture and often do not translate word-for-word.
- that language and culture are interconnected, and both play an important role in effective communication.
- how to locate countries, continents, oceans, and major landmarks on a map.
- how environmental conditions influence human activities (food, clothing, housing).
- that food, music, art, language, sports, traditions, holidays and celebrations both connect people within a culture and highlight cultural diversity and similarities around the world. These same cultural elements provide insight into how people live and what they value.

##### **Skills:**

Students will be able to...

- research and describe key cultural practices, traditions, languages, and perspectives of a country with which they were not previously familiar.
- explain how language is used in daily life within that country (school, family, community, and media).
- identify important geographic, historical, and social factors that shape life in that country.
- analyze how cultural values influence communication, behaviors, and ways of living.
- compare the country studied to others they have learned about and their own, recognizing both similarities and differences.
- reflect on how learning about unfamiliar cultures builds empathy and awareness.
- use geographic tools and technologies to understand the world around them.
- identify and explain cognates across English and other languages to support comprehension and meaning making.
- interpret common colloquial expressions and explain how their meanings are shaped by culture rather than direct translation.

- use library resources to investigate and present information about cultural traditions from around the world.
- describe connections between language and culture, using examples from everyday communication and authentic contexts.

## **Standards:**

### Priority:

- **Interpretive Communication (ACTFL: Communication)**  
Students interpret meaning in familiar and new languages by recognizing cognates, common expressions, and language patterns.
- **Presentational Communication (ACTFL Communication)**  
Students present research information about a country clearly and purposefully for a specific audience.
- **Language Comparisons (ACTFL: Comparisons)**  
Students compare English and other languages to understand similarities and differences in words, expressions, and meaning.
- **Cultural Comparisons (ACTFL Comparisons)**  
Students compare their own cultural experiences with those of the country they are studying to deepen global understanding.
- **Making Connections (ACTFL Connections)**  
Students connect language learning to other content areas and real-world contexts, including careers and global issues.
- **Acquiring Information (ACTFL Connections)**  
Students locate and use information from a variety of reliable sources to learn about another country.
- **Lifelong Learning (ACTFL Communities)**  
Students understand the value of multilingualism for personal growth, civic engagement, and future opportunities.
- **Relating Cultural Practices and Perspectives (ACTFL Cultures)**  
Students investigate and explain how cultural practices, traditions, and perspectives shape daily life in a specific country.

### Supporting:

#### **Interpretive Communication (ACTFL Communication)**

- Students interpret information from age-appropriate texts, visuals, and media related to a country's culture, geography, and daily life.

#### **Interpersonal Communication (ACTFL Communication)**

- Students engage in conversations to ask and answer questions, share information, and clarify understanding about their country of study.

#### **Language Comparisons (ACTFL Comparisons)**

- Students recognize similarities and differences between their own language and the language(s) used in the country studied.

#### **Making Connections (ACTFL Connections)**

- Students use language and cultural knowledge to deepen their understanding of geography, history, and social structures in another country.

#### **Cultural Comparisons (ACTFL Comparisons)**

- Students compare multiple cultures to recognize similarities, differences, and unique cultural identities.

## **Acceptable Evidence:**

### **Performance Tasks**

- **Cognate Detective Task**  
Students identify and categorize cognates across English and one or more other languages and explain how cognates help with understanding meaning.
- **Colloquial Expressions Comparison**  
Students analyze everyday expressions from English and another language and explain why the meaning does not translate word-for-word.
- **Culture in Language**  
Students explore examples of how culture influences language use (such as greetings, idioms, or informal expressions) using visuals or short explanations.
- **Language Comparison Reflection**  
Students write or record a reflection explaining similarities and differences between English and another language and how those comparisons support language learning.
- **Interpretive Language Task**  
Students interpret simple and authentic texts, visuals, or spoken examples containing cognates or colloquial expressions and demonstrate understanding through matching, explaining, or paraphrasing.
- **Language Learning Strategies Self-Assessment**  
Students identify strategies they used (recognizing cognates, using context, considering culture) and explain how these strategies help them learn new languages.

#### **Acceptable evidence of learning other than Performance Tasks:**

##### **Formative Assessment**

- **Entrance/exit tickets**
- **Class discussions or think-pair-share responses**
- **Completed graphic organizers**
- **Reflection journals or learning logs** describing language learning strategies and cultural insights and reflecting on essential questions of the course.
- **Quick writes or short constructed responses**
- **Self-assessments or checklists** where students reflect on and evaluate their understanding/learning.
- **Vocabulary or concept quizzes**
- **Visual evidence** such as anchor charts, concept maps, or student-created posters that show understanding of language and culture.

##### **Summative Unit Assessment**

###### **Description:**

Students complete a summative portfolio project for each unit that includes geography, elements of culture (food, music, art, language, celebrations, sports etc.), demographics, and language. This is broken down into several due dates and collected throughout the unit, culminating in a presentation to the class. Each of the tasks below collectively result in the portfolio project for each unit.

###### **Students will:**

- Select a country on the continent and use a graphic organizer to research.
- Explore and report on the demographics and geography of that country.
- Research a language spoken in their selected country and present their findings to the class. They will also teach several words and phrases from that language to the class.
- Research a cultural topic connected to their country (food, music, art, language, celebrations, sports etc.).
- Confer with the teacher about their research and findings.
- Create a presentation for the class encompassing all the above elements while classmates take notes with a provided note taker.

###### **Format options:**

- PowerPoint/Canva/Sway

- Video
- Poster

#### **Evidence of learning:**

- Students accurately research and communicate information about a selected country.
- Students present findings about a language and demonstrate effective presentation skills.
- Students create a visual product that explains a cultural element and its significance.

## **Suggested Learning Experiences and Instruction**

### **Learning Experiences:**

#### **Cognate Discovery Activity**

Students examine words from English and another language to identify cognates and discuss how those words help them understand meaning.

#### **Colloquialisms in Context**

Students explore everyday expressions (phrases, idioms, greetings) and determine how meaning changes when culture is considered.

#### **Language Comparison Stations**

Students rotate through stations that highlight similarities and differences between English and other languages (words, expressions, sentence patterns).

#### **Culture and Language Case Study**

Students analyze short examples (videos, images, dialogue samples) showing how culture influences how people speak and interact.

#### **Language Learning Reflection**

Students reflect on what they notice about how languages work and which strategies help them make meaning.

#### **Launching Curiosity: What Do We Know / Need to Know?**

Students examine the name, location, images, or symbols of an unfamiliar country and generate initial questions to guide learning.

#### **Country Context Model-Lessons**

Teacher models by introducing key background elements such as geography, history, government, and regional context to support understanding.

#### **Guided Source Evaluation Workshop**

Students learn how to identify reliable sources and practice evaluating texts, videos, maps, and visuals for accuracy and relevance.

#### **Culture Through Daily Life Exploration**

Students explore school routines, family life, food, celebrations, transportation, and media to understand how culture shapes everyday experiences.

#### **Language in Action Analysis**

Students examine how language is used in authentic contexts (signs, media clips, school schedules, menus) to see how language functions in daily life.

#### **Think-Pair-Share Checkpoints**

Regular opportunities for students to share new insights, ask questions, and clarify misunderstandings with peers.

#### **Perspective-Taking Activities**

Students consider questions such as *“What might feel unfamiliar to me, and why?”* or *“How would daily life be different if I lived here?”*

#### **Comparative Discussions**

Students compare the unfamiliar country to countries previously studied, focusing on values, practices, and ways of living.

#### **Reflection**

Students journal or discuss how their thinking changes as they learn more about a culture different from their own.

## **Instructional Strategies:**

### **Inquiry-Driven Instruction**

Students investigate guiding questions about an unfamiliar country to promote curiosity, problem-solving, and deeper understanding.

### **Scaffolded Research Support**

Teachers break the research process into manageable steps (questioning, sourcing, note-taking, synthesizing) with clear checkpoints.

### **Modeling and Think-Alouds**

Teachers demonstrate how to analyze sources, identify cultural perspectives, and draw conclusions from information.

### **Explicit Culture-Perspective Instruction**

Instruction and facilitating conversations based on essential questions highlights how values, beliefs, and perspectives influence daily life, communication, and behaviors.

### **Use of Graphic Organizers and Visual Tools**

Visual supports help students organize information about geography, culture, language use, and daily life.

### **Collaborative Learning Structures**

Partner and small-group discussions allow students to share findings, ask questions, and refine understanding.

### **Explicit instruction with modeling**

Teachers model how to identify cognates, use context clues, and think aloud when interpreting unfamiliar language.

### **Guided discussion and questioning**

Students explain their thinking and respond to questions that emphasize language–culture connections.

### **Visual supports and graphic organizers**

Charts, Venn diagrams, and anchor charts support comparisons and pattern recognition.

### **Collaborative learning**

Students work in pairs or small groups to analyze language examples and share perspectives.

### **Reflection**

Students regularly reflect individually and together on how they are learning language and which strategies are effective. Students reflect on how their thinking evolves as they learn about an unfamiliar cultures, building empathy, and self-awareness.

### **Student Choice Within Structure**

While the country is unfamiliar, students have flexibility in focus topics, sources, and presentation formats to increase engagement.

## **Differentiation/Intervention/Enrichment Options:**

### **• Tiered Activities:**

- Support: Provide students with templates, organizers, and conference time. Collaborate with the librarian to explore the resources through the library.
- Challenge: Offer more complex sentence translations, creative writing prompts, or research projects on specific linguistic elements.
- Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing a map, creating graphic organizers / timelines, participating in pronunciation drills or debates).

### **• Intervention:**

- Teacher/Student Conferencing
- Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups. Utilize peer-tutoring or pair students with stronger understanding to support each other.
- Targeted Practice: Using feedback from formative assessments, offer additional practice opportunities targeting specific areas where students show difficulty or lack of understanding.

### **• Enrichment:**

- Independent Projects: Allow advanced students to complete enrichment activities related to the unit with teacher guidance/approval.



**General strategies for Language Development:** Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures. Draw connections to L1 (first language).

## Central Bucks School District – Passports & Perspectives

### Unit 3 – *Countries of Europe: Land, Language and Life*

#### **Desired Results:**

##### Essential Questions:

- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How does understanding language patterns and culture help us learn new languages?
- What can familiar words, expressions, and cultural practices teach us about learning a new language?
- How are language and culture connected in everyday communication?

##### **Enduring Understandings:**

Students will understand that...

- the global nature of our society requires us to negotiate meaning through a variety of modalities.
- there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- the study of languages provides the opportunity for critical examination of one's own language and culture.
- with an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

##### **Knowledge:**

Students will know...

- that countries within the same region or language group can have unique identities
- that many languages share similar words and patterns, such as cognates, that help learners understand meaning.
- that colloquial expressions are influenced by culture and often do not translate word-for-word.
- that language and culture are interconnected, and both play an important role in effective communication.
- how to locate countries, continents, oceans, and major landmarks on a map.
- how environmental conditions influence human activities (food, clothing, housing).
- that food, music, art, language, sports, traditions, holidays and celebrations both connect people within a culture and highlight cultural diversity and similarities around the world. These same cultural elements provide insight into how people live and what they value.

##### **Skills:**

Students will be able to...

- research and describe key cultural practices, traditions, languages, and perspectives of a country with which they were not previously familiar.
- explain how language is used in daily life within that country (school, family, community, and media).
- identify important geographic, historical, and social factors that shape life in that country.
- analyze how cultural values influence communication, behaviors, and ways of living.
- compare the country studied to others they have learned about and their own, recognizing both similarities and differences.
- reflect on how learning about unfamiliar cultures builds empathy and awareness.
- use geographic tools and technologies to understand the world around them.
- identify and explain cognates across English and other languages to support comprehension and meaning making.

- interpret common colloquial expressions and explain how their meanings are shaped by culture rather than direct translation.
- use library resources to investigate and present information about cultural traditions from around the world.
- describe connections between language and culture, using examples from everyday communication and authentic contexts.

## **Standards:**

### Priority:

- **Interpretive Communication (ACTFL: Communication)**  
Students interpret meaning in familiar and new languages by recognizing cognates, common expressions, and language patterns.
- **Presentational Communication (ACTFL Communication)**  
Students present research information about a country clearly and purposefully for a specific audience.
- **Language Comparisons (ACTFL: Comparisons)**  
Students compare English and other languages to understand similarities and differences in words, expressions, and meaning.
- **Cultural Comparisons (ACTFL Comparisons)**  
Students compare their own cultural experiences with those of the country they are studying to deepen global understanding.
- **Making Connections (ACTFL Connections)**  
Students connect language learning to other content areas and real-world contexts, including careers and global issues.
- **Acquiring Information (ACTFL Connections)**  
Students locate and use information from a variety of reliable sources to learn about another country.
- **Lifelong Learning (ACTFL Communities)**  
Students understand the value of multilingualism for personal growth, civic engagement, and future opportunities.
- **Relating Cultural Practices and Perspectives (ACTFL Cultures)**  
Students investigate and explain how cultural practices, traditions, and perspectives shape daily life in a specific country.

### Supporting:

#### **Interpretive Communication (ACTFL Communication)**

- Students interpret information from age-appropriate texts, visuals, and media related to a country's culture, geography, and daily life.

#### **Interpersonal Communication (ACTFL Communication)**

- Students engage in conversations to ask and answer questions, share information, and clarify understanding about their country of study.

#### **Language Comparisons (ACTFL Comparisons)**

- Students recognize similarities and differences between their own language and the language(s) used in the country studied.

#### **Making Connections (ACTFL Connections)**

- Students use language and cultural knowledge to deepen their understanding of geography, history, and social structures in another country.

#### **Cultural Comparisons (ACTFL Comparisons)**

- Students compare multiple cultures to recognize similarities, differences, and unique cultural identities.

## **Acceptable Evidence:**

## **Performance Tasks**

- **Cognate Detective Task**  
Students identify and categorize cognates across English and one or more other languages and explain how cognates help with understanding meaning.
- **Colloquial Expressions Comparison**  
Students analyze everyday expressions from English and another language and explain why the meaning does not translate word-for-word.
- **Culture in Language**  
Students explore examples of how culture influences language use (such as greetings, idioms, or informal expressions) using visuals or short explanations.
- **Language Comparison Reflection**  
Students write or record a reflection explaining similarities and differences between English and another language and how those comparisons support language learning.
- **Interpretive Language Task**  
Students interpret simple and authentic texts, visuals, or spoken examples containing cognates or colloquial expressions and demonstrate understanding through matching, explaining, or paraphrasing.
- **Language Learning Strategies Self-Assessment**  
Students identify strategies they used (recognizing cognates, using context, considering culture) and explain how these strategies help them learn new languages.

## **Acceptable evidence of learning other than Performance Tasks:**

### **Formative Assessment**

- **Entrance/exit tickets**
- **Class discussions or think-pair-share responses**
- **Completed graphic organizers**
- **Reflection journals or learning logs** describing language learning strategies and cultural insights and reflecting on essential questions of the course.
- **Quick writes or short constructed responses**
- **Self-assessments or checklists** where students reflect on and evaluate their understanding/learning.
- **Vocabulary or concept quizzes**
- **Visual evidence** such as anchor charts, concept maps, or student-created posters that show understanding of language and culture.

### **Summative Unit Assessment**

#### **Description:**

Students complete a summative portfolio project for each unit that includes geography, elements of culture (food, music, art, language, celebrations, sports etc.), demographics, and language. This is broken down into several due dates and collected throughout the unit, culminating in a presentation to the class. Each of the tasks below collectively result in the portfolio project for each unit.

#### **Students will:**

- Select a country on the continent and use a graphic organizer to research.
- Explore and report on the demographics and geography of that country.
- Research a language spoken in their selected country and present their findings to the class. They will also teach several words and phrases from that language to the class.
- Research a cultural topic connected to their country (food, music, art, language, celebrations, sports etc.).
- Confer with the teacher about their research and findings.
- Create a presentation for the class encompassing all the above elements while classmates take notes with a provided note taker.

#### **Format options:**

- PowerPoint/Canva/Sway
- Video
- Poster

#### **Evidence of learning:**

- Students accurately research and communicate information about a selected country.
- Students present findings about a language and demonstrate effective presentation skills.
- Students create a visual product that explains a cultural element and its significance.

## **Suggested Learning Experiences and Instruction**

### **Learning Experiences:**

#### **Cognate Discovery Activity**

Students examine words from English and another language to identify cognates and discuss how those words help them understand meaning.

#### **Colloquialisms in Context**

Students explore everyday expressions (phrases, idioms, greetings) and determine how meaning changes when culture is considered.

#### **Language Comparison Stations**

Students rotate through stations that highlight similarities and differences between English and other languages (words, expressions, sentence patterns).

#### **Culture and Language Case Study**

Students analyze short examples (videos, images, dialogue samples) showing how culture influences how people speak and interact.

#### **Language Learning Reflection**

Students reflect on what they notice about how languages work and which strategies help them make meaning.

#### **Launching Curiosity: What Do We Know / Need to Know?**

Students examine the name, location, images, or symbols of an unfamiliar country and generate initial questions to guide learning.

#### **Country Context Model-Lessons**

Teacher models by introducing key background elements such as geography, history, government, and regional context to support understanding.

#### **Guided Source Evaluation Workshop**

Students learn how to identify reliable sources and practice evaluating texts, videos, maps, and visuals for accuracy and relevance.

#### **Culture Through Daily Life Exploration**

Students explore school routines, family life, food, celebrations, transportation, and media to understand how culture shapes everyday experiences.

#### **Language in Action Analysis**

Students examine how language is used in authentic contexts (signs, media clips, school schedules, menus) to see how language functions in daily life.

#### **Think-Pair-Share Checkpoints**

Regular opportunities for students to share new insights, ask questions, and clarify misunderstandings with peers.

#### **Perspective-Taking Activities**

Students consider questions such as *“What might feel unfamiliar to me, and why?”* or *“How would daily life be different if I lived here?”*

#### **Comparative Discussions**

Students compare the unfamiliar country to countries previously studied, focusing on values, practices, and ways of living.

#### **Reflection**

Students journal or discuss how their thinking changes as they learn more about a culture different from their own.

### **Instructional Strategies:**

#### **Inquiry-Driven Instruction**

Students investigate guiding questions about an unfamiliar country to promote curiosity, problem-solving, and deeper understanding.

#### **Scaffolded Research Support**

Teachers break the research process into manageable steps (questioning, sourcing, note-taking, synthesizing) with clear checkpoints.

#### **Modeling and Think-Alouds**

Teachers demonstrate how to analyze sources, identify cultural perspectives, and draw conclusions from information.

#### **Explicit Culture-Perspective Instruction**

Instruction and facilitating conversations based on essential questions highlights how values, beliefs, and perspectives influence daily life, communication, and behaviors.

#### **Use of Graphic Organizers and Visual Tools**

Visual supports help students organize information about geography, culture, language use, and daily life.

#### **Collaborative Learning Structures**

Partner and small-group discussions allow students to share findings, ask questions, and refine understanding.

#### **Explicit instruction with modeling**

Teachers model how to identify cognates, use context clues, and think aloud when interpreting unfamiliar language.

#### **Guided discussion and questioning**

Students explain their thinking and respond to questions that emphasize language–culture connections.

#### **Visual supports and graphic organizers**

Charts, Venn diagrams, and anchor charts support comparisons and pattern recognition.

#### **Collaborative learning**

Students work in pairs or small groups to analyze language examples and share perspectives.

#### **Reflection**

Students regularly reflect individually and together on how they are learning language and which strategies are effective. Students reflect on how their thinking evolves as they learn about an unfamiliar cultures, building empathy, and self-awareness.

#### **Student Choice Within Structure**

While the country is unfamiliar, students have flexibility in focus topics, sources, and presentation formats to increase engagement.

### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with templates, organizers, and conference time. Collaborate with the librarian to explore the resources through the library.
  - Challenge: Offer more complex sentence translations, creative writing prompts, or research projects on specific linguistic elements.
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing a map, creating graphic organizers / timelines, participating in pronunciation drills or debates).
- **Intervention:**
  - Teacher/Student Conferencing
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups. Utilize peer-tutoring or pair students with stronger understanding to support each other.
  - Targeted Practice: Using feedback from formative assessments, offer additional practice opportunities targeting specific areas where students show difficulty or lack of understanding.
- **Enrichment:**

- Independent Projects: Allow advanced students to complete enrichment activities related to the unit with teacher guidance/approval.

**General strategies for Language Development:** Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures. Draw connections to L1 (first language).

**Central Bucks School District – Passports & Perspectives**  
**Unit 4 – *Countries of South America: Land, Language and Life***

**Desired Results:**

Essential Questions:

- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How does understanding language patterns and culture help us learn new languages?
- What can familiar words, expressions, and cultural practices teach us about learning a new language?
- How are language and culture connected in everyday communication?

**Enduring Understandings:**

Students will understand that...

- the global nature of our society requires us to negotiate meaning through a variety of modalities.
- there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- the study of languages provides the opportunity for critical examination of one's own language and culture.
- with an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Knowledge:**

Students will know...

- that countries within the same region or language group can have unique identities
- that many languages share similar words and patterns, such as cognates, that help learners understand meaning.
- that colloquial expressions are influenced by culture and often do not translate word-for-word.
- that language and culture are interconnected, and both play an important role in effective communication.
- how to locate countries, continents, oceans, and major landmarks on a map.
- how environmental conditions influence human activities (food, clothing, housing).
- that food, music, art, language, sports, traditions, holidays and celebrations both connect people within a culture and highlight cultural diversity and similarities around the world. These same cultural elements provide insight into how people live and what they value.

**Skills:**

Students will be able to...

- research and describe key cultural practices, traditions, languages, and perspectives of a country with which they were not previously familiar.
- explain how language is used in daily life within that country (school, family, community, and media).
- identify important geographic, historical, and social factors that shape life in that country.
- analyze how cultural values influence communication, behaviors, and ways of living.
- compare the country studied to others they have learned about and their own, recognizing both similarities and differences.
- reflect on how learning about unfamiliar cultures builds empathy and awareness.
- use geographic tools and technologies to understand the world around them.
- identify and explain cognates across English and other languages to support comprehension and meaning making.



- interpret common colloquial expressions and explain how their meanings are shaped by culture rather than direct translation.
- use library resources to investigate and present information about cultural traditions from around the world.
- describe connections between language and culture, using examples from everyday communication and authentic contexts.

## **Standards:**

### Priority:

- **Interpretive Communication (ACTFL: Communication)**  
Students interpret meaning in familiar and new languages by recognizing cognates, common expressions, and language patterns.
- **Presentational Communication (ACTFL Communication)**  
Students present research information about a country clearly and purposefully for a specific audience.
- **Language Comparisons (ACTFL: Comparisons)**  
Students compare English and other languages to understand similarities and differences in words, expressions, and meaning.
- **Cultural Comparisons (ACTFL Comparisons)**  
Students compare their own cultural experiences with those of the country they are studying to deepen global understanding.
- **Making Connections (ACTFL Connections)**  
Students connect language learning to other content areas and real-world contexts, including careers and global issues.
- **Acquiring Information (ACTFL Connections)**  
Students locate and use information from a variety of reliable sources to learn about another country.
- **Lifelong Learning (ACTFL Communities)**  
Students understand the value of multilingualism for personal growth, civic engagement, and future opportunities.
- **Relating Cultural Practices and Perspectives (ACTFL Cultures)**  
Students investigate and explain how cultural practices, traditions, and perspectives shape daily life in a specific country.

### Supporting:

#### **Interpretive Communication (ACTFL Communication)**

- Students interpret information from age-appropriate texts, visuals, and media related to a country's culture, geography, and daily life.

#### **Interpersonal Communication (ACTFL Communication)**

- Students engage in conversations to ask and answer questions, share information, and clarify understanding about their country of study.

#### **Language Comparisons (ACTFL Comparisons)**

- Students recognize similarities and differences between their own language and the language(s) used in the country studied.

#### **Making Connections (ACTFL Connections)**

- Students use language and cultural knowledge to deepen their understanding of geography, history, and social structures in another country.

#### **Cultural Comparisons (ACTFL Comparisons)**

- Students compare multiple cultures to recognize similarities, differences, and unique cultural identities.

## **Acceptable Evidence:**

## Performance Tasks

- **Cognate Detective Task**  
Students identify and categorize cognates across English and one or more other languages and explain how cognates help with understanding meaning.
- **Colloquial Expressions Comparison**  
Students analyze everyday expressions from English and another language and explain why the meaning does not translate word-for-word.
- **Culture in Language**  
Students explore examples of how culture influences language use (such as greetings, idioms, or informal expressions) using visuals or short explanations.
- **Language Comparison Reflection**  
Students write or record a reflection explaining similarities and differences between English and another language and how those comparisons support language learning.
- **Interpretive Language Task**  
Students interpret simple and authentic texts, visuals, or spoken examples containing cognates or colloquial expressions and demonstrate understanding through matching, explaining, or paraphrasing.
- **Language Learning Strategies Self-Assessment**  
Students identify strategies they used (recognizing cognates, using context, considering culture) and explain how these strategies help them learn new languages.

## Acceptable evidence of learning other than Performance Tasks:

### Formative Assessment

- **Entrance/exit tickets**
- **Class discussions or think-pair-share responses**
- **Completed graphic organizers**
- **Reflection journals or learning logs** describing language learning strategies and cultural insights and reflecting on essential questions of the course.
- **Quick writes or short constructed responses**
- **Self-assessments or checklists** where students reflect on and evaluate their understanding/learning.
- **Vocabulary or concept quizzes**
- **Visual evidence** such as anchor charts, concept maps, or student-created posters that show understanding of language and culture.

### Summative Unit Assessment

#### Description:

Students complete a summative portfolio project for each unit that includes geography, elements of culture (food, music, art, language, celebrations, sports etc.), demographics, and language. This is broken down into several due dates and collected throughout the unit, culminating in a presentation to the class. Each of the tasks below collectively result in the portfolio project for each unit.

#### Students will:

- Select a country on the continent and use a graphic organizer to research.
- Explore and report on the demographics and geography of that country.
- Research a language spoken in their selected country and present their findings to the class. They will also teach several words and phrases from that language to the class.
- Research a cultural topic connected to their country (food, music, art, language, celebrations, sports etc.).
- Confer with the teacher about their research and findings.
- Create a presentation for the class encompassing all the above elements while classmates take notes with a provided note taker.

#### Format options:

- PowerPoint/Canva/Sway
- Video
- Poster

#### **Evidence of learning:**

- Students accurately research and communicate information about a selected country.
- Students present findings about a language and demonstrate effective presentation skills.
- Students create a visual product that explains a cultural element and its significance.

## **Suggested Learning Experiences and Instruction**

### **Learning Experiences:**

#### **Cognate Discovery Activity**

Students examine words from English and another language to identify cognates and discuss how those words help them understand meaning.

#### **Colloquialisms in Context**

Students explore everyday expressions (phrases, idioms, greetings) and determine how meaning changes when culture is considered.

#### **Language Comparison Stations**

Students rotate through stations that highlight similarities and differences between English and other languages (words, expressions, sentence patterns).

#### **Culture and Language Case Study**

Students analyze short examples (videos, images, dialogue samples) showing how culture influences how people speak and interact.

#### **Language Learning Reflection**

Students reflect on what they notice about how languages work and which strategies help them make meaning.

#### **Launching Curiosity: What Do We Know / Need to Know?**

Students examine the name, location, images, or symbols of an unfamiliar country and generate initial questions to guide learning.

#### **Country Context Model-Lessons**

Teacher models by introducing key background elements such as geography, history, government, and regional context to support understanding.

#### **Guided Source Evaluation Workshop**

Students learn how to identify reliable sources and practice evaluating texts, videos, maps, and visuals for accuracy and relevance.

#### **Culture Through Daily Life Exploration**

Students explore school routines, family life, food, celebrations, transportation, and media to understand how culture shapes everyday experiences.

#### **Language in Action Analysis**

Students examine how language is used in authentic contexts (signs, media clips, school schedules, menus) to see how language functions in daily life.

#### **Think-Pair-Share Checkpoints**

Regular opportunities for students to share new insights, ask questions, and clarify misunderstandings with peers.

#### **Perspective-Taking Activities**

Students consider questions such as *“What might feel unfamiliar to me, and why?”* or *“How would daily life be different if I lived here?”*

#### **Comparative Discussions**

Students compare the unfamiliar country to countries previously studied, focusing on values, practices, and ways of living.

#### **Reflection**

Students journal or discuss how their thinking changes as they learn more about a culture different from their own.

## **Instructional Strategies:**

### **Inquiry-Driven Instruction**

Students investigate guiding questions about an unfamiliar country to promote curiosity, problem-solving, and deeper understanding.

### **Scaffolded Research Support**

Teachers break the research process into manageable steps (questioning, sourcing, note-taking, synthesizing) with clear checkpoints.

### **Modeling and Think-Alouds**

Teachers demonstrate how to analyze sources, identify cultural perspectives, and draw conclusions from information.

### **Explicit Culture-Perspective Instruction**

Instruction and facilitating conversations based on essential questions highlights how values, beliefs, and perspectives influence daily life, communication, and behaviors.

### **Use of Graphic Organizers and Visual Tools**

Visual supports help students organize information about geography, culture, language use, and daily life.

### **Collaborative Learning Structures**

Partner and small-group discussions allow students to share findings, ask questions, and refine understanding.

### **Explicit instruction with modeling**

Teachers model how to identify cognates, use context clues, and think aloud when interpreting unfamiliar language.

### **Guided discussion and questioning**

Students explain their thinking and respond to questions that emphasize language–culture connections.

### **Visual supports and graphic organizers**

Charts, Venn diagrams, and anchor charts support comparisons and pattern recognition.

### **Collaborative learning**

Students work in pairs or small groups to analyze language examples and share perspectives.

### **Reflection**

Students regularly reflect individually and together on how they are learning language and which strategies are effective. Students reflect on how their thinking evolves as they learn about an unfamiliar cultures, building empathy, and self-awareness.

### **Student Choice Within Structure**

While the country is unfamiliar, students have flexibility in focus topics, sources, and presentation formats to increase engagement.

## **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with templates, organizers, and conference time. Collaborate with the librarian to explore the resources through the library.
  - Challenge: Offer more complex sentence translations, creative writing prompts, or research projects on specific linguistic elements.
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing a map, creating graphic organizers / timelines, participating in pronunciation drills or debates).
- **Intervention:**
  - Teacher/Student Conferencing
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups. Utilize peer-tutoring or pair students with stronger understanding to support each other.
  - Targeted Practice: Using feedback from formative assessments, offering additional practice opportunities targeting specific areas where students show difficulty or lack of understanding.
- **Enrichment:**

- Independent Projects: Allow advanced students to complete enrichment activities related to the unit with teacher guidance/approval.

**General strategies for Language Development:** Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures. Draw connections to L1 (first language).

**CENTRAL BUCKS SCHOOL DISTRICT**

**Course of Study  
Recommendation for Adoption**

**Course: Passports and Perspectives**

**Date: May 4, 2026**

**Student Level: Middle School**

**Grade Level: 7-8**

**Characterization of Course of Study:**

*Passports & Perspectives* provides middle school students with an engaging introduction to languages and cultures around the world. The course emphasizes vocabulary strategies, pattern recognition, basic communication skills, and cultural comparisons to help students understand how language reflects identity and values. Through interactive learning and guided exploration of continents, students build curiosity, global awareness, and appreciation for diverse perspectives, laying a strong foundation for future language study and cultural experiences.

**Reasons for Proposed Adoption:**

The *Passports & Perspectives* course is proposed for adoption to provide students with an engaging, culturally responsive course that builds foundational language skills, global awareness, and academic confidence. The course supports vocabulary development, pattern recognition, reading comprehension, and communication strategies that reinforce skills used across content areas. In addition, *Passports & Perspectives* serves as a flexible instructional option within the district's Multitiered System of Supports (MTSS), offering a meaningful supplement to intervention by engaging students in purposeful, standards-aligned learning while supporting language development, critical thinking, and student motivation.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## French 1A

Course Number: 4070

Course Level: Middle School

Grade: 7-8

Time/Credit: 47 minutes every day  
1 credit

Development Date: November 4, 2025

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## **World Languages Department Learning Principles**

Students of World Languages simulate authentic experiences, compare and contrast other languages and cultures, promote tolerance, and make connections with other disciplines.

World Languages programs integrate studying and experiencing the culture(s) in which the world language is used.

The World Languages discipline connects with all the other disciplines.

The learner is at the center of effective World Languages instruction.

World Languages programs should reflect the developmental nature of language acquisition.

The complexity of teaching a World Language requires teachers to reflect on their practice and match knowledge of the discipline with appropriate teaching, while assessing strategies to achieve learning goals.

Differentiated instruction addresses student strengths, interests and learning styles.

World Language learners achieve proficiency through performance-based assessments including speaking, reading, writing, and listening.

To achieve reality-based language learning, the world language acquisition must include technology-based instruction and practice.

World language educators create awareness, incite curiosity, and encourage appreciation of the language and culture being learned.

Sources: World Languages Curriculum Framework Making Connections

### World-Readiness Standards for Learning Languages

| Goal Area     | Standard                                       | Description                                                                                                                                            |
|---------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communication | Interpersonal Communication                    | Learners interact and negotiate meaning in spoken, signed, or written conversations to share information, reactions, feelings, and opinions.           |
| Communication | Interpretive Communication                     | Learners understand, interpret, and analyze what is heard, read, or viewed on a variety of topics.                                                     |
| Communication | Presentational Communication                   | Learners present information, concepts, and ideas to inform, explain, persuade, and narrate on a variety of topics for different audiences.            |
| Cultures      | Relating Cultural Practices to Perspectives    | Learners investigate, explain, and reflect on the relationship between the practices and perspectives of the cultures studied.                         |
| Cultures      | Relating Cultural Products to Perspectives     | Learners investigate, explain, and reflect on the relationship between the products and perspectives of the cultures studied.                          |
| Connections   | Making Connections                             | Learners build, reinforce, and expand their knowledge of other disciplines while using the language to think critically and solve problems creatively. |
| Connections   | Acquiring Information and Diverse Perspectives | Learners access and evaluate information and diverse perspectives available through the language and its cultures.                                     |
| Comparisons   | Language Comparisons                           | Learners investigate, explain, and reflect on the nature of language through comparisons between the language studied and their own.                   |
| Comparisons   | Cultural Comparisons                           | Learners investigate, explain, and reflect on the concept of culture through comparisons between the cultures studied and their own.                   |
| Communities   | School and Global Communities                  | Learners use the language within and beyond the classroom to interact and collaborate in their community and the globalized world.                     |
| Communities   | Lifelong Learning                              | Learners set goals and reflect on their progress in using languages for enjoyment, enrichment, and advancement.                                        |

**Central Bucks School District**  
**World Languages Department Enduring Understandings**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Central Bucks School District**  
**World Languages Department Essential Questions**

1. How does an individual express his or her basic needs and wants in the target language?
2. How are your language and culture affected by others? How are other languages and cultures affected by yours?
3. How and why can you use the target language to further your career and personal enrichment?
4. How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
5. When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

## Central Bucks School District – Course of Study Overview

### French 1A

#### Desired Results

**Course Description:** French 1A is an introductory course where students begin developing skills in listening, speaking, reading, and writing in French. Students will learn to greet others, introduce themselves, describe family and friends, talk about school life and daily activities, and express likes, dislikes, and preferences. Cultural explorations of French-speaking regions such as France, Canada, Algeria, Tunisia, Morocco, and Martinique are integrated throughout the course to build global awareness and appreciation. By the end of French 1A, students will be able to communicate about familiar topics in simple sentences and engage in novice conversations in the target language.

Prerequisite: None

Students will be able to:

- Introduce themselves and others using basic French greetings and courtesy expressions.
- Exchange information about their identity, nationality, and personal characteristics.
- Identify and describe people, classroom objects, school subjects, and daily activities.
- Ask and answer simple questions and participate in brief conversations.
- Communicate about school life, schedules, and everyday routines.
- Tell time and discuss dates, days of the week, and months of the year.
- Describe family members, friends, pets, and occupations.
- Use adjectives to describe people, places, and things.
- Express possession and location using appropriate vocabulary and grammatical structures.
- Understand and use high-frequency French vocabulary related to school, family, and daily life.
- Compare cultural practices and perspectives from France, Québec, the Maghreb, and other French-speaking communities.
- Demonstrate beginning proficiency in listening, speaking, reading, and writing in French.

#### Acceptable Evidence.

District Unit IPAs

District Final IPAs

Other tests, quizzes, projects, and activities will be included at the discretion of the teacher throughout the units in each course to check for understanding of essential skills, vocabulary, grammar, and culture.

#### Course Grading:

World Languages IPA Statement:

Beginning in the fall of 2021, the Central Bucks World Languages Department in each middle and high school will use assessments that are called IPAs which stand for Integrated Performance Assessments. They will occur throughout each unit as formative performance-based assessments. Additionally, they will be given at the end of each unit as common district summative assessments, and at the end of each course as common district final summative assessments. IPAs assess the progress that language students are making in building their proficiency through the World-Readiness Standards and were created by ACTFL (American Council on the

Teaching of Foreign Languages). The Integrated Performance Assessment (IPA) is a cluster assessment featuring three tasks, each of which reflects one of the three modes of communication: Interpretive, Interpersonal, and Presentational. The three tasks are aligned within a single theme or content area, reflecting the way students naturally acquire and **use** the language in the real world or the classroom. The final summative IPAs given at the end of each course (formerly called final assessments) account for 10% of the total grade and are placed into the final exam category in the gradebook.

Breakdown of the gradebook percentages for grades 7-8 for 36-week courses.

22.5% for Marking Period 1

22.5% for Marking Period 2

22.5% for Marking Period 3

22.5% for Marking Period 4

10% for Final Exam

## French 1A – Pacing Guide and Instructional Time

The following times are approximations and therefore, are guidelines inclusive of teaching, reviewing and assessing, to ensure completion of the course within the middle school year.  
Grammar, Vocabulary and Culture are all integrated in World Languages lessons.

| Content                                     | Instructional Time         |
|---------------------------------------------|----------------------------|
| <b>Preliminary Unit: French Foundations</b> | <b>Weeks 1-7</b>           |
| Week 1: Greetings and introductions         | 5 days                     |
| Week 2: Numbers and alphabet                | 5 days                     |
| Week 3: Questions and classroom expressions | 5 days                     |
| Week 4: Dates and calendar                  | 5 days                     |
| Week 5: Francophone world exploration       | 5 days                     |
| Week 6: Communication practice              | 5 days                     |
| Week 7: Formative Assessments               | 5 days                     |
| <b>Unit 1: Introductions</b>                | <b>Weeks 8-17</b>          |
| Week 8: Greetings and manners               | 5 days                     |
| Week 9: Introducing yourself                | 5 days                     |
| Week 10: Introducing others                 | 5 days                     |
| Week 11: Personal information               | 5 days                     |
| Week 12: Basic conversations                | 5 days                     |
| Week 13: Preferences and opinions           | 5 days                     |
| Week 14: France and culture                 | 5 days                     |
| Week 15: Communication activities           | 5 days                     |
| Week 16: Formative Assessments              | 5 days throughout the unit |
| Week 17: Unit IPAs                          | 5 days                     |
| <b>Unit 2: Academic Life</b>                | <b>Weeks 18-27</b>         |
| Week 18: Classes and schedules              | 5 days                     |
| Week 19: School supplies                    | 5 days                     |
| Week 20: School routines                    | 5 days                     |
| Week 21: Daily activities                   | 5 days                     |
| Week 22: Preferences                        | 5 days                     |
| Week 23: Academic conversations             | 5 days                     |
| Week 24: Quebec culture                     | 5 days                     |
| Week 25: Communication activities           | 5 days                     |
| Week 26: Formative Assessments              | 5 days throughout the unit |
| Week 27: Unit IPAs                          | 5 days                     |
| <b>Unit 3: Family and Friends</b>           | <b>Weeks 28-36</b>         |
| Week 28: Family members                     | 5 days                     |
| Week 29: Relationships                      | 5 days                     |
| Week 30: Physical descriptions              | 5 days                     |

|                                |                            |
|--------------------------------|----------------------------|
| Week 31: Personality traits    | 5 days                     |
| Week 32: Occupations           | 5 days                     |
| Week 33: Family life           | 5 days                     |
| Week 34: Maghreb culture       | 5 days                     |
| Week 35: Formative Assessments | 5 days throughout the unit |
| Week 36: Final IPAs            | 5 days                     |

**NOTE:** Enrichment opportunities will be provided to meet the needs of students that acquire an understanding of the content before their peers. Enrichment will be provided after students have completed the work assigned to all students and will be an extension activity with the same theme.

#### **Required Texts and Software**

VHL Central by Vista Higher Learning Supersite Platform (6 year license)

Chemins 1A ISBN# 9978-1-66993-026-6 Student Edition Hardcover

**Supplemental Sites:** Microsoft 365 Tools, Gale Library Resources, Classlink, Quizlet, Blooket, Gimkit, EdPuzzle, Canvas, Wordwall, Kahoot etc.



## **Central Bucks School District – Course of Study – French 1A**

### **Preliminary Unit: French Foundations**

#### **Desired Results:**

##### **Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

##### **Enduring Understandings:**

###### **Students will understand that...**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

##### **Knowledge:**

###### **Students will know...**

- How to greet others, introduce themselves, and exchange basic personal information in French.
- How to identify and describe countries, nationalities, and locations in the French-speaking world.
- How to use the French alphabet and numbers 0–31 to communicate information.
- How to use common classroom vocabulary and expressions to participate in classroom interactions.
- How to communicate days of the week, months of the year, and simple dates.
- The diversity and global influence of French-speaking cultures around the world.

##### **Skills:**

###### **Students will be able to:**

- introduce themselves and ask someone's name.
- talk about countries, capitals, and nationalities.
- ask and tell about ages and birthdays.
- ask and answer basic questions using interrogatives.
- identify regions around the world where French is spoken.
- identify classroom objects and school subjects.
- understand the teacher's instructions and use classroom expressions.

- talk about a schedule.
- identify francophone cultural products and practices and reflect on perspectives related to them.

## **Standards:**

### Priority:

#### **Interpersonal Communication**

- Students can introduce themselves and others, exchange basic personal information, and discuss where they are from.

#### **Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to greetings, introductions, classroom language, school subjects, and personal information.

#### **Presentational Communication**

- Students can present basic information about themselves, including their name, age, birthday, nationality, and school experience.

#### **Cultural Understanding**

- Students can identify French-speaking countries and recognize the global presence and cultural diversity of the Francophone world.

### Supporting:

#### **Language Structures and Vocabulary**

- Students apply foundational vocabulary and grammar, including the verb **être**, numbers, school-related vocabulary, and nationality expressions to communicate meaning.

#### **Language Learning Strategies**

- Students use basic language-learning strategies, such as cognates, visuals, repetition, context clues, and spelling patterns, to improve comprehension and communication.

#### **Cultural Connections**

- Students explore French names, text messaging conventions, and cultural and geographic aspects of the Francophone world to deepen their understanding of language and culture.

## **Acceptable Evidence:**

### **Performance Tasks –**

- **Getting-to-Know-You Conversation** – Introduce yourself and exchange basic personal information, including name, age, birthday, nationality, and place of origin.
- **Personal Introduction Presentation** – Create and present a brief introduction about yourself using target vocabulary and structures.
- **Classroom and School Showcase** – Describe classroom objects, school subjects, and a typical school schedule in French.
- **Francophone World Project** – Research and present information about a French-speaking country or region, highlighting language and cultural features.
- **Spelling and Information Exchange Activity** – Participate in a conversation that requires spelling names and sharing personal information using the French alphabet and numbers.
- **School Schedule Presentation** – Create and explain a class schedule, including subjects, days of the week, and times.
- **Interpretive Culture Task** – Read, listen to, or view an authentic resource about the Francophone world and demonstrate comprehension through written or oral responses.

## Acceptable evidence of learning other than Performance Tasks:

### Formative Assessments

- Vocabulary and grammar **quizzes** on greetings, introductions, numbers, nationalities, and classroom language.
- **Listening comprehension activities** focused on personal information and classroom interactions.
- **Reading comprehension activities** using short texts about students, schools, and French-speaking countries.
- Exit tickets and quick **checks for understanding**.
- Guided **writing activities** about personal information, school subjects, and schedules .
- Workbook, classwork, and **online practice assignments**.
- Partner and **small-group activities**.
- Self-assessments and **reflection activities** on language growth.
- **Cultural reflection activities** related to the Francophone world.

### Summative Assessments

- Preliminary Unit Assessment

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Participate in introductory **conversations** using greetings, introductions, and courtesy expressions.
- Practice **spelling** names and words using the French alphabet.
- Conduct **class surveys** about age, birthdays, nationalities, and countries of origin.
- Create a **personal profile** that includes name, age, birthday, nationality, and interests.
- Label and **describe classroom objects** and school subjects in French.
- Create and share a **class schedule** using days of the week, months, and school vocabulary.
- **Explore maps** of the Francophone world and identify French-speaking countries and regions.
- **Compare school life and cultural practices** in France and other French-speaking communities.
- Engage with **authentic resources** such as videos, songs, infographics, and images from the Francophone world.
- Participate in **interactive games and activities** to practice numbers, vocabulary, and classroom expressions.

### Instructional Strategies:

- Use **comprehensible input** and **TPR** supported by visuals, gestures, realia, and modeling to introduce greetings, introductions, numbers, and classroom vocabulary.
- Facilitate **structured partner and small-group conversations** to practice greetings, personal information, and classroom interactions.
- Incorporate **repetition and recycling of high-frequency vocabulary** through daily routines and warm-up activities.
- Use **interactive games and movement-based activities** to reinforce the French alphabet, numbers, days, and months.
- Model and provide guided practice with the verb **être** and other foundational language structures in meaningful contexts.
- Integrate **authentic cultural resources** such as maps, videos, songs, and images from the Francophone world.
- Use **graphic organizers and visual supports** to build vocabulary and cultural understanding.

- Implement **think-pair-share, turn-and-talk, and information-gap activities** to encourage interpersonal communication.
- Conduct **frequent formative assessments** through exit tickets, quick checks for understanding, and oral comprehension activities.
- Encourage the use of **language-learning strategies** such as cognates, context clues, repetition, and asking for clarification to support comprehension and communication.

#### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

#### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# Central Bucks School District – Course of Study – French 1A

## Unit 1 – Introductions

### **Desired Results:**

#### **Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### **Enduring Understandings:**

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### **Knowledge:**

Students will know...

- Vocabulary related to greetings, introductions, courtesy expressions, numbers 0–60, classroom objects, subject pronouns, and the verb **être**.
- Cultural connections to the geography, diversity, and global influence of France.

#### **Skills:**

**Students will be able to...**

- **Greet** people, make introductions, describe myself and others, and make plans using cognates.
- **Identify** words and phrases used to greet and introduce people.
- **Spell** words in French by accurately pronouncing the letters and accent marks.
- **Understand** greetings, introductions, and short interactions among people.
- **Recognize** cultural norms and behaviors in the francophone world.
- **Greet** people appropriately in various social situations.
- **Identify** familiar objects and people.
- **Express** how many people and items there are.
- **Comprehend** the message of a short authentic ad using visuals and familiar context.
- **Identify** school supplies and familiar objects.
- **Identify** whether consonants at the end of a word are pronounced or silent.

- **Identify** people and objects related to academic life.
- **Identify** and reflect on stereotypes in my own and other cultures.
- **Describe** people, places, and things.
- **Understand** the gist of a conversation by listening for familiar words.
- **Identify** French cultural products and relate them to perspectives in my own and other cultures.

## **Standards:**

### Priority:

#### **Interpersonal Communication**

- Students can greet others, introduce themselves and others, exchange basic personal information, and participate in simple classroom interactions in French.

#### **Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to greetings, introductions, classroom objects, and personal information.

#### **Presentational Communication**

- Students can present basic information about themselves, their classmates, and their classroom using simple sentences and appropriate vocabulary.

#### **Cultural Understanding**

- Students can identify cultural practices, perspectives, and aspects of identity within France and the Francophone world.

#### **Language Structures and Vocabulary**

- Students apply foundational vocabulary and grammar, including nouns and articles, subject pronouns, the verb **être**, adjective agreement, and numbers, to communicate meaning.

### Supporting:

#### **Language Learning Strategies**

- Students use cognates, visuals, repetition, context clues, and communication strategies to improve comprehension and participation in French.

#### **Cultural Connections**

- Students explore French identity, diversity, and the role of the French language in communities around the world.

## **Acceptable Evidence:**

### **Performance Tasks –**

- **Greetings and Introductions Role-Play** – Participate in a conversation introducing yourself and others, exchanging basic personal information, and using appropriate courtesy expressions.
- **My Classroom Presentation** – Create and present a brief description of your classroom, school subjects, and common classroom objects.
- **Student Profile Project** – Create a personal profile including name, age, nationality, physical description, and interests using target vocabulary and grammar.
- **Classmate Interview** – Conduct an interview with a classmate and present information about that person to the class.
- **France and the Francophone World Presentation** – Research and present key information about a French-speaking country or region.

- **Describing People Task** – Describe family members, friends, or well-known figures using adjectives and appropriate grammatical structures.
- **Interpretive Reading or Listening Task** – Demonstrate understanding of an authentic text, video, or audio recording related to school life, greetings, or Francophone culture.
- **School Schedule Presentation** – Present a typical school day, including subjects, times, and daily routines using target language.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessments

- **Vocabulary quizzes** on greetings, introductions, classroom objects, school subjects, family, and descriptive adjectives.
- **Grammar quizzes** assessing nouns and articles, subject pronouns, **être**, **avoir**, adjective agreement, and question formation.
- **Listening comprehension activities** using short dialogues and classroom interactions.
- **Reading comprehension activities** related to school life, family, and Francophone cultures.
- Exit tickets and quick **checks for understanding**.
- Guided **writing activities** about personal information, school, family, and friends.
- Workbook, classwork, and **online practice assignments**.
- Self-assessments and **reflections** on language growth and communication skills.
- Cultural **reflection activities** related to France, and the Francophone world.

#### Summative Assessments

- Unit 1 IPAs

## Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Participate in greetings, introductions, and courtesy-expression **role-plays**.
- Conduct partner **interviews** to exchange personal information and introduce classmates.
- Practice **spelling names and words** using the French alphabet.
- Create a personal identity **profile** that includes age, birthday, nationality, and place of origin.
- **Label and describe classroom objects** and school subjects using French vocabulary.
- **Explore and compare school life** in France and other Francophone communities.
- Create and present a visual representation of a typical **school schedule**.
- **Use maps** to identify French-speaking countries, capitals, and regions around the world.
- Investigate aspects of French identity, diversity, and Francophone cultures through **authentic resources**.
- Participate in **interactive vocabulary games** and collaborative speaking activities focused on numbers, dates, classroom language, and personal information.

#### Instructional Strategies:

- Use **comprehensible input** supported by visuals, gestures, realia, and modeling to introduce greetings, introductions, classroom vocabulary, numbers, dates, and personal information.
- Facilitate **structured partner and small-group conversations** to develop interpersonal communication skills.
- Incorporate **daily vocabulary review and repetition** to build fluency with high-frequency words and expressions.

- Model and provide guided practice with foundational grammar, including **être**, adjectives, nouns, articles, and question formation.
- Use **interactive games, songs, and movement-based activities** to reinforce alphabet, number, and vocabulary acquisition.
- Integrate **authentic cultural resources** such as maps, videos, images, and short texts from the Francophone world.
- Employ **graphic organizers and visual supports** to strengthen vocabulary retention and cultural understanding.
- Implement **think-pair-share, information-gap activities, and interviews** to encourage meaningful communication.
- Use **frequent formative assessments** such as exit tickets, quick writes, and comprehension checks to monitor progress.
- Encourage students to apply **language-learning strategies** such as using cognates, context clues, repetition, and asking for clarification to support comprehension and communication.

#### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

#### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.



# Central Bucks School District – Course of Study – French 1A

## Unit 2 – Academic Life

### Desired Results:

#### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### Enduring Understandings:

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### Knowledge:

Students will know...

- School schedules and daily activities can be discussed using specific French vocabulary and expressions.
- Time can be communicated using French conventions for telling time.
- Questions and negative statements follow specific grammatical patterns in French.
- The verb **avoir** and regular **-ER verbs** are commonly used to discuss school life and daily routines.
- School systems and educational experiences can vary across cultures.
- France and Québec have distinct cultural and educational traditions, including the importance of the **Baccalauréat (BAC)** in France.

#### Skills:

Students will be able to...

- **Understand** conversations about nationalities.
- **Talk** about school-related topics using cognates.
- **Identify** words and phrases related to academic life.
- **Identify** when the final consonants in French words are pronounced.
- **Understand** the secondary school systems in France and Canada.
- **Discuss** daily actions and activities.
- **Describe** a typical day in a French collège.

- **Identify** words and phrases related to daily activities.
- Accurately **pronounce** the “r” sound in French words.
- **Comprehend** authentic short conversations about courses and schedules.
- **Identify and reflect** on cultural products and practices related to school in my own and other cultures.
- **Express** basic feelings and needs.
- **Ask and answer** questions about time of day.
- Use background knowledge to **infer** and understand information in a reading.
- **Create a video** to introduce themselves and talk about school to francophone students.

## **Standards:**

### Priority:

#### **Interpersonal Communication**

- Students can exchange information about school schedules, classes, time, and daily activities using simple conversations in French.

#### **Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to school life, schedules, time, and routines.

#### **Presentational Communication**

- Students can present information about their schedules, daily activities, and school experiences using appropriate vocabulary and grammatical structures.

#### **Cultural Understanding**

- Students can identify and compare aspects of school life in France and Québec, including the role of the Baccalauréat.

#### **Language Structures and Vocabulary**

- Students apply vocabulary related to school, schedules, and daily activities while using **avoir**, regular - **ER verbs**, question formation, and negation to communicate meaning.

### Supporting:

#### **Language Learning Strategies**

- Students use context clues, visuals, repetition, and communication strategies to improve comprehension and participation in French.

#### **Cultural Connections**

- Students explore educational systems, traditions, and cultural perspectives in France and Québec.

## **Acceptable Evidence:**

### **Performance Tasks –**

- **My Schedule Presentation** – Create and present a school schedule and describe daily activities.
- **School Day Interview** – Interview a classmate about classes, schedules, and routines and present findings.
- **School Life Comparison Project** – Compare school experiences in France, Québec, and the United States.
- **Daily Routine Presentation** – Describe a typical weekday using appropriate vocabulary and verbs.
- **Interpretive School-Life Task** – Analyze an authentic French-language school schedule or school-related resource and demonstrate comprehension.

### **Acceptable evidence of learning other than Performance Tasks:**

## Formative Assessments

- Listening and reading **comprehension activities**.
- **Quizzes** on vocabulary, use of avoir and -er verbs.
- Exit tickets and quick **checks for understanding**.
- Guided **writing activities** about schedules and routines.
- Workbook, classwork, and **online practice assignments**.
- Cultural **reflection activities**.
- **Self-assessments** and learning reflections.

## Summative Assessments

- Unit 2 IPAs

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Create and present a personal **school schedule**.
- Conduct **interviews** about classmates' schedules and daily routines.
- Practice telling time through **partner activities** and games.
- Compare a **typical school day** in France, Québec, and the United States.
- Interpret authentic school schedules, timetables, and school-related resources.
- Participate in **conversations about classes**, activities, and daily routines.

### Instructional Strategies:

- Use **comprehensible input** supported by schedules, clocks, visuals, and real-world examples.
- Model and provide **guided practice** with **avoir**, regular **-ER verbs**, question formation, and negation.
- Facilitate **structured partner and small-group conversations** about school and routines.
- Incorporate **authentic resources** related to school life in France and Québec.
- Use graphic organizers and **visual supports** to reinforce vocabulary and grammar.
- Conduct **frequent formative checks** through exit tickets, quick writes, and oral comprehension activities.

### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.

- **Enrichment:**

- Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
- Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# Central Bucks School District – Course of Study – French 1A

## Unit 3 – Family and Friends

### **Desired Results:**

#### **Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### **Enduring Understandings:**

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### **Knowledge:**

Students will know...

- How to describe family members, friends, pets, and occupations using specific French vocabulary and expressions.
- Descriptive and possessive adjectives agree with the nouns they modify.
- Prepositions of location and prepositional pronouns help describe where people, places, and objects are located.
- Numbers 61–100 are used to communicate quantities, ages, dates, and other information.
- Relationships within families and communities may vary across cultures.
- The Maghreb is an important French-speaking region with unique cultural and historical connections to the Francophone world.

#### **Skills:**

**Students will be able to...**

- invite and respond to invitations, and describe people, using cognates.
- identify words and phrases related to family, friends, and pets.
- distinguish how accent marks affect pronunciation and meaning of words.
- understand conversations about family and relationships.

- identify and reflect on cultural products and practices related to family life in my own and other cultures.
- describe people and things.
- express ownership and relationships.
- identify words and phrases related to descriptions and professions.
- understand how accent marks affect meaning and pronunciation in French.
- understand short conversations about people and locations.
- identify and reflect on cultural practices and perspectives around relationships in my own and other cultures.
- Identify and apply numbers up to a hundred in French.
- express locations of people, places, and things in relation to each other.
- understand information that describes people, cultural products and practices of Northern Africa and reflect on attitudes around them.

### **Standards:**

#### Priority:

#### **Interpersonal Communication**

- Students can exchange information about family, friends, pets, occupations, and personal relationships in French.

#### **Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to family life, occupations, and personal descriptions.

#### **Presentational Communication**

- Students can present information about themselves, their families, friends, and communities using descriptive language.

#### **Cultural Understanding**

- Students can identify cultural characteristics and perspectives of the Maghreb and its connection to the Francophone world.

#### **Language Structures and Vocabulary**

- Students apply vocabulary related to family, relationships, occupations, and pets while using descriptive adjectives, possessive adjectives, and prepositions of location to communicate meaning.

#### Supporting:

#### **Language Learning Strategies**

- Students use context clues, visuals, cognates, and communication strategies to improve comprehension and communication.

#### **Cultural Connections**

- Students explore the geography, cultures, and contributions of the Maghreb within the Francophone world.

### **Acceptable Evidence:**

#### **Performance Tasks –**

- **Family and Friends Presentation** – Create and present a description of family members, friends, or pets.
- **My Loved Ones Project** – Develop and explain a visual of your circle of loved ones using relationship and descriptive vocabulary.

- **My Community Presentation** – Describe people and occupations in a community using location and descriptive language.
- **Maghreb Culture Project** – Research and present information about a country or cultural aspect of the Maghreb.
- **Interview Activity** – Conduct and present information gathered from a classmate about family, pets, and interests.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessments

- Vocabulary and grammar **quizzes**.
- Listening and reading **comprehension activities**.
- Exit tickets and quick **checks for understanding**.
- **Guided writing activities** about family and relationships.
- Workbook, classwork, and **online practice assignments**.
- Cultural **reflection activities**.
- **Self-assessments** and learning reflections.

#### Summative Assessments

- Unit 3 IPAs

## Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Create and share family and friends **visual product** using photos, drawings, or digital tools.
- Conduct **interviews** about family members, pets, occupations, and friendships.
- Participate in partner or **small group activities** describing people using physical and personality characteristics.
- **Use maps and images** to explore the geography and cultures of the Maghreb.
- Participate in info gap activities that require giving and interpreting location information.
- Compare family structures and traditions across Francophone cultures.
- Engage with authentic texts, images, and videos related to the Maghreb.

#### Instructional Strategies

- Use **comprehensible input** supported by visuals, family photos, maps, and graphic organizers.
- **Model** and provide guided practice with descriptive adjectives, possessive adjectives, and prepositions of location.
- Facilitate partner interviews and **collaborative speaking activities** focused on family and relationships.
- Incorporate **authentic cultural resources** from the Maghreb and the Francophone world.
- Use **interactive games** and vocabulary-building activities to reinforce numbers 61–100 and relationship vocabulary.
- Implement **think-pair-share**, **information-gap activities**, and presentations to strengthen communication skills.
- Conduct **frequent formative assessments** through exit tickets, quick writes, and comprehension checks.
- **Model** and encourage students to apply language-learning strategies such as cognates, repetition, context clues, and asking for clarification.

**Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.



# CENTRAL BUCKS SCHOOL DISTRICT

## Course of Study

### Recommendation for Adoption

**Course:** French 1 A

**Date:** August 6, 2026

**Student Level:** Middle School

**Grade Level:** 7-8

#### **Characterization of Course of Study:**

French 1A introduces students to the foundations of the French language and the diverse cultures of the Francophone world. Students develop beginning proficiency in listening, speaking, reading, and writing as they learn to communicate about themselves, their families, friends, school life, daily activities, and their communities. Through the study of essential vocabulary, grammar, and cultural perspectives, students build the skills needed to engage in simple conversations and interpret basic spoken and written French. Students also explore the geography, traditions, and cultural diversity of France, Québec, the Maghreb, and other French-speaking regions, fostering intercultural understanding and global awareness. By the end of the course, students will be able to communicate basic information at a novice level about familiar topics and demonstrate an appreciation for the richness and diversity of the French-speaking world.

#### **Reasons for Proposed Adoption:**

The grade realignment in Central Bucks that will begin in fall 2026 creates an opportunity to offer world languages courses in seventh grade; students will have the option to take French 1A and subsequently French 1B. French 1A and French 1B provide students with the equivalent content of our former French 1 course while allowing additional time for language acquisition, practice, and mastery. Learning a new language requires sustained exposure and repeated opportunities to develop listening, speaking, reading, and writing skills. A two-year sequence enables students to build a stronger foundation in vocabulary, grammar, and communication before progressing to higher-level courses. This course provides a developmentally appropriate pace, increased opportunities for communication, and greater retention of vocabulary and language structures through repeated exposure and application over time.

This two-year pathway promotes equitable access to language learning while preparing students for successful completion of upper-level French courses and continued growth in intercultural communication and global competence.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## French 1B

Course Number: 4071

Course Level: Middle School

Grade: 8

Time/Credit: 47 minutes every day  
1 credit

Development Date: November 4, 2025

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## **World Languages Department Learning Principles**

Students of World Languages simulate authentic experiences, compare and contrast other languages and cultures, promote tolerance, and make connections with other disciplines.

World Languages programs integrate studying and experiencing the culture(s) in which the world language is used.

The World Languages discipline connects with all the other disciplines.

The learner is at the center of effective World Languages instruction.

World Languages programs should reflect the developmental nature of language acquisition.

The complexity of teaching a World Language requires teachers to reflect on their practice and match knowledge of the discipline with appropriate teaching, while assessing strategies to achieve learning goals.

Differentiated instruction addresses student strengths, interests and learning styles.

World Language learners achieve proficiency through performance-based assessments including speaking, reading, writing, and listening.

To achieve reality-based language learning, the world language acquisition must include technology-based instruction and practice.

World language educators create awareness, incite curiosity, and encourage appreciation of the language and culture being learned.

Sources: World Languages Curriculum Framework Making Connections

### World-Readiness Standards for Learning Languages

| Goal Area     | Standard                                       | Description                                                                                                                                            |
|---------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communication | Interpersonal Communication                    | Learners interact and negotiate meaning in spoken, signed, or written conversations to share information, reactions, feelings, and opinions.           |
| Communication | Interpretive Communication                     | Learners understand, interpret, and analyze what is heard, read, or viewed on a variety of topics.                                                     |
| Communication | Presentational Communication                   | Learners present information, concepts, and ideas to inform, explain, persuade, and narrate on a variety of topics for different audiences.            |
| Cultures      | Relating Cultural Practices to Perspectives    | Learners investigate, explain, and reflect on the relationship between the practices and perspectives of the cultures studied.                         |
| Cultures      | Relating Cultural Products to Perspectives     | Learners investigate, explain, and reflect on the relationship between the products and perspectives of the cultures studied.                          |
| Connections   | Making Connections                             | Learners build, reinforce, and expand their knowledge of other disciplines while using the language to think critically and solve problems creatively. |
| Connections   | Acquiring Information and Diverse Perspectives | Learners access and evaluate information and diverse perspectives available through the language and its cultures.                                     |
| Comparisons   | Language Comparisons                           | Learners investigate, explain, and reflect on the nature of language through comparisons between the language studied and their own.                   |
| Comparisons   | Cultural Comparisons                           | Learners investigate, explain, and reflect on the concept of culture through comparisons between the cultures studied and their own.                   |
| Communities   | School and Global Communities                  | Learners use the language within and beyond the classroom to interact and collaborate in their community and the globalized world.                     |
| Communities   | Lifelong Learning                              | Learners set goals and reflect on their progress in using languages for enjoyment, enrichment, and advancement.                                        |

**Central Bucks School District**  
**World Languages Department Enduring Understandings**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Central Bucks School District**  
**World Languages Department Essential Questions**

1. How does an individual express his or her basic needs and wants in the target language?
2. How are your language and culture affected by others? How are other languages and cultures affected by yours?
3. How and why can you use the target language to further your career and personal enrichment?
4. How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
5. When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

## Central Bucks School District – Course of Study Overview

### French 1B

#### Desired Results

**Course Description:** The French 1B course builds upon foundational skills developed in French 1A, continuing students' growth in listening, speaking, reading, and writing in the target language. Through thematic units, students expand their ability to communicate about everyday topics such as food, health, leisure activities, travel, celebrations, and clothing. They learn to express preferences, describe routines, discuss past events, and engage in conversations about personal and cultural experiences.

The course emphasizes real-world communication and cultural understanding, integrating explorations of diverse global communities where the target languages are spoken. Students reflect on cultural products, practices, and perspectives while developing language proficiency in meaningful contexts.

By the end of this course, students will be able to communicate about familiar topics in somewhat complex sentences and engage in novice-level conversations.

**Prerequisite:** Grade of C- or higher in level 1A

Students will be able to:

- Communicate in French about themselves, others, school, daily life, and personal interests.
- Exchange information about hobbies, leisure activities, and places in the community.
- Order food and beverages and engage in basic interactions in everyday settings.
- Describe people, clothing, seasons, and weather using appropriate vocabulary and language structures.
- Express plans and intentions using future-oriented language.
- Discuss celebrations, traditions, and cultural experiences in French-speaking communities.
- Describe and discuss past events and experiences using appropriate past-tense structures.
- Interpret and present information in spoken and written French on familiar topics.
- Compare cultural products, practices, and perspectives from different regions in France, Québec, the Maghreb, and other Francophone communities.
- Demonstrate increasing proficiency in listening, speaking, reading, and writing while communicating in a variety of real-world contexts.

#### Acceptable Evidence

District Unit IPAs

District Final IPAs

Other tests, quizzes, projects, and activities will be included at the discretion of the teacher throughout the units in each course to check for understanding of essential skills, vocabulary, grammar, and culture.



## Course Grading:

### World Languages IPA Statement:

Beginning in the fall of 2021, the Central Bucks World Languages Department in each middle and high school will use assessments that are called IPAs which stand for Integrated Performance Assessments. They will occur throughout each unit as formative performance-based assessments. Additionally, they will be given at the end of each unit as common district summative assessments, and at the end of each course as common district final summative assessments. IPAs assess the progress that language students are making in building their proficiency through the World-Readiness Standards and were created by ACTFL (American Council on the Teaching of Foreign Languages). The Integrated Performance Assessment (IPA) is a cluster assessment featuring three tasks, each of which reflects one of the three modes of communication: Interpretive, Interpersonal, and Presentational. The three tasks are aligned within a single theme or content area, reflecting the way students naturally acquire and *use* the language in the real world or the classroom.

The final summative IPAs given at the end of each course (formerly called final assessments) account for 10% of the total grade and are placed into the final exam category in the gradebook.

Breakdown of the gradebook percentages for grades 7-8 for 36-week courses.

22.5% for Marking Period 1

22.5% for Marking Period 2

22.5% for Marking Period 3

22.5% for Marking Period 4

10% for Final Exam

## French 1B – Pacing Guide and Instructional Time

The following times are approximations and therefore, are guidelines inclusive of teaching, reviewing and assessing, to ensure completion of the course within the middle school year.  
Grammar, Vocabulary and Culture are all integrated in World Languages lessons.

| Content                                    | Instructional Time         |
|--------------------------------------------|----------------------------|
| <b>Preliminary Unit: French Essentials</b> | <b>Weeks 1-9</b>           |
| Week 1: Vocabulary review                  | 5 days                     |
| Week 2: Grammar review                     | 5 days                     |
| Week 3: Communication review               | 5 days                     |
| Week 4: Reading strategies                 | 5 days                     |
| Week 5: Listening strategies               | 5 days                     |
| Week 6: Writing review                     | 5 days                     |
| Week 7: Present tense review               | 5 days                     |
| Week 8: Integrated practice                | 5 days                     |
| Week 9: Formative Assessments              | 5 days throughout the unit |
| <b>Unit 4: Around Town</b>                 | <b>Weeks 10-18</b>         |
| Week 10: Places in town                    | 5 days                     |
| Week 11: Directions                        | 5 days                     |
| Week 12: Community locations               | 5 days                     |
| Week 13: Activities around town            | 5 days                     |
| Week 14: Transportation                    | 5 days                     |
| Week 15: City navigation                   | 5 days                     |
| Week 16: Francophone communities           | 5 days                     |
| Week 17: Formative Assessments             | 5 days throughout the unit |
| Week 18: Unit IPAs                         | 5 days                     |
| <b>Unit 5: Sports and Hobbies</b>          | <b>Weeks 19-27</b>         |
| Week 19: Sports vocabulary                 | 5 days                     |
| Week 20: Hobbies                           | 5 days                     |
| Week 21: Weather                           | 5 days                     |
| Week 22: Seasons                           | 5 days                     |
| Week 23: Preferences                       | 5 days                     |
| Week 24: Invitations and activities        | 5 days                     |
| Week 25: Cultural connections              | 5 days                     |
| Week 26: Formative Assessments             | 5 days throughout the unit |
| Week 27: Unit IPAs                         | 5 days                     |
| <b>Unit 6: Celebrations</b>                | <b>Weeks 28-36</b>         |
| Week 28: Celebrations and holidays         | 5 days                     |
| Week 29: Clothing                          | 5 days                     |
| Week 30: Colors and descriptions           | 5 days                     |

|                                   |                            |
|-----------------------------------|----------------------------|
| Week 31: Special events           | 5 days                     |
| Week 32: Traditions               | 5 days                     |
| Week 33: Planning celebrations    | 5 days                     |
| Week 34: Francophone celebrations | 5 days                     |
| Week 35: Formative Assessments    | 5 days throughout the unit |
| Week 36: Final IPAs               | 5 days                     |

**NOTE:** Enrichment opportunities will be provided to meet the needs of students that acquire an understanding of the content before their peers. Enrichment will be provided after students have completed the work assigned to all students and will be an extension activity with the same theme.

### **Required Texts and Software**

VHL Central by Vista Higher Learning Supersite Platform  
 French 1B ISBN # 978-1-66993-027-3

**Supplemental Sites:** Microsoft 365 Tools, Gale Library Resources, Classlink, Quizlet, Blooket, Gimkit, EdPuzzle, Canvas, Wordwall, Kahoot etc.

## Central Bucks School District – Course of Study – French 1B

### Preliminary Unit - French Essentials

#### **Desired Results:**

##### **Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

##### **Enduring Understandings:**

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

##### **Knowledge:**

Students will know...

- Greetings, introductions, courtesy expressions, and classroom language are used to communicate in a variety of everyday situations.
- Numbers, dates, days of the week, and months are used to share personal and school-related information.
- The verbs **être** and **avoir**, along with regular **-er verbs**, are essential building blocks for communication in French.
- Questions, negation, adjectives, possessive adjectives, and prepositions help speakers express ideas more clearly.
- Family members, friends, pets, occupations, and school experiences can be described using specific French vocabulary.
- Language structures such as adjective agreement and possessive adjectives help convey relationships and descriptions accurately.
- France, Québec, the Maghreb, and other Francophone regions contribute to the diversity of the French-speaking world.
- School systems, family relationships, cultural traditions, and daily life may differ across Francophone communities.

- Language and culture are interconnected and provide insight into how people live, learn, and interact in French-speaking communities.
- Effective communication in French requires the integration of listening, speaking, reading, and writing skills that develop through meaningful practice.

### **Skills:**

#### **Students will be able to...**

- Communicate basic information about themselves, their families, friends, school life, and daily activities in French.
- Ask and answer questions, describe people and objects, and express simple ideas using a variety of foundational vocabulary and grammar structures.
- Interpret and respond to familiar spoken and written French related to school, routines, relationships, and everyday situations.
- Use present-tense French to discuss personal information, schedules, interests, and experiences.
- Describe family members, friends, pets, occupations, and locations using appropriate vocabulary and descriptive language.
- Demonstrate an understanding of the cultures, geography, and diversity of France, Québec, the Maghreb, and the broader Francophone world.
- Engage in simple conversations and present information about familiar topics using listening, speaking, reading, and writing skills in French.

### **Standards:**

#### Priority:

#### **Interpersonal Communication**

- Students can exchange information about themselves, their families, friends, school life, daily activities, and personal interests in French.

#### **Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to everyday topics, relationships, school, and daily routines.

#### **Presentational Communication**

- Students can present information about familiar topics using foundational vocabulary and grammar learned throughout French 1A.

#### **Cultural Understanding**

- Students can identify and compare cultural practices, products, and perspectives from France, Québec, the Maghreb, and other Francophone communities.

#### **Language Structures and Vocabulary**

- Students apply foundational vocabulary and grammar, including **être**, **avoir**, regular **-er verbs**, adjective agreement, possessive adjectives, question formation, and expressions of location to communicate meaning.

#### Supporting:

#### **Language Learning Strategies**

- Students use cognates, context clues, visuals, repetition, and communication strategies to improve comprehension and expression.

#### **Cultural Connections**

- Students explore the geography, diversity, school systems, family life, and cultural traditions of the Francophone world.

## **Acceptable Evidence:**

### **Performance Tasks –**

- Portfolio Presentation – Create and present a personal profile including introductions, family, friends, school life, daily activities, and interests.
- Classmate Interview and Presentation – Conduct an interview with a classmate and present information about that person using vocabulary and grammar from throughout the course.
- Family and Community Showcase – Create and present a visual representation of family, friends, pets, occupations, and relationships using descriptive language.
- School Life Comparison – Compare school experiences in France or Québec with students' own experiences through a written, oral, or multimedia presentation.
- Daily Life Role-Play – Participate in a conversation that incorporates greetings, introductions, asking questions, discussing schedules, and describing daily activities.
- Interpretive Communication Tasks – Demonstrate understanding of an authentic French texts, videos, or audio resources and respond through written or spoken communication.
- Partner Conversation – Engage in an interpersonal conversation that requires students to introduce themselves, discuss school, describe people, and answer questions on familiar topics.

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessments**

- Vocabulary and grammar **quizzes** covering key French 1A content
- **Listening comprehension activities** using familiar topics and classroom language
- **Reading comprehension activities** focused on school, family, friends, and daily life
- Exit tickets and quick **checks for understanding**
- Guided **writing activities** using French 1A vocabulary and grammar structures
- **Warm-up activities and bell ringers** reviewing previously learned content
- Partner and small-group **speaking practice activities**
- Workbook, classwork, and **online practice assignments**
- **Cultural reflection activities** related to France, Québec, the Maghreb, and the Francophone world
- **Self-assessments** and reflection activities on language growth and proficiency
- **Unit review** games, practice assessments, and cumulative checkpoints

#### **Summative Assessments**

- Reprise Unit Assessments

## **Suggested Learning Experiences and Instruction**

### **Learning Experiences:**

- Participate in review **conversations** about introductions, school, family, friends, daily activities, and personal interests.
- Create a **portfolio** highlighting key language and cultural learning from the unit.
- Conduct partner **interviews** and present information about classmates.
- Complete **review stations** that revisit vocabulary, grammar, and communication skills from each unit.
- **Compare aspects of life** in France, Québec, the Maghreb, and other Francophone communities.

- Engage with **authentic texts, videos, songs, and images** from the Francophone world.
- Create **visual projects** that describe family, school life, daily routines, and personal interests.
- Participate in **collaborative review games** and problem-solving activities using French.
- Reflect on language growth and **set goals** for French 1B.
- Demonstrate proficiency through integrated listening, speaking, reading, and writing activities.

#### Instructional Strategies:

- Use **comprehensible input** through visuals, gestures, realia, and authentic resources to reinforce previously learned content.
- Facilitate **structured interpersonal communication activities** such as interviews, information-gap tasks, and partner conversations.
- Incorporate **spiraled review** of vocabulary and grammar from all French 1A units.
- Use **guided practice and modeling** to reinforce foundational language structures and communication skills.
- Implement **collaborative learning strategies** such as think-pair-share, turn-and-talk, and cooperative group activities.
- Integrate **authentic cultural resources** to deepen understanding of Francophone cultures and perspectives.
- Use **graphic organizers, anchor charts, and visual supports** to organize and review key concepts.
- Provide **frequent formative assessments** through exit tickets, quick writes, comprehension checks, and self-assessments.
- **Encourage students to apply language-learning strategies** such as cognates, context clues, repetition, and circumlocution.
- **Differentiate instruction** through varied modes of input and opportunities for listening, speaking, reading, and writing practice.

#### Differentiation/Intervention/Enrichment Options:

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.

- Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.



# Central Bucks School District – Course of Study – French 1B

## Unit 4 – Around Town

### Desired Results:

#### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### Enduring Understandings:

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### Knowledge:

Students will know...

- Places in a community and popular leisure activities can be described using specific French vocabulary.
- The verb **aller** is used to talk about where people go and activities they are going to do.
- Interrogative words are used to ask for information and engage in conversation.
- The verbs **prendre** and **boire** are commonly used when talking about food, beverages, and dining experiences.
- Partitive articles are used to express quantities of food and drink.
- Regular **-ir verbs** follow predictable conjugation patterns in the present tense.
- Cafés play an important role in French culture as places for social interaction and community life.
- French is spoken in regions beyond mainland France, including **La France d'outre-mer** (French overseas territories).
- Cultural practices, daily routines, and leisure activities vary across the French-speaking world.
- Language and culture are interconnected and provide insight into the lives and perspectives of Francophone communities.

#### Skills:

Students will be able to...

- understand conversations about places in town, food, and drinks.

- talk about errands and places around town.
- identify and correctly pronounce oral vowel sounds.
- understand short conversations about places around town.
- identify and reflect on cultural products and practices related to leisure.
- ask about the near future and say where people are going.
- ask and answer information questions.
- understand a report about the prices of drinks in a café.
- identify and use words related to café food and service.
- identify nasal vowels.
- understand short conversations about restaurant orders.
- identify and reflect on cultural products and practices related to eateries in their own and other cultures.
- discuss eating and drinking and express parts of a whole.
- express the actions of choosing, finishing, and succeeding.
- understand the gist of a conversation about food and activities.
- identify cultural products and practices of the French overseas departments and reflect on attitudes around them.
- understand unfamiliar words in a menu by making inferences.

## **Standards:**

### Priority:

#### **Interpersonal Communication**

- Students can exchange information about places in the community, leisure activities, food, beverages, and daily plans in French.

#### **Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to community life, leisure activities, cafés, and everyday experiences.

#### **Presentational Communication**

- Students can present information about destinations, activities, food preferences, and leisure interests using appropriate vocabulary and grammatical structures.

#### **Cultural Understanding**

- Students can identify and compare cultural practices related to café culture and daily life in France and the French overseas territories.

#### **Language Structures and Vocabulary**

- Students apply vocabulary related to places around town, leisure activities, food, and beverages while using **aller**, **prendre**, **boire**, regular **-ir verbs**, interrogative words, and partitive articles to communicate meaning.

### Supporting:

#### **Language Learning Strategies**

- Students use context clues, visuals, cognates, repetition, and communication strategies to improve comprehension and expression in French.

#### **Cultural Connections**

- Students explore the role of cafés, leisure activities, and the cultural diversity of **La France d'outre-mer** within the Francophone world.

## Acceptable Evidence:

### Performance Tasks –

- **A Day in Town Presentation** – Create and present an itinerary describing places around town, planned activities, and how to get there using **aller**.
- **Café Role-Play** – Participate in a simulated café interaction by ordering food and beverages and responding to questions from a server or customer.
- **Leisure Activities Survey** – Conduct a class survey about favorite leisure activities and present the results in French.
- **Community Guide Project** – Create a brochure, map, or digital presentation featuring places of interest and activities in a town or neighborhood.
- **French Café Menu Project** – Design a café menu and explain food and beverage choices using **partitive articles**, **prendre**, and **boire**.
- **La France d’Outre-Mer Presentation** – Research and present information about a French overseas region, highlighting its geography, culture, and daily life.
- **Destination Interview** – Engage in a conversation about where people go, what they do for fun, and their food and drink preferences.
- **Interpretive Communication Task** – Demonstrate understanding of an authentic menu, café advertisement, map, or community guide and respond through written or oral communication.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Vocabulary quizzes on places around town, leisure activities, food, and beverages
- Grammar assessments focused on **aller**, **prendre**, **boire**, regular **-ir verbs**, interrogative words, and partitive articles
- Listening comprehension activities using conversations about cafés, community activities, and daily plans
- Reading comprehension activities using menus, maps, advertisements, schedules, and short cultural texts
- Exit tickets and quick checks for understanding
- Guided writing activities about favorite activities, destinations, and food preferences
- Workbook, classwork, and online practice assignments
- Teacher observations during partner and small-group interactions
- Cultural reflection activities related to café culture and **La France d’outre-mer**
- Self-assessments and goal-setting reflections
- Matching, sorting, and categorization activities involving foods, beverages, locations, and leisure activities

#### Summative Assessments

- Unit 4 IPAs

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Explore maps, photos, and virtual tours to identify and discuss places around town in French.
- Conduct surveys and interviews about favorite leisure activities and places to visit.
- Create and share itineraries describing where people go and what they do using **aller**.

- Interpret authentic French café menus and discuss food and beverage preferences.
- Participate in simulated café experiences to practice ordering and interacting in French.
- Compare café culture in France with food and dining customs in students' own communities.
- Research and present information about a French overseas territory (La France d'outre-mer).
- Create community maps, travel guides, or brochures featuring local attractions and activities.
- Read, view, and discuss authentic resources related to leisure activities, cafés, and Francophone communities.
- Engage in collaborative speaking activities focused on asking and answering questions about activities, destinations, and preferences.

#### Instructional Strategies:

- Use comprehensible input supported by visuals, maps, menus, photographs, and authentic resources.
- Model and provide guided practice with *aller*, *prendre*, *boire*, regular -ir verbs, interrogative words, and partitive articles.
- Incorporate role-playing and real-world scenarios related to cafés, community life, and leisure activities.
- Facilitate structured partner and small-group conversations to build interpersonal communication skills.
- Use graphic organizers, anchor charts, and sentence frames to support vocabulary and grammar development.
- Integrate authentic cultural materials such as menus, advertisements, videos, and travel resources from France and French overseas territories.
- Implement think-pair-share, information-gap activities, and collaborative problem-solving tasks to promote communication.
- Encourage students to use language-learning strategies such as cognates, context clues, repetition, and circumlocution.
- Differentiate instruction through multiple modes of input and output, including listening, speaking, reading, and writing.
- Monitor learning through frequent formative assessments, including exit tickets, quick writes, comprehension checks, and informal speaking assessments.

#### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- Intervention:
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.

- **Enrichment:**

- Independent Projects: Allow advanced students to research additional vocabulary, grammar, or cultural topics related to the theme of the unit.
- Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

## Central Bucks School District – Course of Study – French 1B

### Unit 5 – Sports and Hobbies

#### Desired Results:

##### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

##### Enduring Understandings:

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

##### Knowledge:

Students will know...

- Sports, leisure activities, weather, seasons, and dates can be discussed using specific French vocabulary and expressions.
- The verb **faire** is used in many common expressions related to activities, sports, and weather.
- Irregular **-ir** verbs and spelling-change **-er** verbs follow unique conjugation patterns that are used in everyday communication.
- Numbers above 100 are used to communicate quantities, dates, distances, and other real-world information.
- Weather and seasonal conditions influence daily activities and recreational choices.
- Soccer is an important sport throughout many Francophone communities and reflects cultural traditions and identities.
- Major events such as **Le Tour de France** are significant cultural and sporting traditions in France.
- The regions of **Les Pays de la Loire**, **Le Centre-Val de Loire**, **La Normandie**, and **La Bretagne** have distinct geographic, historical, and cultural characteristics.
- Geography, climate, and regional traditions contribute to the diversity of the French-speaking world.
- Language and culture are interconnected and provide insight into the lifestyles and perspectives of Francophone communities.

**Skills:****Students will be able to...**

- understand an invitation to do an activity and an exchange about ordering food.
- describe sports preferences using cognates.
- discuss leisure activities and how often people do them.
- appropriately use intonation to ask questions and react to statements.
- understand conversations about sports and other leisure activities.
- identify and reflect on cultural products and practices related to sports.
- discuss everyday activities including leaving, sleeping, and running.
- talk about seasons, dates, and weather.
- distinguish between open and closed vowel sounds.
- understand conversations about important dates and weather.
- identify and reflect on cultural products and practices related to leisure activities in their own and other cultures.
- talk about years and express large quantities.
- talk about bringing, buying, and sending things.
- identify key information from an audio recording of a weather forecast.
- explain how the weather influenced my plans.
- identify cultural products and practices of the Loire Valley and reflect on attitudes around them.
- identify and reflect on cultural products and practices of Normandy and Brittany.
- understand the information provided by a brochure.

**Standards:**Priority:**Interpersonal Communication**

- Students can exchange information about sports, leisure activities, weather, seasons, dates, and personal interests using simple conversations in French.

**Interpretive Communication**

- Students can understand the main idea and key details of familiar spoken and written French related to sports, recreation, weather, seasonal activities, and cultural traditions.

**Presentational Communication**

- Students can present information about hobbies, sports, weather conditions, seasonal preferences, and regional cultural topics using appropriate vocabulary and language structures.

**Cultural Understanding**

- Students can identify and compare cultural practices, traditions, and regional identities associated with soccer, **Le Tour de France**, and the regions of **Les Pays de la Loire**, **Le Centre-Val de Loire**, **La Normandie**, and **La Bretagne**.

**Language Structures and Vocabulary**

- Students apply vocabulary related to sports, leisure activities, weather, seasons, months, and numbers while using **faire**, expressions with **faire**, irregular **-ir verbs**, and spelling-change **-er verbs** to communicate meaning.

**Supporting:****Language Learning Strategies**

- Students use context clues, visuals, cognates, repetition, and communication strategies to improve comprehension and expression in French.

## Cultural Connections

- Students explore the significance of soccer, **Le Tour de France**, regional geography, and cultural traditions in the French-speaking world.

## Acceptable Evidence:

### Performance Tasks –

- **Sports and Leisure Presentation** – Create and present a profile of favorite sports and leisure activities, explaining preferences and participation using **faire** expressions and target vocabulary.
- **Weather and Seasons Forecast** – Deliver a weather report that includes seasons, temperatures, dates, and appropriate seasonal activities.
- **Le Tour de France Project** – Research and present information about the Tour de France, including its significance, route, and cultural impact.
- **Regional France Presentation** – Create a presentation highlighting the geography, culture, traditions, and attractions of **Normandy, Brittany, Pays de la Loire, or Centre-Val de Loire**.
- **Activity Planning Role-Play** – Engage in a conversation planning leisure activities based on weather conditions, seasons, and personal interests.
- **Sports Survey and Analysis** – Conduct a class survey about sports and hobbies and present the results using numbers above 100 when applicable.
- **Soccer in the Francophone World Project** – Research and present the importance of soccer in a Francophone country or region.
- **Interpretive Communication Task** – Analyze an authentic weather forecast, sports article, event advertisement, or tourism resource and demonstrate comprehension through written or spoken responses.
- **Seasonal Activities Brochure** – Create a travel or activity guide recommending sports and leisure activities for different seasons and regions of France.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessments

- Vocabulary quizzes on sports, leisure activities, weather, seasons, months, and numbers 101+
- Grammar assessments focused on **faire**, expressions with **faire**, irregular **-ir verbs**, and spelling-change **-er verbs**
- Listening comprehension activities using weather forecasts, sports reports, and conversations about hobbies and leisure activities
- Reading comprehension activities using authentic texts such as event advertisements, weather reports, tourism materials, and sports articles
- Exit tickets and quick checks for understanding
- Guided writing activities about favorite sports, seasonal activities, and weather preferences
- Calendar and weather journal entries using target vocabulary and structures
- Workbook, classwork, and online practice assignments
- Teacher observations during partner discussions and collaborative activities
- Cultural reflection activities related to soccer, **Le Tour de France**, and the regions of Normandy, Brittany, Pays de la Loire, and Centre-Val de Loire
- Self-assessments and learning reflections on communication skills and cultural understanding
- Unit tests and common assessments covering vocabulary, grammar, interpretive communication, and cultural content
- Matching, categorization, and graphic organizer activities focused on leisure activities, weather conditions, seasons, and regional geography



## Summative Assessments

- Unit 5 IPAs

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Conduct surveys and interviews about favorite sports, hobbies, and leisure activities.
- Create and share weather forecasts using seasonal and weather-related vocabulary.
- Track weather patterns and seasonal changes using a class calendar or weather journal.
- Investigate the cultural importance of soccer in Francophone countries and share findings with classmates.
- Explore maps, videos, and images of **Normandy, Brittany, Pays de la Loire, and Centre-Val de Loire** and discuss regional characteristics.
- Research and present key facts about **Le Tour de France**, including its route, history, and significance.
- Read and interpret authentic weather reports, sports schedules, event advertisements, and tourism materials.
- Participate in conversations about favorite activities, sports, seasonal preferences, and weekend plans.
- Create travel or activity guides that recommend seasonal activities in different regions of France.
- Compare sports, recreation, and regional traditions in France with those in students' own communities.

### Instructional Strategies:

- Use **comprehensible input** supported by visuals, maps, weather graphics, sports images, and authentic resources.
- Model and provide guided practice with **faire**, expressions with **faire**, irregular **-ir verbs**, and spelling-change **-er verbs** in meaningful contexts.
- Incorporate **structured partner and small-group conversations** focused on sports, leisure activities, weather, and seasons.
- Use **authentic materials** such as weather forecasts, sports articles, travel brochures, and videos from Francophone regions.
- Implement **information-gap activities, surveys, and interviews** to develop interpersonal communication skills.
- Utilize **graphic organizers, anchor charts, and sentence frames** to support vocabulary and grammar acquisition.
- Facilitate **cultural inquiry activities** exploring soccer culture, Le Tour de France, and the regions of Normandy, Brittany, Pays de la Loire, and Centre-Val de Loire.
- Provide opportunities for **interpretive practice** through listening and reading activities using authentic texts and media.
- Encourage students to use **language-learning strategies** such as cognates, context clues, repetition, and circumlocution.
- Monitor progress through **formative assessment practices** including exit tickets, quick writes, comprehension checks, and teacher observation.

### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:

- Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
- Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
- Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

#### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

## Central Bucks School District – Course of Study – French 1B

### Unit 6 - Celebrations

#### Desired Results:

##### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

##### Enduring Understandings:

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

##### Knowledge:

Students will know...

- Parties, celebrations, and life events are important aspects of personal and cultural identity.
- Clothing and colors can be described using specific French vocabulary and expressions.
- **Demonstrative adjectives** are used to identify and point out specific people, places, and things.
- The **passé composé with avoir** is used to describe completed actions and events in the past.
- **Indirect object pronouns** help speakers communicate more efficiently by replacing nouns in a sentence.
- Regular and irregular **-re verbs** follow specific conjugation patterns that are used in everyday communication.
- Fashion plays an important role in French culture and influences trends around the world.
- **Le Carnaval** is a significant cultural celebration in many Francophone communities.
- Paris is an important cultural, historical, and artistic center of the French-speaking world.
- Language and culture are interconnected and provide insight into traditions, celebrations, and daily life in Francophone communities.

##### Skills:

**Students will be able to...**

- discuss plans, shopping, family, clothing, and colors using cognates.

- discuss celebrations and the stages of life.
- differentiate between open and closed sounds, and pronounce cognates correctly.
- understand conversations about parties and gifts.
- identify and reflect on cultural products and practices related to celebrations in their own and other cultures.
- refer and distinguish between nearby items.
- discuss past actions and events.
- identify and reflect on holiday traditions.
- describe and discuss clothing and accessories.
- understand how the position of vowels within words influences how they sound.
- understand conversations about shopping and clothing.
- identify and reflect on cultural products and practices related to fashion.
- discuss common, daily activities and avoid repetition when discussing previously mentioned people and animals.
- discuss driving, waiting, laughing, and other common actions.
- understand a conversation about clothing.
- identify cultural products and practices of Paris and reflect on attitudes around them.
- understand important information found on a poster.
- interview a classmate about fashion influences and respond to questions about their own, using visual examples.

## **Standards:**

### Priority:

#### **Interpersonal Communication**

- Students can exchange information about celebrations, life events, clothing, fashion, and past experiences in French.

#### **Interpretive Communication**

- Students can understand the main idea and key details of spoken and written French related to celebrations, fashion, cultural traditions, and personal experiences.

#### **Presentational Communication**

- Students can present information about celebrations, stages of life, clothing preferences, and past events using appropriate vocabulary and grammatical structures.

#### **Cultural Understanding**

- Students can identify and compare cultural practices and perspectives related to **Le Carnaval**, fashion, and life in Paris and other Francophone communities.

#### **Language Structures and Vocabulary**

- Students apply vocabulary related to celebrations, life events, clothing, colors, and fashion while using **demonstrative adjectives, indirect object pronouns, -re verbs**, and the **passé composé with avoir** to communicate meaning.

### Supporting:

#### **Language Learning Strategies**

- Students use context clues, visuals, cognates, repetition, and communication strategies to improve comprehension and expression in French.

#### **Cultural Connections**

- Students explore the cultural significance of **Le Carnaval**, French fashion, and the historical and cultural influence of Paris.

### Acceptable Evidence:

#### Performance Tasks –

- **Celebration Presentation** – Create and present information about a celebration, holiday, or life event in a Francophone culture.
- **Fashion Show Project** – Describe clothing, colors, and fashion choices in a live or digital presentation.
- **Past Event Narrative** – Write or present a description of a past celebration or memorable event using the **passé composé with avoir**.
- **Le Carnaval Cultural Project** – Research and present the traditions, history, and significance of Carnaval in a Francophone region.
- **Paris Travel Guide** – Create a brochure, presentation, or digital guide highlighting important cultural and historical sites in Paris.
- **Shopping Role-Play** – Participate in a conversation about selecting, describing, and purchasing clothing items.
- **Life Stages Timeline** – Create and present a timeline describing significant stages and events in a person's life.
- **Interpretive Communication Task** – Analyze an authentic article, advertisement, fashion catalog, or cultural resource and demonstrate comprehension through written or oral responses.

#### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessments

- Vocabulary quizzes on clothing, colors, celebrations, and stages of life
- Grammar assessments focused on **demonstrative adjectives, indirect object pronouns, -re verbs**, and the **passé composé with avoir**
- Listening comprehension activities related to celebrations, shopping, and personal experiences
- Reading comprehension activities using authentic texts, advertisements, and cultural resources
- Exit tickets and quick checks for understanding
- Guided writing activities about celebrations, clothing, and past events
- Workbook, classwork, and online practice assignments
- Teacher observations during partner and small-group communication activities
- Cultural reflection activities related to Carnaval, fashion, and Paris
- Self-assessments and learning reflections

##### Summative Assessments

- Unit 6 IPAs

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Explore celebrations and traditions from the Francophone world through videos, images, and authentic texts.
- Participate in fashion-themed activities describing clothing, colors, and personal style preferences.
- Create timelines of important life events and stages of life.
- Research and discuss the history and traditions of Le Carnaval.
- Examine authentic French fashion magazines, advertisements, and online catalogs.

- Explore landmarks, neighborhoods, and cultural attractions in Paris through virtual tours and maps.
- Practice describing past celebrations and experiences using the *passé composé*.
- Engage in role-plays involving shopping for clothing and preparing for special events.
- Compare celebrations and fashion trends in Francophone cultures with students' own experiences.
- Create visual projects highlighting Parisian culture, fashion, or celebrations.

#### Instructional Strategies

- Use comprehensible input supported by visuals, clothing items, photographs, maps, and authentic resources.
- Model and provide guided practice with demonstrative adjectives, indirect object pronouns, -re verbs, and the *passé composé* with *avoir*.
- Facilitate structured partner and small-group conversations about celebrations, life events, clothing, and fashion.
- Incorporate authentic cultural resources such as fashion magazines, advertisements, travel guides, and videos about Paris and Carnaval.
- Use role-playing and real-world scenarios related to shopping, celebrations, and social events.
- Implement graphic organizers, timelines, and visual supports to reinforce vocabulary and grammar concepts.
- Engage students in cultural inquiry activities exploring fashion, festivals, and life in Paris.
- Provide opportunities for interpretive communication through authentic readings, videos, and advertisements.
- Encourage students to use language-learning strategies such as cognates, context clues, repetition, and circumlocution.
- Monitor progress through formative assessment practices, including exit tickets, quick writes, comprehension checks, and teacher observation.

#### Differentiation/Intervention/Enrichment Options:

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.

- Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** French 1B

**Date:** November 25, 2025

**Student Level:** Middle School

**Grade Level:** 8

### **Characterization of Course of Study:**

French 1B builds on the foundational communication skills developed in French 1A through continued study of vocabulary, grammar, and cultural perspectives. Students strengthen their proficiency in listening, speaking, reading, and writing as they communicate about community life, leisure activities, food and café culture, sports, weather, celebrations, clothing, fashion, and past experiences. Through the exploration of France and other Francophone communities, students develop a deeper understanding of the diversity of the French-speaking world. The course emphasizes meaningful communication, cultural awareness, and the use of French in real-world contexts while expanding students' ability to communicate in both present and past time frames. By the end of the course, students will be able to understand and communicate at a novice level about familiar topics, experiences, and cultural perspectives using increasingly complex vocabulary and grammatical structures in French.

### **Reasons for Proposed Adoption:**

The grade realignment in Central Bucks that will begin in fall 2026 creates an opportunity to offer world languages courses in seventh grade; students will have the option to take French 1A and subsequently French 1B. French 1A and French 1B provide students with the equivalent content of our former French 1 course while allowing additional time for language acquisition, practice, and mastery. Learning a new language requires sustained exposure and repeated opportunities to develop listening, speaking, reading, and writing skills. A two-year sequence enables students to build a stronger foundation in vocabulary, grammar, and communication before progressing to higher-level courses. This course provides a developmentally appropriate pace, increased opportunities for communication, and greater retention of vocabulary and language structures through repeated exposure and application over time.

This two-year pathway promotes equitable access to language learning while preparing students for successful completion of upper-level French courses and continued growth in intercultural communication and global competence.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_





## Spanish 1A

Course Number: 4080

Course Level: Middle School

Grade: 7-8

Time/Credit: 47 minutes every day  
1 credit

Development Date: 2025 - 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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## **World Languages Department Learning Principles**

Students of World Languages simulate authentic experiences, compare and contrast other languages and cultures, promote tolerance, and make connections with other disciplines.

World Languages programs integrate studying and experiencing the culture(s) in which the world language is used.

The World Languages discipline connects with all the other disciplines.

The learner is at the center of effective World Languages instruction.

World Languages programs should reflect the developmental nature of language acquisition.

The complexity of teaching a World Language requires teachers to reflect on their practice and match knowledge of the discipline with appropriate teaching, while assessing strategies to achieve learning goals.

Differentiated instruction addresses student strengths, interests and learning styles.

World Language learners achieve proficiency through performance-based assessments including speaking, reading, writing, and listening.

To achieve reality-based language learning, the world language acquisition must include technology-based instruction and practice.

World language educators create awareness, incite curiosity, and encourage appreciation of the language and culture being learned.

Sources: World Languages Curriculum Framework Making Connections

### World-Readiness Standards for Learning Languages

| Goal Area     | Standard                                       | Description                                                                                                                                            |
|---------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communication | Interpersonal Communication                    | Learners interact and negotiate meaning in spoken, signed, or written conversations to share information, reactions, feelings, and opinions.           |
| Communication | Interpretive Communication                     | Learners understand, interpret, and analyze what is heard, read, or viewed on a variety of topics.                                                     |
| Communication | Presentational Communication                   | Learners present information, concepts, and ideas to inform, explain, persuade, and narrate on a variety of topics for different audiences.            |
| Cultures      | Relating Cultural Practices to Perspectives    | Learners investigate, explain, and reflect on the relationship between the practices and perspectives of the cultures studied.                         |
| Cultures      | Relating Cultural Products to Perspectives     | Learners investigate, explain, and reflect on the relationship between the products and perspectives of the cultures studied.                          |
| Connections   | Making Connections                             | Learners build, reinforce, and expand their knowledge of other disciplines while using the language to think critically and solve problems creatively. |
| Connections   | Acquiring Information and Diverse Perspectives | Learners access and evaluate information and diverse perspectives available through the language and its cultures.                                     |
| Comparisons   | Language Comparisons                           | Learners investigate, explain, and reflect on the nature of language through comparisons between the language studied and their own.                   |
| Comparisons   | Cultural Comparisons                           | Learners investigate, explain, and reflect on the concept of culture through comparisons between the cultures studied and their own.                   |
| Communities   | School and Global Communities                  | Learners use the language within and beyond the classroom to interact and collaborate in their community and the globalized world.                     |
| Communities   | Lifelong Learning                              | Learners set goals and reflect on their progress in using languages for enjoyment, enrichment, and advancement.                                        |

**Central Bucks School District**  
**World Languages Department Enduring Understandings**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Central Bucks School District**  
**World Languages Department Essential Questions**

1. How does an individual express his or her basic needs and wants in the target language?
2. How are your language and culture affected by others? How are other languages and cultures affected by yours?
3. How and why can you use the target language to further your career and personal enrichment?
4. How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
5. When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

## Central Bucks School District – Course of Study Overview

### Spanish 1A

#### **Desired Results**

##### Course Description:

Spanish 1A is an introductory course where students begin developing skills in listening, speaking, reading, and writing in Spanish. Students will learn to greet others, introduce themselves, describe family and friends, talk about daily activities, and express likes, preferences, and the future. Cultural explorations of Spanish-speaking countries such as México, Guatemala, and Perú and the U.S. (Puerto Rico) are integrated throughout the course to build global awareness. By the end of Spanish 1A, students will be able to communicate about familiar topics in simple sentences and engage in novice conversations in the target language.

Prerequisite: None

##### Students will be able to:

- Greet others, introduce themselves, and exchange basic personal information in Spanish.
- Describe themselves, their family members, and their friends using simple sentences.
- Discuss daily routines, school activities, and familiar topics using basic vocabulary and expressions.
- Express likes, dislikes, preferences, and the future in simple conversations and written responses.
- Understand and respond to spoken and written Spanish on familiar topics at a novice level.
- Ask and answer simple questions to participate in basic interpersonal communication.
- Compare cultural practices, products, and perspectives from Spanish-speaking countries such as México, Guatemala, and Perú and the U.S. (Puerto Rico).
- Read and write short texts in Spanish to share information, ideas, and personal experiences.
- Communicate using simple sentences and memorized language to express meaning in real-world situations.
- Demonstrate growing confidence and proficiency in listening, speaking, reading, and writing in Spanish.

#### **Acceptable Evidence.**

District Unit IPAs

District Final IPAs

Other tests, quizzes, projects, and activities will be included at the discretion of the teacher throughout the units in each course to check for understanding of essential skills, vocabulary, grammar, and culture.

## Course Grading:

### World Languages IPA Statement:

Beginning in the fall of 2021, the Central Bucks World Languages Department in each middle and high school will use assessments that are called IPAs which stand for Integrated Performance Assessments. They will occur throughout each unit as formative performance-based assessments. Additionally, they will be given at the end of each unit as common district summative assessments, and at the end of each course as common district final summative assessments. IPAs assess the progress that language students are making in building their proficiency through the World-Readiness Standards and were created by ACTFL (American Council on the Teaching of Foreign Languages). The Integrated Performance Assessment (IPA) is a cluster assessment featuring three tasks, each of which reflects one of the three modes of communication: Interpretive, Interpersonal, and Presentational. The three tasks are aligned within a single theme or content area, reflecting the way students naturally acquire and *use* the language in the real world or the classroom.

The final summative IPAs given at the end of each course (formerly called final assessments) account for 10% of the total grade and are placed into the final exam category in the gradebook.

Breakdown of the gradebook percentages for grades 7-8 for 36-week courses.

22.5% for Marking Period 1

22.5% for Marking Period 2

22.5% for Marking Period 3

22.5% for Marking Period 4

10% for Final Exam



## Spanish 1A – Pacing Guide and Instructional Time

The following times are approximations and therefore, are guidelines inclusive of teaching, reviewing and assessing, to ensure completion of the course within the middle school year.  
Grammar, Vocabulary and Culture are all integrated in World Languages lessons.

| Content                                                                     | Instructional Time         |
|-----------------------------------------------------------------------------|----------------------------|
| <b>Preliminary Unit: First Steps</b>                                        | <b>Weeks 1-4</b>           |
| Week 1: Greetings, introductions, pronunciation, and learning strategies    | 5 days                     |
| Week 2: Classroom objects, expressions, and interrogatives                  | 5 days                     |
| Week 3: Numbers, dates, schedules, and calendars                            | 5 days                     |
| Week 4: Weather, seasons, Spanish-speaking world, and formative assessments | 5 days                     |
| <b>Unit 1: Family and Friends</b>                                           | <b>Weeks 5-13</b>          |
| Week 5: Personal information, ser, and México                               | 5 days                     |
| Week 6: Physical descriptions and adjective agreement                       | 5 days                     |
| Week 7: Personality traits and communication practice                       | 5 days                     |
| Week 8: Family vocabulary and possessive adjectives                         | 5 days                     |
| Week 9: Extended family and tener                                           | 5 days                     |
| Week 10: States, conditions, and tener expressions                          | 5 days                     |
| Week 11: Daily life and cultural comparisons                                | 5 days                     |
| Week 12: Formative Assessments                                              | 5 days throughout the unit |
| Week 13: Unit 1 IPAs                                                        | 5 days                     |
| <b>Unit 2: Life at Home</b>                                                 | <b>Weeks 14-22</b>         |
| Week 14: Rooms of the house and Puerto Rico                                 | 5 days                     |
| Week 15: Household items and nouns/articles                                 | 5 days                     |
| Week 16: Chores and regular -ar verbs                                       | 5 days                     |
| Week 17: Responsibilities and regular -er verbs                             | 5 days                     |
| Week 18: Leisure activities and regular -ir verbs                           | 5 days                     |
| Week 19: Schedules and routines                                             | 5 days                     |
| Week 20: Home, community, and cultural traditions                           | 5 days                     |
| Week 21: Formative Assessments                                              | 5 days throughout the unit |
| Week 22: Unit 2 IPAs                                                        | 5 days                     |
| <b>Unit 3: Shopping and Clothing</b>                                        | <b>Weeks 23-31</b>         |
| Week 23: Clothing and Guatemala                                             | 5 days                     |
| Week 24: Colors, descriptions, and demonstratives                           | 5 days                     |
| Week 25: Stores and shopping vocabulary                                     | 5 days                     |
| Week 26: Shopping expressions and stem-changing verbs                       | 5 days                     |
| Week 27: Likes, dislikes, and gustar                                        | 5 days                     |
| Week 28: Shopping activities and preferences                                | 5 days                     |
| Week 29: Comparisons and consumer choices                                   | 5 days                     |
| Week 30: Formative Assessments                                              | 5 days throughout the unit |

|                                                     |                            |
|-----------------------------------------------------|----------------------------|
| Week 31: Unit 3 IPAs                                | 5 days                     |
| <b>Unit 4: Food</b>                                 | <b>Weeks 32-36</b>         |
| Week 32: Foods and beverages and Perú               | 5 days                     |
| Week 33: Dining and restaurant interactions         | 5 days                     |
| Week 34: Preferences, descriptions, and comparisons | 5 days                     |
| Week 35: Formative Assessments                      | 5 days throughout the unit |
| Week 36: Final Course IPAs                          | 5 days                     |

**NOTE:** Enrichment opportunities will be provided to meet the needs of students that acquire an understanding of the content before their peers. Enrichment will be provided after students have completed the work assigned to all students and will be an extension activity with the same theme.

### **Required Texts and Software**

VHL Central by Vista Higher Learning Supersite Platform

Encuentros 2026 Level 1 Student Edition(Hardcover) + Supersite Plus(v) + WebSAM(6 year license) 978-1-66994-070-8

**Supplemental Sites:** Microsoft 365 Tools, Gale Library Resources, Classlink, Quizlet, Blooket, Gimkit, EdPuzzle, Canvas, Wordwall, Kahoot etc.

# Central Bucks School District – Course of Study – Spanish 1A

## Preliminary Unit – First Steps

### Desired Results:

#### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### Enduring Understandings:

##### Students will understand that:

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### Knowledge:

##### Students will know...

- vocabulary related to greetings/goodbyes, seasons, weather, days, dates, and telling time.
- vocabulary related to the classroom and school schedule
- subject pronouns, the verbs ser, estar, tener, adjectives, possessive adjectives and prepositions, alphabet
- geography as it relates to Spanish-speaking countries
- language acquisition strategies

#### Skills:

##### Students will be able to...

- **Greet others and say goodbye** appropriately in Spanish in common classroom and everyday situations.
- **Share basic personal information**, such as name, how they are feeling, the date, the time, and the weather.
- **Understand and use classroom language** to follow directions, ask for help, and talk about their school schedule.

- **Create simple, novice-level sentences** using subject pronouns, common verbs (ser, estar, tener), adjectives, and basic prepositions.
- **Talk about days, dates, seasons, and time** in familiar, supported contexts.
- **Identify key geography** and develop an awareness of where Spanish is spoken.
- **Use basic language learning strategies**, such as using cognates, visuals, repetition, and asking for clarification to support understanding and communication.

## **Standards:**

### Priority:

These are the **big ideas** for which students will demonstrate proficiency and will revisit throughout the course.

### **Interpersonal Communication**

- Students can **exchange basic information** using simple sentences about themselves, the classroom, weather, the date/time, and daily routines and schedules.

### **Interpretive Communication**

- Students can **understand the main idea and key details** of short, familiar spoken and written Spanish related to greetings, classroom language, schedules, weather, and dates.

### **Presentational Communication**

- Students can **present basic information** about themselves and ask questions.

### **Cultural Understanding**

- Students can **identify Spanish-speaking countries** and understand cultural difference related to school norms, greetings, and polite conversation.

### Supporting:

These standards are **embedded within the priority standards**, not taught in isolation.

### **Language Structures and Vocabulary**

- Students apply **foundational grammar** (subject pronouns, interrogatives, verbs in context) to build conversations.

### **Language Learning Strategies**

- Students use **basic language strategies** (cognates, visuals, repetition, and asking for clarification) to improve comprehension and communication.

## **Acceptable Evidence:**

### **Performance Tasks –**

- Participate in a **basic classroom conversation** using greetings, introductions, and farewells.
- **Describe a school day** (schedule, classroom items, day/date/time) in a short oral or written presentation.
- **Demonstrate understanding** of short spoken and written Spanish related to classroom routines and schedules.
- Give a brief **weather, date, and time check-in** using practiced phrases and sentences.
- Create a simple **cultural snapshot of México** showing basic geographic and cultural understanding.

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessments**

- Short quizzes or checks for understanding of **vocabulary and basic sentence formation**.
- **Listening or reading comprehension activities** with selected-response answers.
- **Exit tickets or bell-ringers** using greetings, dates, weather, or classroom language.
- **Guided writing samples**, such as labeled images or sentence frames.
- **Student self-assessments or reflections** on communication strategies and progress.

- **Notebook checks** for accurate use of vocabulary, visuals, and practice activities.

#### Summative Assessments

- Preliminary Unit Assessment

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- Participate in **daily greetings, check-ins, and classroom conversations** in Spanish with teacher.
- Engage in **partner and small-group activities** to talk about schedules, dates, time, and weather.
- Complete **listening and reading activities** using short, familiar texts (dialogs, schedules, announcements).
- Create and interpret **simple oral or written products** related to weather, school schedule, calendar.
- Explore **cultural content about Spanish-speaking countries through maps, images, short texts, and guided tasks.**

#### Instructional Strategies:

- Model language through **repetition, visuals, gestures, and comprehensible input.**
- Teach vocabulary and grammar **in context**, embedded in meaningful communication.
- Use **sentence frames and guided practice** to support beginning learners.
- Incorporate **songs, movement, and visuals** to reinforce meaning and engagement.
- Explicitly model and reinforce **language learning strategies**, such as using cognates, interrogatives and asking for clarification (yes/no, then one word response).

#### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# Central Bucks School District – Course of Study – Spanish 1A

## Unit 1 – Family and Friends

### Desired Results:

#### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### Enduring Understandings:

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### Knowledge:

Students will know...

- Vocabulary to **identify and describe family members and other people**, including physical traits, personality traits, emotions, and conditions.
- How to use **subject pronouns and adjective agreement** to describe people accurately.
- How and when to use the verbs **ser, estar, and tener** to tell what people are like, how they feel, and their characteristics or conditions.
- Common celebrations in Mexico and indigenous places and people groups.

#### Skills:

Students will be able to...

- **Identify and describe family members and friends** using basic physical and personality traits.
- **Express emotions and conditions** using novice level Spanish.
- **Ask and answer simple questions** about people using practiced words and phrases.
- **Create simple sentences** using subject pronouns with correct adjective agreement.
- **Use ser, estar, and tener** to describe what someone is like, how they feel, and basic characteristics.
- **Recognize cultural perspectives** related to family and culture in modern Mexico.

## Standards:

### Priority:

- **Interpersonal Communication:** Students exchange basic information about family members and friends using simple, practiced Spanish.
- **Interpretive Communication:** Students understand the main idea and key details of short spoken and written texts about people, relationships, and emotions.
- **Presentational Communication:** Students present basic descriptions of people (family, friends) using simple sentences and familiar language.
- **Language Structures and Vocabulary:** Students apply subject pronouns, adjective agreement, and the verbs **ser, estar, and tener** to describe people accurately.

### Supporting:

- **Language Learning Strategies:** Students use strategies such as visuals, cognates, repetition, and asking for clarification to support comprehension and communication.
- **Cultural Understanding:** Students identify and describe basic cultural perspectives related to Mexico.

## Acceptable Evidence:

### Performance Tasks –

- Participate in a **partner and classroom conversations** describing family members and friends using physical traits, personality, and emotions.
- Create a **short oral or written description** of a family member or friend using **ser, estar, and tener** with correct adjective agreement.
- Interpret a **short text or audio** about a family or group of friends and show understanding of key details.
- Present a **visual-supported product** (poster, slide, or simple paragraph) about family relationships, including a cultural connection to Mexico by using famous people.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- **Quizzes or checks for understanding** of vocabulary, spelling and basic sentence structures.
- **Listening and reading comprehension activities** with selected-response or short answers.
- **Guided writing activities**, such as sentence frames or labeled images.
- **Exit tickets or bell ringers** describing people, emotions, or relationships.
- **Notebook or digital portfolio checks** showing practice and application of language.
- **Self-assessments or reflections** on communication and learning strategies.

#### Summative Assessments

- Unit 1 Section Quizzes
- Unit 1 IPA

## Suggested Learning Experiences and Instruction

### Learning Experiences:



- Engage in **daily interpersonal speaking routines** describing family members, friends, and emotions.
- Participate in **structured partner and small-group activities** using sentence frames or images to describe people.
- Complete **listening and reading activities** featuring short texts about families and relationships.
- Create **simple oral and written descriptions** of family, friends or celebrities using visuals and models.
- Use **images, photos, or family trees** to support comprehension and communication.
- Explore **Mexican culture and perspectives on family** through, images, short readings, and discussion.
- Practice **language learning strategies** such as using visuals, cognates, repetition, and asking for clarification.

#### **Instructional Strategies:**

- Model new vocabulary and structures using **visuals, gestures, and comprehensible input**.
- Introduce grammar (**ser, estar, tener, adjective agreement**) **in context**, tied to meaningful communication.
- Use **sentence frames and guided practice** to support beginning learners in speaking and writing.
- Scaffold communication with **structured interpersonal tasks** (partner talk, information gaps).
- Provide frequent opportunities for **oral repetition and recycled language** in daily routines.
- Integrate **listening and reading supports**, such as visuals, graphic organizers, and chunked texts.
- Incorporate **cultural content** through images, short readings, and guided discussion about family in Mexico and the United States.
- Explicitly teach and reinforce **language learning strategies**, such as using cognates and asking for clarification.

#### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# Central Bucks School District – Course of Study – Spanish 1A

## Unit 2 – Life at Home

### Desired Results:

#### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### Enduring Understandings:

Students will understand that...

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### Knowledge:

Students will know...

- Vocabulary related to rooms in a home, furniture, and household chores.
- The difference between Spanish nouns and articles and how they agree in gender and number.
- How to use **hay** and forms of **haber** to express existence.
- How to describe the location of people and objects using common location expressions.
- How to conjugate and use regular **-ar**, **-er**, and **-ir** verbs in the present tense.
- How to express obligations and responsibilities using **tener que + infinitive** and **hay que + infinitive**.
- How to use adverbs of frequency to talk about how often activities and chores are completed.
- Important cultural features of **Puerto Rico**, including **Old San Juan** and the significance of **salsa music** as an expression of Puerto Rican culture.
- Similarities and differences between home life and cultural practices in Puerto Rico and their own communities.

#### Skills:

**Students will be able to...**

- Describe their home, rooms, and furniture using simple Spanish sentences.
- Identify where people and objects are located by using common location expressions and **hay**.

- Discuss household chores and daily responsibilities using present-tense **-ar, -er, and -ir** verbs.
- Explain what they and others have to do using **tener que + infinitive** and **hay que + infinitive**.
- Talk about how often they complete chores and household activities using adverbs of frequency.
- Compare aspects of home life and culture in Puerto Rico, including Old San Juan and the importance of salsa music.

### Standards:

#### Priority:

**Interpersonal Communication:** Students interact and negotiate meaning in spoken, signed, or written conversations to share information, reactions, feelings, and opinions about chores, leisure activities and homes.

**Interpretive Communication:** Learners understand, interpret, and analyze what is heard, read, or viewed on a variety of topics using *hay*, prepositions and **-ar, -er and -ir** verbs.

**Presentational Communication:** Learners present information, describe homes, furniture, and chores in writing or through a presentation.

#### Supporting:

**Cultures:** Learners explore how cultural products reflect Puerto Rican values and traditions.

**Comparisons:** Compare home life, family responsibilities, and cultural traditions in Puerto Rico and the United States.

**Connections:** Use Spanish-language texts, images, and media to gain information about homes and culture in Puerto Rico using adverbs of frequency and articles.

### Acceptable Evidence:

#### Performance Tasks –

- Participate in **partner and classroom conversations** about rooms in a home, furniture, and household chores using simple present-tense sentences.
- Create a short **oral or written description** of their home, including rooms, furniture, and where items are located using *hay* and location expressions.
- Interpret a **short text, infographic, or audio** about a home or family responsibilities and demonstrate understanding of key details.
- Present **information about daily chores and responsibilities** using regular **-ar, -er, and -ir** verbs, adverbs of frequency, and expressions such as *tener que* and *hay que*.
- Create a **visual-supported product** (poster, slide, digital tour, or simple paragraph) describing a home and comparing aspects of home life in Puerto Rico and the United States.
- Investigate and **present information about Puerto Rican culture**, including Old San Juan or salsa music, and explain its cultural significance using simple Spanish.

#### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- **Formative Assessments** on vocabulary related to the home, furniture, chores, and Puerto Rican culture.
- **Quizzes or checks for understanding** of nouns, articles, present-tense verbs, location expressions, obligation expressions (*tener que* and *hay que*), adverbs of frequency and articles.

- **Listening and reading comprehension activities** focused on descriptions of homes, household responsibilities, and life in Puerto Rico.
- **Guided writing activities** such as labeling rooms and furniture, completing sentences about chores, or describing locations of objects.
- **Exit tickets or bell ringers** describing a room, explaining a household responsibility, or using adverbs of frequency in a sentence.
- **Notebook, interactive notebook, or digital portfolio checks** demonstrating practice with vocabulary, grammar structures, and cultural learning.
- **Self-assessments and reflections** on students' ability to communicate about their home, responsibilities, and Puerto Rican culture in Spanish.

### Summative Assessments

- Section quizzes
- IPA Unit 2 Assessment

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Engage in **daily interpersonal speaking** routines about homes, rooms, furniture, and household responsibilities.
- Participate in **structured partner and small-group activities** to describe locations of people and objects using visuals, maps, and room layouts.
- Complete **listening and reading activities** featuring descriptions of homes, chores, and daily routines in Spanish-speaking communities.
- Create simple **oral and written descriptions** of their home and household responsibilities using models, sentence frames, and visual supports.
- Use floor plans, photographs, virtual home tours, and labeled diagrams to support **comprehension and communication**.
- Explore **Puerto Rican culture** through images, videos, short readings, and discussions about Old San Juan, home life, food, art, sports, and music.
- Practice **language-learning strategies** such as using cognates, context clues, graphic organizers, repetition, and peer collaboration to support communication.

#### Instructional Strategies:

- Use **comprehensible input** supported by visuals, gestures, realia, and modeled language to introduce vocabulary related to the home and chores.
- Provide **structured speaking opportunities** through partner work, information-gap activities, and classroom conversations.
- Incorporate **sentence frames and guided practice** to support the use of present-tense verbs, location expressions, and obligation phrases.
- Use **interactive activities** such as labeling diagrams, matching tasks, and digital learning tools to reinforce vocabulary and grammar.
- Integrate **authentic cultural resources**, including images, videos, music, art and texts from Puerto Rico, to build cultural understanding.
- Facilitate **collaborative learning** through pair and small-group tasks that encourage communication and problem-solving in Spanish.

- Differentiate instruction using visual supports, graphic organizers, word banks, and scaffolded reading and writing activities.

### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# Central Bucks School District – Course of Study – Spanish 1A

## Unit 3 – Shopping and Clothing

### Desired Results:

#### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

#### Enduring Understandings:

- Students will understand that...
- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

#### Knowledge:

Students will know...

- Vocabulary related to clothing, shopping, colors, sizes, and physical descriptions.
- How to use **gustar** and similar expressions to talk about likes, preferences, and interests.
- How to use the verb **ir** to talk about where they are going and future plans.
- How to recognize and use common **e → ie** and **o → ue** stem-changing verbs in the present tense.
- How to make comparisons and use demonstratives.
- Strategies for describing products, expressing preferences, and making simple purchases in Spanish.
- Important cultural features of **Guatemala**, including its traditions, textiles, markets, and cultural diversity.
- Similarities and differences between shopping practices and clothing traditions in Guatemala and their own community.

#### Skills:

Students will be able to...

- Describe clothing, colors, sizes, and physical characteristics using simple Spanish sentences.
- Express likes, dislikes, and preferences about clothing, products and shopping using **gustar** and similar expressions.

- Talk about where they are going and future plans using the verb *ir*.
- Communicate about shopping experiences using common *e* → *ie* and *o* → *ue* stem-changing verbs in the present tense.
- Compare products and clothing items and use demonstrative adjectives to identify and describe them.
- Participate in simple shopping interactions by asking about items, expressing preferences, and making purchases in Spanish.
- Interpret information about Guatemalan markets, textiles, and traditions and identify key cultural products and practices.
- Compare shopping habits and clothing traditions in Guatemala with those in their own community.

### Standards:

#### Priority:

**Interpersonal Communication:** Students interact and negotiate meaning in spoken or written conversations about clothing, shopping, preferences, and purchases using ***gustar***, ***ir***, and stem-changing verbs.

**Interpretive Communication:** Learners understand, interpret, and analyze what is heard, read, or viewed about shopping, clothing, descriptions, and consumer choices using familiar vocabulary and present-tense verbs.

**Presentational Communication:** Learners present information about clothing, personal style, shopping preferences, and future shopping plans using ***gustar***, ***ir***, and stem-changing verbs.

#### Supporting:

**Cultures:** Learners explore how Guatemalan traditions, textiles, markets, and cultural products reflect the country's diverse cultural perspectives.

**Comparisons:** Learners compare clothing styles, shopping practices, and consumer preferences in Guatemala and the United States using comparatives and demonstratives.

**Connections:** Learners use Spanish-language texts, images, and media to gain information about Guatemalan markets, traditional clothing, and cultural traditions while applying ***ir* + *a* + infinitive**, ***jugar***, and descriptive language.

### Acceptable Evidence:

#### Performance Tasks –

- **Participate in a partner or small-group shopping role-play** in which students ask about clothing items, sizes, colors, prices, and preferences using ***gustar***, demonstratives, and stem-changing verbs.
- **Create and present a digital outfit catalog or fashion board** describing clothing items, colors, and styles while explaining personal preferences and recommendations.
- **Interpret an advertisement, online store, or clothing catalog** and demonstrate understanding of key details by identifying products, prices, descriptions, and preferred items.
- **Write and present a short shopping plan** with a budget describing where they are going to shop and what they are going to buy using ***ir*** and ***ir* + *a* + infinitive**.
- **Compare and recommend clothing items** by using comparatives and descriptive language to explain which products are more practical, stylish, or affordable.
- **Create a visual-supported presentation about Guatemalan textiles, markets, or traditional clothing** and explain how these cultural products reflect Guatemalan traditions and identity.

#### Acceptable evidence of learning other than Performance Tasks:



## Formative Assessments

- **Formative assessments** on clothing, shopping, colors, sizes, descriptions, and Guatemalan culture.
- **Quizzes or checks for understanding** of **gustar, ir**, stem-changing verbs, comparatives, demonstratives, and vocabulary related to shopping and clothing.
- **Listening and reading comprehension activities** focused on clothing descriptions, shopping situations, advertisements, and Guatemalan markets.
- **Guided writing activities** such as describing clothing, expressing preferences, comparing products, or planning a shopping trip using sentence frames and models.
- **Exit tickets or bell ringers** using target vocabulary and structures to describe outfits, express likes and dislikes, or explain future shopping plans.
- **Notebook, interactive notebook, or digital portfolio checks** demonstrating practice with vocabulary, verb conjugations, and cultural reflections.
- **Vocabulary and grammar application activities** including matching, labeling, categorizing, and sentence completion tasks.
- **Self-assessments and reflections** on students' ability to communicate about shopping, clothing, preferences, and Guatemalan culture in Spanish.

## Summative Assessments

- Section quizzes
- IPA Unit 3 Assessment

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Engage in **daily interpersonal speaking routines** about clothing, shopping preferences, and favorite styles.
- Participate in **structured partner and small-group shopping simulations** using clothing catalogs, advertisements, and role-play scenarios.
- Complete **listening and reading activities** featuring clothing descriptions, shopping experiences, and traditional markets in Guatemala.
- Create simple **oral and written descriptions** of outfits, personal style, and shopping preferences using models and visual supports.
- Use **authentic materials** such as store advertisements, online catalogs, price tags, and product images to support comprehension and communication.
- Explore **Guatemalan culture** through images, videos, short readings, and discussions about traditional textiles, markets, and cultural diversity.
- Compare **clothing styles and shopping practices** in Guatemala and the United States using graphic organizers and class discussions.
- Practice **language-learning strategies** such as using cognates, context clues, repetition, and visual supports to understand and communicate about shopping and fashion.

### Instructional Strategies:

- Use **comprehensible input** supported by visuals, realia, gestures, and modeling to introduce clothing, shopping, and descriptive vocabulary.
- Provide **structured speaking opportunities** through partner interviews, information-gap activities, and shopping role-plays.

- Incorporate **sentence frames and guided practice** to support the use of **gustar, ir**, stem-changing verbs, comparatives, and demonstratives.
- Use **interactive activities** such as matching tasks, sorting activities, scavenger hunts, and digital learning tools to reinforce vocabulary and grammar.
- Integrate **authentic cultural resources**, including Guatemalan textiles, market scenes, advertisements, and videos, to build cultural understanding.
- Facilitate **collaborative learning** through pair and small-group tasks that encourage communication, negotiation, and decision-making in Spanish.
- Differentiate instruction using graphic organizers, word banks, anchor charts, visual supports, and scaffolded reading and writing activities.
- Provide **frequent formative feedback** and opportunities for self-assessment to support growth in interpretive, interpersonal, and presentational communication.

#### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

#### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

## Central Bucks School District – Course of Study – Spanish 1A

### Unit 4 – Food

#### Desired Results:

##### Essential Questions:

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

##### Enduring Understandings:

Students will understand that:

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Note: If time is limited at the end of the school year, teachers facilitate the acquisition of vocabulary from this unit after the final IPAs. Spanish 1B begins with material from this unit to serve as reentry, review and possible new material for some students.**

##### Knowledge:

Students will know...

- How to use **adverbs of quantity** to describe how much, how many, or the extent of something.
- How to express **wants, preferences, and dislikes** using the verbs **querer** and **preferir**.
- How to recognize and use common **irregular yo-form verbs** in the present tense.
- How to identify and use **direct object pronouns** and **indirect object pronouns** in simple sentences.
- How to recognize and use **e → i stem-changing verbs** in the present tense.
- Strategies for expressing preferences, making choices, and communicating about everyday needs and interests in Spanish.
- Important cultural features of **Peru**, including the **Inca civilization**, the **Nazca Lines**, and the significance of the **Inti Raymi** festival.
- Similarities and differences between Peruvian cultural traditions and those of their own community.

##### Skills:

### Students will be able to ...

- Express wants, preferences, and dislikes using **querer**, **preferir**, and adverbs of quantity.
- Communicate about everyday needs, choices, and interests using simple spoken and written Spanish.
- Use common **irregular yo-form verbs** and **e → i stem-changing verbs** in present-tense conversations and writing.
- Identify and use **direct and indirect object pronouns** to provide and receive information in simple sentences.
- Interpret short texts, audio, and visual sources about Peruvian culture and traditions.
- Describe key aspects of **Peru**, including the Inca civilization, the Nazca Lines, and the Inti Raymi festival.
- Compare **Peruvian cultural traditions and historical achievements** with those of their own culture and community.
- Present information and **opinions about preferences, cultural topics, and everyday experiences** using simple Spanish sentences.

### Standards:

#### Priority:

- **Interpersonal Communication:** Students interact and negotiate meaning in spoken or written conversations to express wants, preferences, dislikes, and opinions using unit vocabulary, **gustar**, **querer**, and **preferir**.
- **Interpretive Communication:** Learners understand, interpret, and analyze what is heard, read, or viewed about everyday preferences, choices, and interests using high-frequency vocabulary, adverbs of quantity, and familiar verb forms.
- **Presentational Communication:** Learners present information about their preferences, needs, and interests using unit vocabulary, irregular **yo** forms, and **e → i** stem-changing verbs.
- **Connections:** Learners use Spanish-language texts, images, and media to gain information about Peru while expanding vocabulary and applying it in context.

#### Supporting:

- **Cultures:** Learners explore how the Inca civilization, the Nazca Lines, and the Inti Raymi festival reflect Peruvian cultural perspectives and history.
- **Comparisons:** Learners compare cultural traditions, food, and historical contributions of Peru with those of their own community and culture.

### Acceptable Evidence:

#### Performance Tasks –

- Participate in a **partner conversation** in which students discuss their wants, preferences, and dislikes about activities, food, or personal interests using *gustar*, *querer*, *preferir*, and adverbs of quantity.
- Create a short **oral or written presentation** describing their preferences and choices, using unit vocabulary, irregular *yo* forms, and *e → i* stem-changing verbs.
- Interpret a **short text, infographic, or video** about the Inca civilization, the Nazca Lines, or Inti Raymi and demonstrate understanding of key details.
- Role-play a **real-world scenario** in which students make decisions, express preferences, and respond to others using vocabulary and grammar from the unit.
- Conduct a **class survey about preferences and interests**, then present the results using adverbs of quantity and preference expressions.

## Acceptable evidence of learning other than Performance Tasks:

### Formative Assessments

- **Formative assessments** on vocabulary related to preferences, interests, quantity expressions, and Peruvian culture.
- **Quizzes or checks for understanding** of **gustar, querer, preferir**, irregular **yo** forms, **e → i** stem-changing verbs, and direct and indirect object pronouns.
- **Listening and reading comprehension activities** focused on everyday choices, preferences, and cultural topics such as the Incas, the Nazca Lines, and Inti Raymi.
- **Guided writing activities** in which students express wants, preferences, opinions, and reactions using sentence frames and models.
- **Vocabulary application activities** such as matching, categorizing, graphic organizers, and sentence-completion tasks.
- **Exit tickets or bell ringers** requiring students to express preferences, identify quantities, or use target grammar structures in context.
- **Notebook, interactive notebook, or digital portfolio checks** demonstrating vocabulary development, grammar practice, and cultural reflections.
- **Self-assessments and reflections** on students' ability to communicate about preferences, everyday needs, and Peruvian culture in Spanish.
- **Interpretive tasks** using authentic images, infographics, short readings, or videos to identify key information and new vocabulary.

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Engage in **daily interpersonal speaking routines** expressing wants, preferences, dislikes, and opinions using **gustar, querer, preferir**, and adverbs of quantity.
- Participate in **structured partner and small-group activities** to discuss favorite activities, foods, hobbies, and interests using target vocabulary and sentence frames.
- Complete **listening and reading activities** featuring short texts about personal preferences, cultural traditions, and life in Peru.
- Create simple **oral and written responses** explaining preferences, making choices, and expressing agreement or disagreement.
- Use **surveys, polls, and class interviews** to gather and share information about classmates' likes, dislikes, and preferences.
- Explore **Peruvian culture** through images, videos, maps, short readings, and discussions about the Inca civilization, the Nazca Lines, and the Inti Raymi festival.
- Analyze **authentic cultural resources** and identify key vocabulary, main ideas, and cultural perspectives.
- Practice vocabulary through **interactive games, role-plays, and communicative tasks**.
- Compare **Peruvian traditions and celebrations** with those in students' own communities using graphic organizers and class discussions.
- Use **vocabulary-learning strategies** such as cognates, visual supports, repetition, categorization, and context clues to build and retain new language.

### Instructional Strategies:

- Use **comprehensible input** supported by visuals, gestures, graphic organizers, and modeled language to introduce vocabulary related to preferences, choices, and cultural topics.

- Provide **structured speaking opportunities** through partner interviews, surveys, information-gap activities, and preference-based discussions.
- Incorporate **sentence frames and guided practice** to support the use of **querer, preferir**, irregular **yo** forms, direct and indirect object pronouns, and **e → i** stem-changing verbs.
- Use **interactive vocabulary strategies** such as word walls, picture matching, categorization activities, and digital flashcards to promote vocabulary acquisition and retention.
- Integrate **authentic cultural resources** including images, videos, maps, infographics, and readings about the Incas, the Nazca Lines, and Inti Raymi to build cultural understanding.
- Facilitate **collaborative learning** through pair and small-group tasks that require students to express opinions, make choices, and negotiate meaning in Spanish.
- Use **scaffolded reading and listening activities** with pre-teaching of key vocabulary, comprehension checks, and discussion prompts.
- Differentiate instruction through **visual supports, word banks, anchor charts, graphic organizers, and choice-based activities** to meet diverse learner needs.
- Provide **frequent formative feedback** through quick checks for understanding, exit tickets, and low-stakes speaking and writing tasks.

#### **Differentiation/Intervention/Enrichment Options:**

- **Tiered Activities:**
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

#### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** Spanish 1A

**Date:** November 4, 2025

**Student Level:** Middle School

**Grade Level:** 7-8

### **Characterization of Course of Study:**

Spanish 1A is an introductory world language course designed to develop students' abilities in listening, speaking, reading, and writing in Spanish. Through meaningful communication and cultural exploration, students build foundational proficiency by discussing familiar topics such as personal identity, family, friends, home life, daily routines, shopping, clothing, preferences, and future plans. Students learn to communicate using simple sentences and high-frequency language while developing an understanding of the cultures, products, practices, and perspectives of Spanish-speaking countries, including Mexico, Guatemala, and Peru and the US (Puerto Rico). Instruction is aligned to the ACTFL World-Readiness Standards and emphasizes interpretive, interpersonal, and presentational communication (IPAs). By the end of the course, students will be able to engage in novice-level conversations, exchange information on familiar topics, and demonstrate growing intercultural awareness and confidence in using Spanish in real-world contexts.

### **Reasons for Proposed Adoption:**

The grade realignment in Central Bucks that will begin in fall 2026 creates an opportunity to offer world languages courses in seventh grade; students will have the option to take Spanish 1A and subsequently Spanish 1B. Spanish 1A and Spanish 1B provide students with the equivalent content of Spanish 1 while allowing additional time for language acquisition, practice, and mastery. Learning a new language requires sustained exposure and repeated opportunities to develop listening, speaking, reading, and writing skills. A two-year sequence enables students to build a stronger foundation in vocabulary, grammar, and communication before progressing to higher-level courses. This course provides a developmentally appropriate pace, increased opportunities for communication, greater retention of vocabulary and language structures through repeated exposure and application over time. This two-year pathway promotes equitable access to language learning while preparing students for successful completion of upper-level Spanish courses and continued growth in intercultural communication and global competence.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## Spanish 1B

Course Number: 4081

Course Level: Middle School

Grade: 8

Time/Credit: 47 minutes every day  
1 credit

Development Date: 2025 - 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901



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## **World Languages Department Learning Principles**

Students of World Languages simulate authentic experiences, compare and contrast other languages and cultures, promote tolerance, and make connections with other disciplines.

World Languages programs integrate studying and experiencing the culture(s) in which the world language is used.

The World Languages discipline connects with all the other disciplines.

The learner is at the center of effective World Languages instruction.

World Languages programs should reflect the developmental nature of language acquisition.

The complexity of teaching a World Language requires teachers to reflect on their practice and match knowledge of the discipline with appropriate teaching, while assessing strategies to achieve learning goals.

Differentiated instruction addresses student strengths, interests and learning styles.

World Language learners achieve proficiency through performance-based assessments including speaking, reading, writing, and listening.

To achieve reality-based language learning, the world language acquisition must include technology-based instruction and practice.

World language educators create awareness, incite curiosity, and encourage appreciation of the language and culture being learned.

Sources: World Languages Curriculum Framework Making Connections

### World-Readiness Standards for Learning Languages

| Goal Area     | Standard                                       | Description                                                                                                                                            |
|---------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communication | Interpersonal Communication                    | Learners interact and negotiate meaning in spoken, signed, or written conversations to share information, reactions, feelings, and opinions.           |
| Communication | Interpretive Communication                     | Learners understand, interpret, and analyze what is heard, read, or viewed on a variety of topics.                                                     |
| Communication | Presentational Communication                   | Learners present information, concepts, and ideas to inform, explain, persuade, and narrate on a variety of topics for different audiences.            |
| Cultures      | Relating Cultural Practices to Perspectives    | Learners investigate, explain, and reflect on the relationship between the practices and perspectives of the cultures studied.                         |
| Cultures      | Relating Cultural Products to Perspectives     | Learners investigate, explain, and reflect on the relationship between the products and perspectives of the cultures studied.                          |
| Connections   | Making Connections                             | Learners build, reinforce, and expand their knowledge of other disciplines while using the language to think critically and solve problems creatively. |
| Connections   | Acquiring Information and Diverse Perspectives | Learners access and evaluate information and diverse perspectives available through the language and its cultures.                                     |
| Comparisons   | Language Comparisons                           | Learners investigate, explain, and reflect on the nature of language through comparisons between the language studied and their own.                   |
| Comparisons   | Cultural Comparisons                           | Learners investigate, explain, and reflect on the concept of culture through comparisons between the cultures studied and their own.                   |
| Communities   | School and Global Communities                  | Learners use the language within and beyond the classroom to interact and collaborate in their community and the globalized world.                     |
| Communities   | Lifelong Learning                              | Learners set goals and reflect on their progress in using languages for enjoyment, enrichment, and advancement.                                        |

**Central Bucks School District**  
**World Languages Department Enduring Understandings**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Central Bucks School District**  
**World Languages Department Essential Questions**

1. How does an individual express his or her basic needs and wants in the target language?
2. How are your language and culture affected by others? How are other languages and cultures affected by yours?
3. How and why can you use the target language to further your career and personal enrichment?
4. How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
5. When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

## Central Bucks School District – Course of Study Overview

### Spanish 1B

#### **Desired Results**

##### Course Description:

Spanish 1B builds on the foundational skills developed in Spanish 1A through continued study of Spanish vocabulary, grammar, and communication. Students strengthen their reading, listening, speaking, and writing skills while exploring real-world topics such as food and dining, health and wellness, hobbies and sports, travel and transportation, geography, and the environment. Through an exploration of Peru, Spain, the United States, Argentina, and Chile, students gain a deeper understanding of the diverse cultures, products, practices, and perspectives of the Spanish-speaking world while increasing their confidence and proficiency in Spanish.

Prerequisite: C- in Spanish 1A

##### Students will be able to:

- Communicate about food, meals, and dining experiences in Spanish.
- Describe personal health, habits, symptoms, and basic wellness practices.
- Discuss hobbies, sports, free-time activities, and everyday interests.
- Exchange information about work, responsibilities, and leisure activities.
- Talk about travel, transportation, destinations, and lodging.
- Ask for and give directions using location and city-related vocabulary.
- Describe geographic features, regions, and topics about nature.
- Use numbers to communicate quantities and real-world information.
- Interpret and respond to spoken, written, and visual Spanish in a variety of contexts.
- Present information, ideas, and opinions in Spanish using appropriate vocabulary and structures.
- Compare cultural practices and perspectives from Peru, Spain, Argentina, Chile, and Spanish-speaking communities in the United States.
- Demonstrate increased proficiency in reading, listening, speaking, and writing in Spanish.

#### **Acceptable Evidence.**

District Unit IPAs

District Final IPAs

Other tests, quizzes, projects, and activities will be included at the discretion of the teacher throughout the units in each course to check for understanding of essential skills, vocabulary, grammar, and culture.

## Course Grading:

### World Languages IPA Statement:

Beginning in the fall of 2021, the Central Bucks World Languages Department in each middle and high school will use assessments that are called IPAs which stand for Integrated Performance Assessments. They will occur throughout each unit as formative performance-based assessments. Additionally, they will be given at the end of each unit as common district summative assessments, and at the end of each course as common district final summative assessments. IPAs assess the progress that language students are making in building their proficiency through the World-Readiness Standards and were created by ACTFL (American Council on the Teaching of Foreign Languages). The Integrated Performance Assessment (IPA) is a cluster assessment featuring three tasks, each of which reflects one of the three modes of communication: Interpretive, Interpersonal, and Presentational. The three tasks are aligned within a single theme or content area, reflecting the way students naturally acquire and *use* the language in the real world or the classroom.

The final summative IPAs given at the end of each course (formerly called final assessments) account for 10% of the total grade and are placed into the final exam category in the gradebook.

Breakdown of the gradebook percentages for grades 7-8 for 36-week courses.

22.5% for Marking Period 1

22.5% for Marking Period 2

22.5% for Marking Period 3

22.5% for Marking Period 4

10% for Final Exam

## Spanish 1B – Pacing Guide and Instructional Time

The following times are approximations and therefore, are guidelines inclusive of teaching, reviewing and assessing, to ensure completion of the course within the middle school year.  
Grammar, Vocabulary and Culture are all integrated in World Languages lessons.

| <b>Content</b>                                        | <b>Instructional Time</b>  |
|-------------------------------------------------------|----------------------------|
| Review of Spanish 1A                                  | Weeks 1-2                  |
| Week 1: Vocabulary and present tense review           | 5 days                     |
| Week 2: Communication review and readiness assessment | 5 days                     |
| <b>Unit 4: Food (second half)</b>                     | <b>Weeks 3-6</b>           |
| Week 3: Foods and beverages                           | 5 days                     |
| Week 4: Restaurants and dining                        | 5 days                     |
| Week 5: Preferences and food culture in Perú          | 5 days                     |
| Week 6: Unit IPAs                                     | 5 days                     |
| <b>Unit 5: Health and Wellness</b>                    | <b>Weeks 7-16</b>          |
| Week 7: Healthy habits                                | 5 days                     |
| Week 8: Parts of the body                             | 5 days                     |
| Week 9: Illnesses and symptoms                        | 5 days                     |
| Week 10: Advice and recommendations                   | 5 days                     |
| Week 11: Daily wellness routines                      | 5 days                     |
| Week 12: Healthcare conversations                     | 5 days                     |
| Week 13: Cultural perspectives on health              | 5 days                     |
| Week 14: Communication and application                | 5 days                     |
| Week 15: Formative Assessment                         | 5 days throughout the unit |
| Week 16: Unit IPAs                                    | 5 days                     |
| <b>Unit 6: Pastimes</b>                               | <b>Weeks 17-25</b>         |
| Week 17: Hobbies and interests                        | 5 days                     |
| Week 18: Sports and recreation                        | 5 days                     |
| Week 19: Careers and professions                      | 5 days                     |
| Week 20: Future aspirations                           | 5 days                     |
| Week 21: Free-time activities                         | 5 days                     |
| Week 22: Cultural exploration                         | 5 days                     |
| Week 23: Communication activities                     | 5 days                     |
| Week 24: Formative Assessments                        | 5 days throughout the unit |
| Week 25: Unit IPAs                                    | 5 days                     |
| <b>Unit 7: Travel</b>                                 | <b>Weeks 26-34</b>         |
| Week 26: Travel vocabulary                            | 5 days                     |
| Week 27: Transportation                               | 5 days                     |
| Week 28: Destinations and lodging                     | 5 days                     |
| Week 29: Planning trips                               | 5 days                     |
| Week 30: Travel experiences                           | 5 days                     |
| Week 31: Spanish-speaking destinations                | 5 days                     |



|                                                 |                            |
|-------------------------------------------------|----------------------------|
| Week 32: Communication activities               | 5 days                     |
| Week 33: Formative Assessments                  | 5 days throughout the unit |
| Week 34: Unit IPAs                              | 5 days                     |
| Unit 8: Nature                                  | Weeks 35-36                |
| Week 35: Geography, nature, and the environment | 5 days                     |
| Week 36: Final IPAs                             | 5 days                     |

**NOTE:** Enrichment opportunities will be provided to meet the needs of students that acquire an understanding of the content before their peers. Enrichment will be provided after students have completed the work assigned to all students and will be an extension activity with the same theme.

### **Required Texts and Software**

VHL Central by Vista Higher Learning Supersite Platform  
Encuentros 978-1-54334-316-8

**Supplemental Sites:** Microsoft 365 Tools, Gale Library Resources, Classlink, Quizlet, Blooket, Gimkit, EdPuzzle, Canvas, Wordwall, Kahoot etc.

**Central Bucks School District – Course of Study – Spanish 1B**  
**Unit 4 – Food**  
**(Vocabulary Review and Introduction of Grammar)**

**Desired Results:**

**Essential Questions**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

**Enduring Understandings**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Note:** There are 2 weeks prior to this that allow for students to review foundational skills and vocabulary from Spanish 1A.

**Knowledge:**

Students will know...

- How to use **adverbs of quantity** to describe how much, how many, or the extent of something.
- How to express **wants, preferences, and dislikes** using the verbs **querer** and **preferir**.
- How to recognize and use common **irregular yo-form verbs** in the present tense.
- How to identify and use **direct object pronouns** and **indirect object pronouns** in simple sentences.
- How to recognize and use **e → i stem-changing verbs** in the present tense.
- Strategies for expressing preferences, making choices, and communicating about everyday needs and interests in Spanish.
- Important cultural features of **Peru**, including the **Inca civilization**, the **Nazca Lines**, and the significance of the **Inti Raymi** festival.
- Similarities and differences between Peruvian cultural traditions and those of their own community.

**Skills:****Students will be able to ...**

- Express wants, preferences, and dislikes using **querer**, **preferir**, and adverbs of quantity.
- Communicate about everyday needs, choices, and interests using simple spoken and written Spanish.
- Use common **irregular yo-form verbs** and **e → i stem-changing verbs** in present-tense conversations and writing.
- Identify and use **direct and indirect object pronouns** to provide and receive information in simple sentences.
- Interpret short texts, audio, and visual sources about Peruvian culture and traditions.
- Describe key aspects of **Peru**, including the Inca civilization, the Nazca Lines, and the Inti Raymi festival.
- Compare **Peruvian cultural traditions and historical achievements** with those of their own culture and community.
- Present information and **opinions about preferences, cultural topics, and everyday experiences** using simple Spanish sentences.

**Standards:**Priority:

- **Interpersonal Communication:** Students interact and negotiate meaning in spoken or written conversations to express wants, preferences, dislikes, and opinions using unit vocabulary, **gustar**, **querer**, and **preferir**.
- **Interpretive Communication:** Learners understand, interpret, and analyze what is heard, read, or viewed about everyday preferences, choices, and interests using high-frequency vocabulary, adverbs of quantity, and familiar verb forms.
- **Presentational Communication:** Learners present information about their preferences, needs, and interests using unit vocabulary, irregular **yo** forms, and **e → i** stem-changing verbs.
- **Connections:** Learners use Spanish-language texts, images, and media to gain information about Peru while expanding vocabulary and applying it in context.

Supporting:

- **Cultures:** Learners explore how the Inca civilization, the Nazca Lines, and the Inti Raymi festival reflect Peruvian cultural perspectives and history.
- **Comparisons:** Learners compare cultural traditions, food, and historical contributions of Peru with those of their own community and culture.
- **Interpretive Communication:** Learners understand, interpret, and analyze what is heard, read, or viewed about everyday preferences, choices, and interests using indirect and direct object pronouns.

**Acceptable Evidence:****Performance Tasks**

- Participate in a **partner conversation** in which students discuss their wants, preferences, and dislikes about activities, food, or personal interests using *gustar*, *querer*, *preferir*, and adverbs of quantity.
- Create a short **oral or written presentation** describing their preferences and choices, using unit vocabulary, irregular *yo* forms, and *e → i* stem-changing verbs.
- Interpret a **short text, infographic, or video** about the Inca civilization, the Nazca Lines, or Inti Raymi and demonstrate understanding of key details.

- Role-play a **real-world scenario** in which students make decisions, express preferences, and respond to others using vocabulary and grammar from the unit.
- Conduct a **class survey about preferences and interests**, then present the results using adverbs of quantity and preference expressions.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessments

- **Formative assessments** on vocabulary related to preferences, interests, quantity expressions, and Peruvian culture.
- **Quizzes or checks for understanding** of **gustar, querer, preferir**, irregular **yo** forms, **e → i** stem-changing verbs, and direct and indirect object pronouns.
- **Listening and reading comprehension activities** focused on everyday choices, preferences, and cultural topics such as the Incas, the Nazca Lines, and Inti Raymi.
- **Guided writing activities** in which students express wants, preferences, opinions, and reactions using sentence frames and models.
- **Vocabulary application activities** such as matching, categorizing, graphic organizers, and sentence-completion tasks.
- **Exit tickets or bell ringers** requiring students to express preferences, identify quantities, or use target grammar structures in context.
- **Notebook, interactive notebook, or digital portfolio checks** demonstrating vocabulary development, grammar practice, and cultural reflections.
- **Self-assessments and reflections** on students' ability to communicate about preferences, everyday needs, and Peruvian culture in Spanish.
- **Interpretive tasks** using authentic images, infographics, short readings, or videos to identify key information and new vocabulary.

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Engage in **daily interpersonal speaking routines** expressing wants, preferences, dislikes, and opinions using **gustar, querer, preferir**, and adverbs of quantity.
- Participate in **structured partner and small-group activities** to discuss favorite activities, foods, hobbies, and interests using target vocabulary and sentence frames.
- Complete **listening and reading activities** featuring short texts about personal preferences, cultural traditions, and life in Peru.
- Create simple **oral and written responses** explaining preferences, making choices, and expressing agreement or disagreement.
- Use **surveys, polls, and class interviews** to gather and share information about classmates' likes, dislikes, and preferences.
- Explore **Peruvian culture** through images, videos, maps, short readings, and discussions about the Inca civilization, the Nazca Lines, and the Inti Raymi festival.
- Analyze **authentic cultural resources** and identify key vocabulary, main ideas, and cultural perspectives.
- Practice vocabulary through **interactive games, role-plays, and communicative tasks**.
- Compare **Peruvian traditions and celebrations** with those in students' own communities using graphic organizers and class discussions.
- Use **vocabulary-learning strategies** such as cognates, visual supports, repetition, categorization, and context clues to build and retain new language.

### Instructional Strategies:

- Use **comprehensible input** supported by visuals, gestures, graphic organizers, and modeled language to introduce vocabulary related to preferences, choices, and cultural topics.
- Provide **structured speaking opportunities** through partner interviews, surveys, information-gap activities, and preference-based discussions.
- Incorporate **sentence frames and guided practice** to support the use of **querer**, **preferir**, irregular **yo** forms, direct and indirect object pronouns, and **e → i** stem-changing verbs.
- Use **interactive vocabulary strategies** such as word walls, picture matching, categorization activities, and digital flashcards to promote vocabulary acquisition and retention.
- Integrate **authentic cultural resources** including images, videos, maps, infographics, and readings about the Incas, the Nazca Lines, and Inti Raymi to build cultural understanding.
- Facilitate **collaborative learning** through pair and small-group tasks that require students to express opinions, make choices, and negotiate meaning in Spanish.
- Use **scaffolded reading and listening activities** with pre-teaching of key vocabulary, comprehension checks, and discussion prompts.
- Differentiate instruction through **visual supports, word banks, anchor charts, graphic organizers, and choice-based activities** to meet diverse learner needs.
- Provide **frequent formative feedback** through quick checks for understanding, exit tickets, and low-stakes speaking and writing tasks.

### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- Intervention:
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- Enrichment:
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

### General strategies for Language Development:

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

**Central Bucks School District – Course of Study – Spanish 1B**  
**Unit 5 – Health and Wellness**

**Desired Results:**

**Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

**Enduring Understandings:**

**Students will understand that**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Knowledge:**

**Students will know...**

- How to describe parts of the body using Spanish vocabulary.
- Healthy habits contribute to overall wellness.
- Vocabulary to describe common symptoms, illnesses, and basic remedies in Spanish.
- How to use reflexive verbs to talk about daily routines, personal care, and actions.
- How to use the verbs **ver**, **oír**, **oler**, **decir**, **doler** and **sentirse** to describe pain, discomfort, and feelings of wellness.
- Affirmative and negative **tú** commands to give advice, instructions, and recommendations.
- Spain has unique cultural traditions, historical influences, and artistic contributions, including those found in Madrid and southern Spain.
- That cultural perspectives can influence health practices, daily routines, and lifestyles.

**Skills:**

**Students will be able to...**

- **Communicate about health**, wellness, and personal care in Spanish.
- **Describe symptoms, illnesses, and basic remedies** using appropriate vocabulary and grammar.
- **Give simple advice and instructions** related to healthy habits.

- **Compare health-related practices and cultural influences** in Spain with their own experiences.

### **Standards:**

#### Priority:

**Interpersonal Communication:** Students can discuss health, wellness, personal care routines, symptoms, illnesses, and remedies using simple conversations in Spanish.

**Interpretive Communication:** Students can understand the main idea and key details of short, familiar spoken and written Spanish related to health, healthy habits, and wellness.

**Presentational Communication:** Students can present information and give simple advice about health, personal care, and healthy lifestyle choices.

**Cultural Understanding:** Students can identify cultural products, practices, and perspectives related to health and daily life in Spain, including regional historical influences.

**Language Structures and Vocabulary:** Students apply health-related vocabulary and grammatical structures, including reflexive verbs, affirmative **tú** commands, and expressions with **doler** and **sentir** to communicate meaning.

#### Supporting:

**Language Structures and Vocabulary:** Students apply health-related vocabulary and grammatical structures, including reflexive verbs, negative **tú** commands, and expressions with **oír**, **oler**, **decir** to communicate meaning.

**Language Learning Strategies:** Students use context clues, cognates, visuals, and language-learning strategies to improve comprehension and communication when discussing health and wellness topics.

### **Acceptable Evidence:**

#### **Performance Tasks –**

- Participate in a **conversation about symptoms, illnesses, and healthy habits** with a partner.
- Health care **scenarios** (visit to a doctor, nurse, or pharmacy) using unit vocabulary and target language structures.
- Create and present a **wellness plan** that includes healthy habits and self-care routines.
- Give **advice to a peer** about staying healthy using affirmative **tú** commands.
- Interpret and respond to an **authentic health-related reading, infographic, or video** in Spanish.
- Create a **poster, brochure, or digital presentation** promoting healthy lifestyle choices.
- Compare **health practices and perspectives** in Spain with those in their own community.
- Write a short **personal reflection** describing how they feel, their daily routine and habits that support wellness.

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessments**

- Quizzes or checks for understanding of vocabulary, spelling and basic sentence structures.
- Listening and reading comprehension activities with selected responses or short answers.
- Exit tickets and formative checks for understanding.
- Written responses and guided journal entries .
- Speaking practice activities and partner conversations.
- Completion of workbook, practice, and classwork assignments .
- Cultural reflection activities .
- Self-assessments and goal-setting reflections.



## Summative Assessments

- Unit 5 Section Quizzes
- Unit 5 IPA

## Suggested Learning Experiences and Instruction

### Learning Experiences:

- Practice **conversations** about health, symptoms, and wellness routines.
- Real-world **simulations** such as interacting with health care providers or giving health advice.
- Interpret **authentic Spanish-language resources** like health articles, infographics, or videos.
- Create **wellness plans, posters, or presentations** promoting healthy habits.
- Compare **health-related practices and perspectives** in Spain and the United States.
- Participate in structured collaborative vocabulary, grammar, and **speaking activities**.
- Explore cultural connections through the study of Spain's history and daily life.

### Instructional Strategies:

- **Comprehensible input** through visuals, gestures, and contextualized language.
- **Structured activities** for partners and small-group conversations.
- **Scenario-based learning** and other interpersonal tasks.
- Vocabulary development through **explicitly teach and reinforce language learning strategies** such as using cognates and using commands in context.
- Guided **reading and listening activities** with authentic resources.
- **Model** and practice targeted grammar in meaningful contexts.
- Incorporate **cultural content** through images, short readings, realia and guided discussions.
- Formative assessment through **questioning, exit tickets, and checks** for understanding.

### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

**Central Bucks School District – Course of Study – Spanish 1B**  
**Unit 6 – Pastimes**

**Desired Results:**

**Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

**Enduring Understandings:**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Knowledge:**

**Students will know...**

- Vocabulary related to work, hobbies, sports, and leisure activities.
- How to use the verb **-ir** to express the future.
- How to use the **imperfect tense** to express what they used to do.
- Different vocabulary and expressions used to discuss jobs, interests, and free-time activities in Spanish.
- People have a variety of interests and activities that reflect their preferences and lifestyles.
- Sports and recreational activities play an important role in the U.S. and other cultures.
- Cultural perspectives can influence how people spend their free time and balance work and leisure.
- Language can be used to express preferences, interests, and participation in activities.

**Skills:**

**Students will be able to...**

- Discuss jobs, hobbies, sports, and free-time activities using appropriate vocabulary and expressions.
- Express preferences and describe how they spend their free time.
- Use **ir + a + infinitive** to talk about future plans and activities.
- Use the **present progressive tense** to describe actions that are happening in the moment.
- Use the **imperfect tense** to describe past habits, routines, and ongoing activities.

- Use **u → ue stem-changing verbs** in context to communicate about activities, plans, and personal interests.
- Compare leisure activities, sports, and lifestyle preferences across cultures.
- Interpret and present information about work, hobbies, and recreation in spoken and written Spanish.

### Standards:

#### Priority:

**Interpersonal Communication:** Students can exchange information about work, hobbies, sports, leisure activities, and future plans using simple conversations in Spanish.

**Interpretive Communication:** Students can understand the main idea and key details of spoken and written Spanish related to jobs, recreation, sports, and free-time activities.

**Presentational Communication:** Students can present information about their interests, hobbies, routines, and plans using appropriate vocabulary and time frames.

**Cultural Understanding:** Students can identify and compare leisure activities, sports, and cultural perspectives on work and free time in Spanish-speaking communities and in the United States.

#### Supporting:

*These standards are embedded within the priority standards, not taught in isolation.*

**Language Structures and Vocabulary:** Students apply vocabulary related to work, hobbies, sports, and leisure while using **ir + a + infinitive**, the **present progressive**, the **imperfect tense**, and **u → ue stem-changing verbs** to communicate and negotiate meaning.

**Language Learning Strategies:** Students use context clues, cognates, visuals, and communication strategies to interpret and express ideas about activities, interests, and future plans.

### Acceptable Evidence:

#### Performance Tasks –

- Conduct and participate in a **conversations and interviews** about favorite hobbies, sports, and free-time activities.
- Create a **presentation** describing weekend plans using **ir + a + infinitive** and leisure-related vocabulary.
- **Compare past and present interests**, routines, or sports participation using the **imperfect tense** and present-tense language.
- Collect and analyze classmates' preferences for sports and hobbies, then present the results in Spanish.
- Create a short **video or digital presentation** describing hobbies, current activities (**present progressive**), and future plans.
- **Research and present leisure activities, sports, or work-related experiences** in a Spanish-speaking community and compare them to students' own experiences.
- **Read or listen to an authentic source** about hobbies, sports, or jobs and demonstrate comprehension through written or spoken responses.
- Create a **personal profile** describing interests, talents, future goals, and potential careers using unit vocabulary and target structures.

### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessments

- **Quizzes or checks for understanding** of vocabulary, spelling and basic sentence structures.
- Listening and reading **comprehension activities** with selected response or short answers.
- Exit tickets and **formative checks** for understanding.

- **Written responses** and guided journal entries .
- Speaking **practice activities** and partner conversations.
- Completion of workbook, practice, and **classwork assignments** .
- Cultural reflection activities with **guiding prompts**.
- Self-assessments and goal-setting **reflections**.

### Summative Assessments

- Unit 6 Section Quizzes
- Unit 6 IPA

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Conduct **surveys and interviews** about hobbies, sports, and free-time activities.
- Participate in **conversations** about current activities, past interests, and future plans.
- Create **presentations, posters, or digital profiles** showcasing personal interests and hobbies.
- Explore **authentic Spanish-language resources** related to sports, recreation, and careers.
- **Compare leisure activities and sports** in Spanish-speaking cultures and their own community.
- Engage in **role-plays involving recreation, work, and planning activities** with friends.

#### Instructional Strategies:

- **Comprehensible input** supported by visuals, gestures, and real-world contexts to introduce vocabulary related to work, hobbies, free time and sports.
- Structured **interpersonal speaking activities** and cooperative learning tasks.
- Modeling and guided practice of **ir + a + infinitive**, the **present progressive**, the **imperfect tense**, and **u → ue stem-changing verbs**.
- Use of **authentic texts, videos, and media** to build interpretive skills.
- **Graphic organizers, word walls** and vocabulary-building activities.
- Cultural comparisons and **inquiry-based discussions**.
- Frequent formative assessments, including **exit tickets and comprehension checks**.

#### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries
  - Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.

- **Enrichment:**

- Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
- Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

**Central Bucks School District – Course of Study – Spanish 1B**  
**Unit 7 – Travel**

**Desired Results:**

**Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

**Enduring Understandings:**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Knowledge:**

**Students will know...**

- Vocabulary related to transportation, destinations, lodging, and directions that are essential communicating while traveling.
- Different modes of transportation used for various travel needs and destinations.
- That cities contain common locations and landmarks that help people navigate and give directions.
- Travel experiences can be described using specific vocabulary and past-tense language.
- How to use the **regular preterite tense** to describe completed actions and events that occurred in the past.
- That travel practices and experiences reflect the culture, geography, and daily life of Spanish-speaking communities like Argentina.
- Effective communication is important when planning trips, navigating new places, and interacting with others while traveling.

**Skills:**

**Students will be able to...**

- Communicate and express needs relating to travel, transportation, destinations, and lodging in Spanish.

- Ask for, understand, and provide directions using city and location vocabulary.
- Plan and discuss trips, routes, and travel experiences.
- Describe past travel experiences using the **regular preterite tense**.
- Interpret authentic maps, schedules, and travel-related information in Spanish.
- Compare travel practices and destinations in Spanish-speaking communities and their own experiences.

### **Standards:**

#### Priority:

**Interpersonal Communication:** Students can exchange information about travel, transportation, destinations, lodging, and directions using simple conversations in Spanish.

**Interpretive Communication:** Students can understand the main idea and key details of spoken and written Spanish related to travel, navigation, city locations, and transportation.

**Presentational Communication:** Students can present information about trips, travel experiences, destinations, and routes using appropriate vocabulary and the regular preterite tense.

**Cultural Understanding:** Students can identify and compare travel experiences, geographic locations, and cultural landmarks in Spanish-speaking communities.

**Language Structures and Vocabulary:** Students apply vocabulary related to travel, transportation, lodging, destinations, city locations, and directions while using the **regular preterite tense** to communicate about past events.

#### Supporting:

**Language Learning Strategies:** Students use context clues, maps, visuals, authentic resources, and communication strategies to interpret and convey travel-related information.

### **Acceptable Evidence:**

#### **Performance Tasks –**

- **Travel Planning Project** – Create and present an itinerary for a trip to a Spanish-speaking destination, including transportation, lodging, and planned activities.
- **Giving Directions Role-Play** – Ask for and provide directions to locations in a city using appropriate vocabulary and expressions.
- **Travel Experience Narrative** – Write or present a description of a past trip using the **regular preterite tense**.
- **City Map Activity** – Use a map to describe routes, locations, and landmarks in Spanish.
- **Hotel or Transportation Simulation** – Participate in a real-world conversation involving reservations, transportation, or travel planning.
- **Destination Presentation** – Research and present a Spanish-speaking destination like Argentina, highlighting attractions, transportation options, and cultural landmarks.
- **Interpretive Travel Task** – Read, listen to, or analyze authentic travel materials (maps, schedules, brochures, or advertisements) and demonstrate comprehension.
- **Travel Comparison Project** – Compare travel experiences, destinations, or transportation systems between a Spanish-speaking country and the United States.

### **Acceptable evidence of learning other than Performance Tasks:**

#### **Formative Assessments**

- Vocabulary **quizzes** on transportation, travel, lodging, destinations, and directions.



- Grammar assessments focused on the **regular preterite tense**.
- **Listening comprehension activities** using travel-related audio or video clips.
- **Reading comprehension activities** using maps, schedules, travel brochures, or advertisements.
- **Exit tickets and bell ringers**, quick writes about travel plans or past trips.
- Guided writing activities describing a trip or giving directions.
- Partner and small-group **speaking practice activities**.
- Completion of workbook, classwork, and online **practice assignments**.
- Self-assessments and **reflection activities** on language growth and travel communication skills.

#### Summative Assessments

- Unit 7 Section Quizzes
- Unit 7 IPA

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- Practice **giving and following directions** using maps of cities in Spanish-speaking countries.
- **Plan a trip** that includes transportation, lodging, destinations, and activities.
- Participate in **travel-related role-plays**, such as booking a hotel, asking for directions, or purchasing transportation tickets.
- **Create and share itineraries** for real or imaginary travel experiences.
- **Read and interpret authentic travel resources**, including maps, schedules, brochures, and websites.
- **Explore cultural and geographic features of destinations** in Argentina and other Spanish-speaking countries.
- **Write and discuss past travel experiences** using the regular preterite tense.

#### Instructional Strategies:

- **Comprehensible input** supported by visuals, maps, infographics, and authentic travel materials to introduce and discuss transportation and travel.
- Structured **interpersonal speaking activities**, including information-gap tasks and role-plays.
- **Modeling and guided practice** of travel vocabulary and the regular preterite tense in meaningful contexts.
- Map-based learning and navigation activities to develop direction-giving skills.
- Think-pair-share and **collaborative planning tasks** focused on travel scenarios.
- Use of **authentic resources** like texts, videos, schedules, and advertisements to build interpretive communication skills.
- Cultural **comparison activities** that connect travel experiences in Spanish-speaking countries to students' own experiences.
- Frequent formative **checks for understanding** through exit tickets, quick writes, and comprehension questions.

#### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries

- Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

### **General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

**Central Bucks School District – Course of Study – Spanish 1B**  
**Unit 8 – Nature**

**Desired Results:**

**Essential Questions:**

- How does an individual express his or her basic needs and wants in the target language?
- How are your language and culture affected by others? How are other languages and cultures affected by yours?
- How and why can you use the target language to further your career and personal enrichment?
- How can the use of the target language and cultural proficiency allow an individual to contribute to the local, national, and international communities?
- When and how can an individual use the target language to express cause and effect in order to foster global stewardship?

**Enduring Understandings:**

**Students will understand that:**

- The global nature of our society requires us to negotiate meaning through a variety of modalities.
- Students understand that there are commonalities present in all cultures. Language study brings a heightened sensitivity, tolerance, understanding and connection with the global community while providing a perspective of one's own culture.
- Interdisciplinary connections provide the framework to navigate through an increasingly complex global society.
- The study of languages provides the opportunity for critical examination of one's own language and culture.
- With an increasingly connected world, language learning generates life-long interest and opportunities for students to become productive citizens of the global community.

**Knowledge:**

**Students will know...**

- Specific Spanish **vocabulary and expressions** related to nature, geography, and the universe.
- How to discuss **geographic features and natural environments** in Spanish.
- How to use the have irregular verbs **ir** and **decir in the preterite tense** to talk about geography and nature.
- How to use the **preterite tense** to describe completed natural events in the past.
- Spanish-speaking countries have diverse geographic regions, climates, and natural environments.

**Skills:**

**Students will be able to...**

- Describe and identify features of nature, geography, and the universe using appropriate Spanish vocabulary.
- Interpret and communicate information about maps, locations, and environmental features.
- Describe past events and experiences using the irregular **preterite forms of ir and decir**.
- Compare geographic and environmental characteristics of different regions and cultures.
- Present information about natural landmarks, geographic features, and the environment in spoken and written Spanish.

## **Standards:**

### Priority:

**Interpersonal Communication:** Students can exchange information about nature, geography, locations, and environmental features using simple conversations in Spanish.

**Interpretive Communication:** Students can understand the main idea and key details of authentic spoken and written Spanish related to geography, the natural world, and the environment.

**Presentational Communication:** Students can present information about geographic regions, natural landmarks, environmental features, and past events using appropriate vocabulary and the irregular preterite forms of **ir** and **decir**.

**Cultural Understanding:** Students can identify and compare geographic features, natural environments, and culture as they related to products and perspectives of Spanish-speaking countries and regions like Chile.

### Supporting:

**Language Structures and Vocabulary:** Students apply vocabulary related to nature, geography, the universe, and the environment together with the irregular preterite forms of **ir** and **decir** to communicate about past events and experiences.

**Language Learning Strategies:** Students use maps, visuals, context clues, authentic resources, and communication strategies to interpret and express information about geographic and environmental topics.

### Supporting:

## **Acceptable Evidence:**

### **Performance Tasks –**

- **Geography Presentation** – Research and present a Spanish-speaking country's geographic features, regions, climate, and natural landmarks.
- **Environmental Awareness Project** – Create a poster, infographic, or digital presentation about an environmental issue or natural resource in a Spanish-speaking region.
- **Travel and Exploration Narrative** – Write or present a story about a journey to a natural landmark using the irregular preterite forms of **ir** and **decir**.
- **Map Interpretation Activity** – Use authentic maps and geographic information to describe locations, landforms, and regions in Spanish.
- **Natural Wonders Showcase** – Present information about a significant natural feature, ecosystem, or location in the Spanish-speaking world.
- **Cultural and Geographic Comparison** – Compare the geography and environment of Chile or another Andean country with a region in the United States.
- **Interpretive Task** – Analyze an authentic text, infographic, map, or video about nature, geography, or the environment and demonstrate comprehension.
- **Universe and Nature Presentation** – Create and deliver a brief presentation describing features of the natural world, geography, or the universe using unit vocabulary.

## **Acceptable evidence of learning other than Performance Tasks:**

### **Formative Assessments**

- **Vocabulary quizzes** on nature, geography, the universe.
- **Grammar assessments** focused on the irregular preterite forms of **ir** and **decir**.
- **Reading comprehension activities** using maps, articles, infographics, and geographic texts.
- **Listening comprehension activities** related to geography, travel, and Chile.

- **Exit tickets** and quick writes about geographic features and natural phenomena.
- **Guided writing activities** describing locations, environments, and past experiences.
- Map-labeling and geography **practice activities**.
- Classwork, workbook, and online **practice assignments**.
- Self-assessments and **reflections** on language growth and geographic understanding.

#### Summative Assessment

- Unit 8 Section Quizzes
- Unit 8 IPA

### Suggested Learning Experiences and Instruction

#### Learning Experiences:

- **Explore** maps and satellite images to identify geographic regions, landforms, and natural features in Spanish-speaking countries.
- **Read and discuss** Spanish-language texts, videos, and infographics about nature, the environment, and the universe.
- **Create** maps, travel guides, or digital presentations highlighting geographic and environmental features.
- **Compare** the geography and natural environments of Spanish-speaking countries with students' local region.
- **Investigate** natural landmarks, ecosystems, and environmental issues in the Spanish-speaking world.
- Practice describing past events related to travel, exploration, or nature using the irregular preterite forms of **ir** and **decir**.
- **Participate** in collaborative activities focused on geography, environmental awareness, and cultural connections.

#### Instructional Strategies:

- **Comprehensible input** using maps, photographs, videos, and authentic geographic resources to introduce vocabulary related to geography, nature, the universe.
- Explicit **modeling and guided practice** of vocabulary related to nature, geography, the universe, and the environment.
- **Structured practice** with the irregular preterite forms of **ir** and **decir** in meaningful contexts.
- **Inquiry-based learning** using essential questions as prompts.
- Think-pair-share, **cooperative learning**, and discussion protocols to build communication skills.
- Use of **authentic texts, maps, graphs, and multimedia resources** to develop interpretive communication.
- **Cultural comparisons** that connect geographic features and environmental issues across regions.
- Frequent **formative assessments**, including exit tickets, quick writes, comprehension checks, and map-based activities.

#### Differentiation/Intervention/Enrichment Options:

- Tiered Activities:
  - Support: Provide students with sentence starters, word banks, or visual aids for translation and composition activities. Offer additional practice exercises with simpler sentence structures.
  - Challenge: Offer more complex sentence translations, creative writing prompts in Spanish, or research projects on specific aspects of Spanish speaking cultures and/or countries

- Learning Styles: Cater to various learning styles by offering a variety of activities (e.g., drawing vocabulary, creating graphic organizers / timelines, participating in pronunciation drills or debates)
- **Intervention:**
  - Small Group Instruction: Identify students struggling with specific concepts and provide focused instruction in smaller groups or individually.
  - Targeted Practice: Using feedback from classroom exercises, offer additional practice worksheets or online exercises targeting specific grammar points or vocabulary sets where students show difficulty.
- **Enrichment:**
  - Independent Projects: Allow advanced students to research additional vocabulary, grammar, cultural topics related to the theme of the unit.
  - Literature Exploration: For advanced students, offer opportunities to explore authentic materials in the target language related to the unit theme.

**General strategies for Language Development:**

Scaffolding strategies to be used; modeling, prior knowledge activation, pre-teach vocabulary, visual aids, manipulatives, videos, charts, diagrams, graphic organizers, chunking, sentence starters, sentence structures.

**CENTRAL BUCKS SCHOOL DISTRICT**

**Course of Study**

**Recommendation for Adoption**

**Course:** Spanish 1B

**Date:** November 4, 2025

**Student Level:** Middle School

**Grade Level:** 8

**Characterization of Course of Study:**

Spanish 1B builds on the foundational communication skills developed in Spanish 1A through the continued study of vocabulary, grammar, and cultural perspectives. Students expand their proficiency in listening, speaking, reading, and writing as they explore themes such as food and dining, health and wellness, hobbies and leisure activities, travel and transportation, geography, nature, and the environment. Through the study of diverse Spanish-speaking regions, including Peru, Spain, Argentina, Chile, and Spanish-speaking communities in the United States, students develop intercultural understanding while increasing their ability to communicate in real-world contexts using a variety of time frames and language structures.

**Reasons for Proposed Adoption:**

The grade realignment in Central Bucks that will begin in fall 2026 creates an opportunity to offer world languages courses in seventh grade; students will have the option to take Spanish 1A and subsequently Spanish 1B. Spanish 1A and Spanish 1B provide students with the equivalent content of Spanish 1 while allowing additional time for language acquisition, practice, and mastery. Learning a new language requires sustained exposure and repeated opportunities to develop listening, speaking, reading, and writing skills. A two-year sequence enables students to build a stronger foundation in vocabulary, grammar, and communication before progressing to higher-level courses. This course provides a developmentally appropriate pace, increased opportunities for communication, greater retention of vocabulary and language structures through repeated exposure and application over time.

This two-year pathway promotes equitable access to language learning while preparing students for successful completion of upper-level Spanish courses and continued growth in intercultural communication and global competence.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_

# **Kindergarten Decodable Books – Proposed Purchase**

## **1. Half-Pint Kids Decodable Books – Level A – Sights and Sounds**

To preview the books, visit this website - [Online Materials - Half Pint Kids Decodable Books](#) and follow the directions below:

- Scroll down, just below the image of the person with the stop sign.
- Click on  **Jump to Level A Books**
- Click on any book in Level A to preview the book. There are 6 sets of books that come with the purchase of Level A.

## **2. Pioneer Valley MyCodables:**

- Bella and Rosie – Set 1
- Oliver the Cat – Set 1
- Jack and Daisy – Set 1

The collections can be viewed digitally by signing up for a free two-week trial of their Digital Reader. The Digital Reader is essentially a digital library for teachers and students that includes every book Pioneer Valley offers.

Here is the link to sign up for the free trial - [Digital Reader](#)

- ## **3. [The Reading League – Little Learners Love Literacy – Wild Detective Stages 1-4](#)**
- If you click on the images of the books, you are able to see a few sample pages of some of the books.



## Student Fluency Graph

This bar chart displays a student's cold- and hot-timing scores for all stories passed in a specified series and level. Teachers use this report to track the student's reading fluency in a series/level in order to make instructional decisions that optimize the student's progress.

### Read Naturally Live Student Fluency Graph

Series/Level: Sequenced/3.0

**Dorrie Tanner**

Current Grade: 4

Current Homeroom:

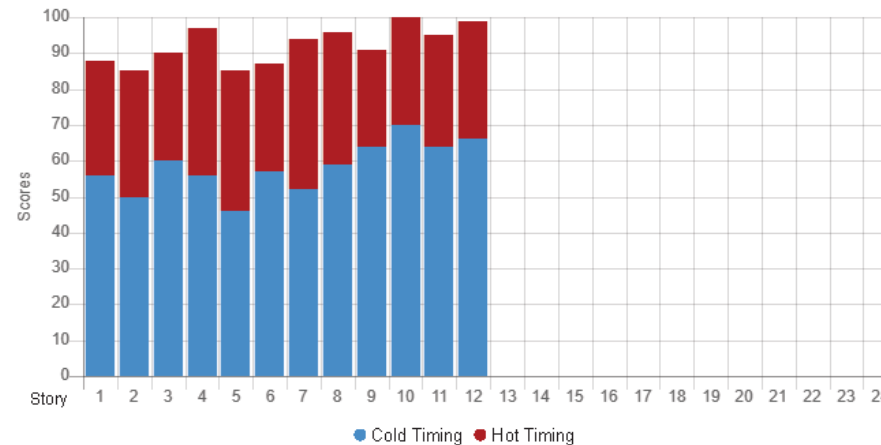
Current Lead Teacher: P Ramos

School: Springfield Elementa...

Report Date: 10/10/2019

### Fluency Graph

Scores represent the number of words read correctly in one minute.



| Order Passed | Story                   | Date Passed | Cold Timing | Cold Timing Errors | Goal (wcpm) | Hot Timing | Hot Timing Errors | Hot Timing Attempts | Expression |
|--------------|-------------------------|-------------|-------------|--------------------|-------------|------------|-------------------|---------------------|------------|
| 1            | Gorilla                 | 09/10/2019  | 56          | 2                  | 85          | 88         | 1                 | 1                   | 3          |
| 2            | Calling All Citizens!   | 09/12/2019  | 50          | 1                  | 85          | 85         | 2                 | 1                   | 3          |
| 3            | Electric Eel            | 09/14/2019  | 60          | 6                  | 85          | 90         | 3                 | 1                   | 3          |
| 4            | Destructive Builders    | 09/17/2019  | 56*         | 1                  | 85          | 97         | 0                 | 1                   | 3          |
| 5            | Trapdoor Spider         | 09/21/2019  | 46*         | 6                  | 85          | 85         | 0                 | 1                   | 3          |
| 6            | The Tree of Life        | 09/22/2019  | 57*         | 4                  | 85          | 87         | 1                 | 1                   | 3          |
| 7            | A Remarkable Friendship | 09/24/2019  | 52*         | 1                  | 85          | 94         | 0                 | 1                   | 3          |
| 8            | Reaching for the Stars  | 09/25/2019  | 59*         | 2                  | 85          | 96         | 1                 | 1                   | 3          |
| 9            | Poison Dart Frog        | 10/04/2019  | 64*         | 1                  | 85          | 91         | 0                 | 1                   | 3          |
| 10           | Painting With Eggs      | 10/06/2019  | 70*         | 0                  | 85          | 100        | 0                 | 1                   | 4          |
| 11           | Ida Lewis               | 10/07/2019  | 64*         | 0                  | 85          | 95         | 2                 | 1                   | 4          |
| 12           | Puffer Fish             | 10/09/2019  | 66*         | 0                  | 85          | 99         | 1                 | 1                   | 4          |

Read Naturally Live

**Students At-a-Glance**

Report period: 9/5/2019 to 10/18/2019

**Current Lead Teacher:** Jane Murray

School: Springfield Elementary

**Students At-a-Glance Report**

This report includes a student-by-student summary of results for Read Naturally Live stories passed. Teachers use this report to quickly identify students who may not be making adequate progress in fluency and comprehension and therefore may require adjustments in their programs or additional instruction. This report provides trend data so that teachers can easily compare the average scores from the first three stories to the average scores from the last three stories.

| Current Grade | Student        | Current Homeroom | Series/Level |                    |                | Fluency                         |                      |                                |                                |                               | Comprehension                      |                                     | Phonics                                          |
|---------------|----------------|------------------|--------------|--------------------|----------------|---------------------------------|----------------------|--------------------------------|--------------------------------|-------------------------------|------------------------------------|-------------------------------------|--------------------------------------------------|
|               |                |                  | Series/Level | Date Level started | Stories passed | Cold timing<br>(first 3/last 3) | Goal<br>(first/last) | Hot timing<br>(first 3/last 3) | Expression<br>(first 3/last 3) | Practices<br>(first 3/last 3) | Quiz % correct<br>(first 3/last 3) | Words in Retell<br>(first 3/last 3) | Seconds to<br>read word list<br>(first 3/last 3) |
| 3             | Herr, Lee      | Goss, H.         | Seq/2.5      | 9/5/2019           | 8              | 41 / 48                         | 70 / 70              | 74 / 80                        | 2 / 3                          | 6 / 5                         | 87 / 93                            | 13 / 24                             | /                                                |
| 3             | Smith, Jeff    | Goss, H.         | Seq/2.0      | 9/5/2019           | 8              | 61 / 64                         | 90 / 90              | 93 / 97                        | 3 / 3                          | 6 / 3                         | 67 / 83                            | 12 / 20                             | /                                                |
| 4             | Cole, Rob      | Goss, H.         | Seq/3.0      | 9/5/2019           | 9              | 59 / 70                         | 90 / 90              | 92 / 100                       | 2 / 2                          | 4 / 4                         | 73 / 94                            | 15 / 21                             | /                                                |
| 4             | Stack, Janelle | Goss, H.         | Seq/2.5      | 9/5/2019           | 11             | 47 / 64                         | 75 / 85              | 78 / 92                        | 2 / 3                          | 6 / 4                         | 80 / 100                           | 15 / 23                             | /                                                |
| 6             | Anderson, John | Goss, H.         | Seq/5.0      | 9/5/2019           | 10             | 101 / 104                       | 140 / 140            | 141 / 144                      | 2 / 2                          | 6 / 5                         | 76 / 81                            | 18 / 29                             | /                                                |
| 7             | Aubid, Anna    | Goss, H.         | Seq/5.6      | 9/5/2019           | 11             | 82 / 90                         | 120 / 120            | 124 / 132                      | 2 / 2                          | 6 / 5                         | 78 / 85                            | 23 / 30                             | /                                                |

\* Teacher was not present for one or more of the cold timings used to calculate the first 3 or last 3 cold timing score.

## Periodic Assessment of Fluency Report

Read Naturally Live

### Student Report Assessment of Fluency Report

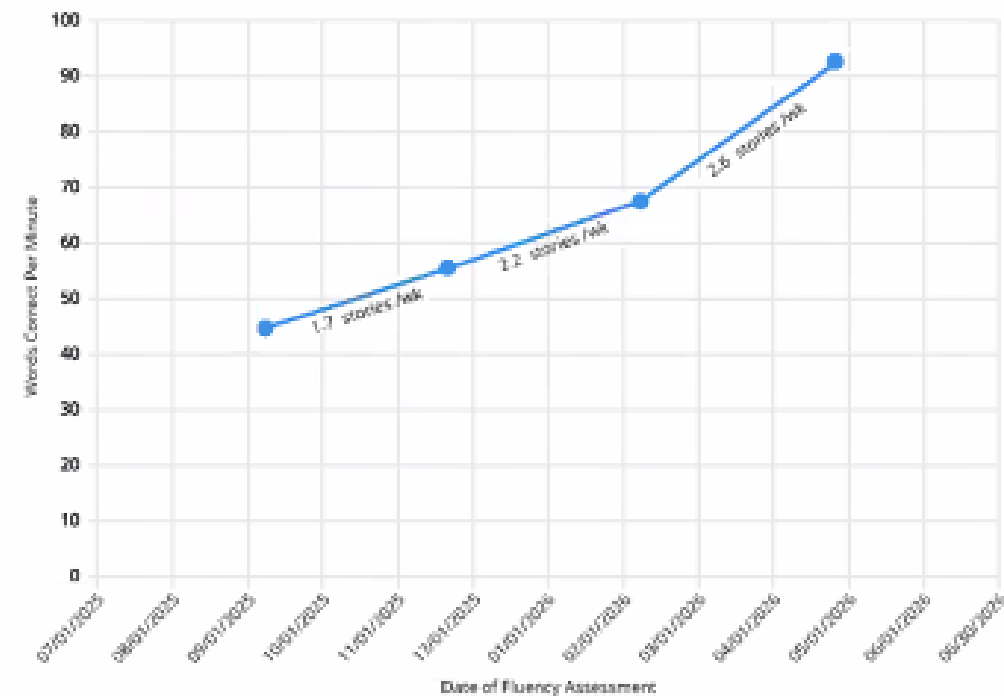
Report Period: 07/01/2025 to 6/30/2026  
Periodic Assessment of Fluency level: 3.0

Report Date: 04/29/2026

**Reed P.**

Current Grade: 5  
Current Homeroom:  
Current Lead Teacher: Paige Turner  
School: Letterfield Elementary

**Periodic Assessment of Fluency (wcpm)**



| Date Completed | Mean score (wcpm) | # of valid timings | Stories read/wk (since previous PAF timings) |
|----------------|-------------------|--------------------|----------------------------------------------|
| 09/09/2025     | 45                | 2                  | N/A                                          |
| 11/20/2025     | 56                | 2                  | 1.7                                          |
| 02/10/2026     | 68                | 2                  | 2.2                                          |
| 04/29/2026     | 91                | 2                  | 2.6                                          |

## Student Comprehension Graph

This graph shows which quiz questions a student answered correctly or incorrectly on the first try for *each story in a specified level*. Quiz results are reported by question type and story. This report allows teachers to assess comprehension and quickly note whether a certain type of question (e.g., the vocabulary question) is challenging for the student and provide additional instruction as necessary.

Read Naturally Live

### Student Comprehension Graph

Series/Level: Sequenced/3.0

**Dorrie Tanner**

Current Grade: 4

Current Homeroom:

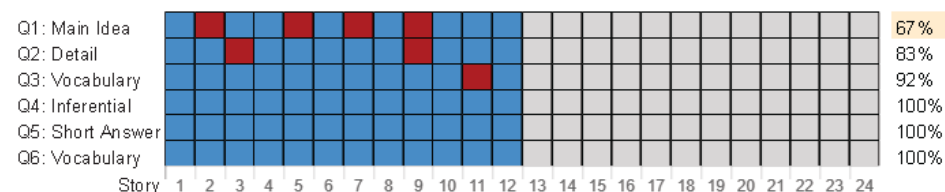
Current Lead Teacher: P Ramos

School: Springfield Elementa...

Report Date: 10/10/2019

### Quiz - First Attempt Results

Blue squares represent questions answered correctly on the first try



| Order Passed | Story                   | Date Passed | Quiz (first attempt) |
|--------------|-------------------------|-------------|----------------------|
| 1            | Gorilla                 | 09/10/2019  | 100%                 |
| 2            | Calling All Citizens!   | 09/12/2019  | 83%                  |
| 3            | Electric Eel            | 09/14/2019  | 83%                  |
| 4            | Destructive Builders    | 09/17/2019  | 100%                 |
| 5            | Trapdoor Spider         | 09/21/2019  | 83%                  |
| 6            | The Tree of Life        | 09/22/2019  | 100%                 |
| 7            | A Remarkable Friendship | 09/24/2019  | 83%                  |
| 8            | Reaching for the Stars  | 09/25/2019  | 100%                 |
| 9            | Poison Dart Frog        | 10/04/2019  | 67%                  |
| 10           | Painting With Eggs      | 10/06/2019  | 100%                 |
| 11           | Ida Lewis               | 10/07/2019  | 83%                  |
| 12           | Puffer Fish             | 10/09/2019  | 100%                 |

## Student Retell Graph

This graph shows the number of words a student used to retell each completed story on the first try and whether or not the student met the teacher's expectations on the first try. This report indicates how well the student is able to communicate his/her comprehension of the story and allows teachers to assess whether it is necessary to modify the retell step and/or provide additional comprehension instruction.

### Read Naturally Live Student Retell Graph

Series/Level: Sequenced/3.0

**Dorrie Tanner**

Current Grade: 4

Current Homeroom:

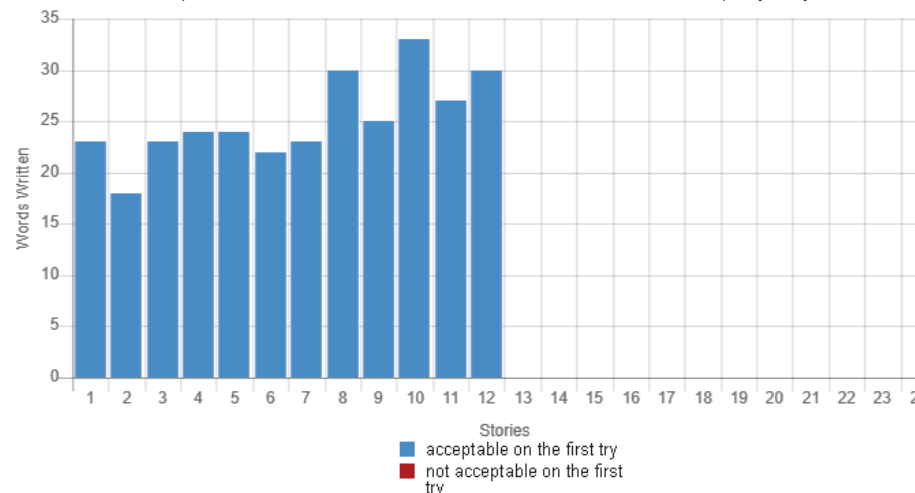
Current Lead Teacher: P Ramos

School: Springfield Elementa...

Report Date: 10/10/2019

### Retell Words Written

Graph shows the number of words written in the retell on the first attempt, by story.



| Order Passed | Story                   | Date Passed | Words Written (first attempt) | Retell Met Expectations (first attempt)? |
|--------------|-------------------------|-------------|-------------------------------|------------------------------------------|
| 1            | Gorilla                 | 09/10/2019  | 23                            | Y                                        |
| 2            | Calling All Citizens!   | 09/12/2019  | 18                            | Y                                        |
| 3            | Electric Eel            | 09/14/2019  | 23                            | Y                                        |
| 4            | Destructive Builders    | 09/17/2019  | 24                            | Y                                        |
| 5            | Trapdoor Spider         | 09/21/2019  | 24                            | Y                                        |
| 6            | The Tree of Life        | 09/22/2019  | 22                            | Y                                        |
| 7            | A Remarkable Friendship | 09/24/2019  | 23                            | Y                                        |
| 8            | Reaching for the Stars  | 09/25/2019  | 30                            | Y                                        |
| 9            | Poison Dart Frog        | 10/04/2019  | 25                            | Y                                        |
| 10           | Painting With Eggs      | 10/06/2019  | 33                            | Y                                        |
| 11           | Ida Lewis               | 10/07/2019  | 27                            | Y                                        |
| 12           | Puffer Fish             | 10/09/2019  | 30                            | Y                                        |

## Word List Graph

This graph in the Phonics Series shows how long it took a student to read the word list on the most recent attempt for each story the student completed in a specified level. This report shows how well the student is learning the featured phonics patterns and helps teachers identify patterns that may require additional instruction.

### Read Naturally Live Student Word List Graph

Series/Level: Phonics/2.3a r-controlled  
and soft c/g

Report Date: 04/27/2019

### August Waverly

Current Grade: 3

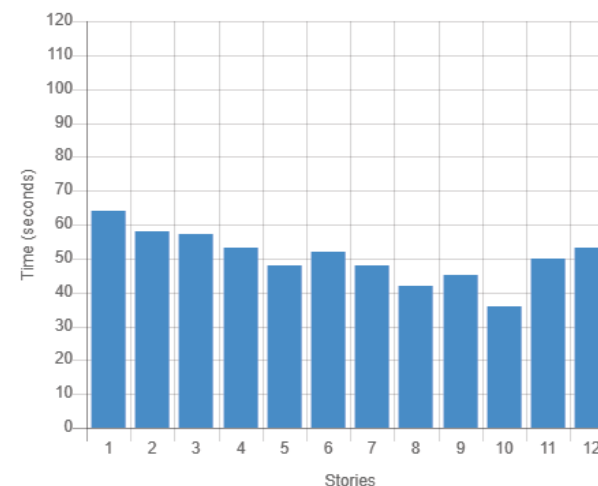
Current Homeroom:

Current Lead Teacher: P Ramos

School: Springfield School

### Word List

Graph shows the number of seconds student took to read the word list on most recent attempt, by story.



| Order Passed | Story                         | Date Passed | Goal (seconds) | Most Recent Attempt (seconds) | Pass Timing Errors | Attempts |
|--------------|-------------------------------|-------------|----------------|-------------------------------|--------------------|----------|
| 1            | Tornadoes                     | 01/25/2019  | 60             | 64                            | 0                  | 1        |
| 2            | Hurricanes                    | 02/13/2019  | 60             | 58                            | 2                  | 1        |
| 3            | Cinco de Mayo                 | 02/15/2019  | 60             | 57                            | 2                  | 1        |
| 4            | A Village on the Cliffs       | 02/22/2019  | 60             | 53                            | 0                  | 1        |
| 5            | Kermit and the Puppet Master  | 02/23/2019  | 60             | 48                            | 0                  | 1        |
| 6            | Henry Ford                    | 02/27/2019  | 60             | 52                            | 0                  | 1        |
| 7            | What Is Chirping in the Tree? | 03/02/2019  | 60             | 48                            | 0                  | 1        |
| 8            | Garter Snakes                 | 03/06/2019  | 60             | 42                            | 0                  | 1        |
| 9            | Thurgood Marshall             | 03/13/2019  | 60             | 45                            | 0                  | 1        |
| 10           | Aardvarks                     | 03/16/2019  | 60             | 36                            | 0                  | 1        |
| 11           | Battle of the Bicyclists      | 04/06/2019  | 60             | 50                            | 2                  | 2        |
| 12           | Giants                        | 04/12/2019  | 60             | 53                            | 0                  | 1        |

## Story Details Report

This report provides a student's detailed results for a specific Read Naturally Live story, so that teachers can see how the student performed on that story. The student's written prediction and retell are included in this report, as well as other information such as all words-correct-per-minute, individual quiz question scores, and more.

Report Date: 10/10/2019

Read Naturally Live

### Story Details

Series/Level: Sequenced/3.0

### Dorrie Tanner

Current Grade: 4

Current Homeroom:

Current Lead Teacher: P Ramos

School: Springfield Elementa...

### Story Data

**Title:** Puffer Fish  
**Series/Level:** Sequenced 3.0  
**Start date:** 10/07/2019

**Goal:** 85 wcpm  
**Pass date:** 10/09/2019

### Summary

| CRITERIA   | PASS RESULTS                                  | REQUIREMENTS               |
|------------|-----------------------------------------------|----------------------------|
| Hot timing | ★ 99 (first attempt)                          | Goal 85 wcpm               |
| Errors     | ★ 1 (first attempt)                           | 3 or fewer                 |
| Expression | ★ 4 (first attempt)                           | 2 or higher                |
| Quiz       | ★ 6/6 (first attempt)                         | All correct                |
| Retell     | ★ 30 words / met expectations (first attempt) | Meets teacher expectations |

### Retell

#### First attempt

Words written: 30

Puffer fish can take in water or air to expand in size so they look too big to eat. If the predator eats the puffer, it will die from poison.

### Quiz

**Q1 - Main Idea** ★ first attempt

**Q2 - Detail** ★ first attempt

**Q3 - Vocabulary** ★ first attempt

**Q4 - Inferential** ★ first attempt

**Q5 - Short Answer** ★ first attempt

The people like the danger of eating a puffer.

**Q6 - Vocabulary** ★ first attempt

### Practice

**Total practices** 3

**Highest practice score** 95 wcpm

**Difficult words** 0



# Read Live – 60-Day Trial Success Plan

---

Our goal during the trial is simple: help struggling readers experience measurable growth while ensuring teachers feel confident implementing the program.

## 1. Getting Started (Week 1)

**Goal: Launch the program and assign students.**

Recommended Steps

- Teachers attend the live virtual onboarding session (included with the trial)
- Students complete placement passages
- Students watch student training videos
- Teachers schedule regular Read Live sessions

Success Indicators

- ✓ All participating teachers log in
- ✓ Students complete placement activities
- ✓ Intervention groups are scheduled

## 2. Consistent Implementation (Weeks 2–7)

**Goal: Students use Read Live consistently with fidelity.**

Recommended Usage

- 3–5 sessions per week
- 30–45 minutes per session



### Typical Student Activity

- Repeated reading with and without audio support
- Vocabulary development
- Comprehension questions
- Cold and hot timing fluency checks

### Success Indicators

- ✓ 70–90% of assigned students actively using the program
- ✓ Students completing 2–3 stories per week

## 3. Monitoring Progress

**Teachers can monitor progress using built-in reports.**

### Key Reports

- Student-At-A-Glance Report
- Story completion and quiz scores
- Words Correct Per Minute (WCPM) growth

### What Teachers Often Notice

- Increased reading confidence
- Improved accuracy and expression
- Higher engagement during intervention time

## 4. Expected Student Outcomes

**Many schools see measurable improvement within the trial period.**

### Typical Outcomes

- 30–40% greater gains in reading fluency compared to national norms
- Improved reading accuracy

- Growth in reading comprehension
- Increased academic vocabulary
- Noticeable improvement in reading confidence

## **5. End-of-Trial Review**

**At the end of the trial we can:**

- Review student progress reports
- Discuss teacher feedback
- Identify next steps for expanding the program

Many schools choose to expand Read Live after seeing how quickly students progress and how easy the program is to implement.

## **Support Included with Your Trial**

- ✓ Live virtual onboarding training
- ✓ Implementation support
- ✓ Access to all four Read Live programs



For more than 30 years, **Read Live** has delivered measurable results for struggling and developing readers of all ages in an affordable online platform.

# Why our programs get results...

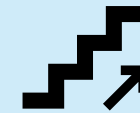
- Research-based interventions using evidence-based strategies.



- Carefully designed lessons based on the **science of reading**.



- Multiple levels meet a range of instructional needs.



- Nonfiction stories are interesting for students.



- Teacher tools for differentiating instruction and monitoring progress.



- Efficient use of teachers' and students' time.



- It's Affordable- All students should have access to effective intervention.



# Read Live In The Classroom

## Real Stories, Real Results

Discover why educators and students love Read Live in this [short video](#). Learn about the remarkable results that set this program apart.



## Success Story With Read Live

[Learn how](#) Centreville Elementary in Fairfax County, VA, achieved significant improvements in reading fluency and comprehension using Read Live in just one semester.



## Transform Your Classroom With Read Live

See how Read Live is uniquely effective in this [short video](#). Learn how its four programs help turn struggling readers into confident, grade-level readers with targeted phonics instruction and independent reading practice.

SUCCESS STORY | ReadNaturally

Centreville

Elementary School's

Success with Read Live



Fairfax County

**Background**

Centreville Elementary School identified fluency and comprehension as critical focus areas for the 2023-24 school year after analyzing fall benchmark data from the previous year. The majority of students with disabilities required individualized fluency interventions.

**About Centreville**

Location

Fairfax County, Virginia

Grades

K-6

Enrollment

775+

Centreville Elementary School Motto

"We are **GROWING**, we are **KIND**, and we **BELONG!**"





# The Read Live Platform



- Seamless Access:** Supports ClassLink rostering & SSO, Clever SSO, and Google Classroom logins
- Personalized Instruction:** Differentiated lessons for RTI and MTSS
- Flexible Learning:** Cloud-based platform accessible anytime, anywhere, including remote learning
- Printable Options:** Optional stories and quizzes for offline use
- Track Progress:** Built-in monitoring and reporting tools
- Comprehensive Support:** Live training included



**Read Live**  
includes



**Read  
Naturally® Live**

Improve fluency and phonics skills while supporting vocabulary and comprehension development.



**Word  
Warm-ups® Live**

Build mastery and automaticity in phonics and decoding with systematic phonics instruction.



**One Minute  
Reader® Live**

Transform independent reading time into an exciting, guided reading experience.



**Read Naturally®  
Live—Español**

Help multilingual readers develop Spanish literacy skills and fluency.

# The Read Live Programs



## Purpose

Fluency intervention that supports vocabulary, comprehension, and phonics (Phonics series)

Phonics intervention  
Can be paired with Read Naturally Live for Fluency

Structured, independent reading practice—any student  
Extra practice for a student already working in RNL and/or WWL

Builds native-Spanish speaker's fluency in Spanish  
Supports any student's Spanish reading development

## Fluency, Vocabulary, Comprehension

Sequenced 1.0 - 8.0  
Idioms 1.0 - 4.5

One story exercise in each section

Levels E - 5  
(early first through mid-fifth grade)

Sequenced 1.0 – 5.6

## Phonics Series/ Phonics Emphasis

Phonics 0.8 – 2.7  
Instruction in the context of non-fiction stories

Level 1: One-syllable words  
Level 2: Two-syllable words  
Level 3: Multi-syllabic words

No

No

## English Language Learners

English content  
English or Spanish directions

English content

English content

Spanish content  
Spanish or English directions  
English read along option

Spanish read-along option

## Teacher Required

Cold Timing step (optional)  
Pass step

Pass step

No

Cold Timing step (optional)  
Pass step



# Series and Level Options

## Placement Testing Level

## Read Naturally Live

|     | Sequenced | Phonics*   | Idioms |
|-----|-----------|------------|--------|
| 1.0 |           | 0.8        |        |
| 1.5 | 1.5       | 1.3        |        |
| 2.0 | 2.0       | 1.8        |        |
| 2.5 | 2.5       | 1.0        |        |
| 3.0 | 3.0       | 2.6<br>2.7 | 3.0    |
| 3.5 | 3.5       |            | 3.5    |
| 4.0 | 4.0       |            | 4.0    |
| 4.5 | 4.5       |            | 4.5    |
| 5.0 | 5.0       |            |        |
| 5.6 | 5.6       |            |        |
| 6.0 | 6.0       |            |        |
| 7.0 | 7.0       |            |        |
| 8.0 | 8.0       |            |        |

## \*Phonics Content by Level

|     |                                          |
|-----|------------------------------------------|
| 0.8 | short vowels                             |
| 1.3 | long vowels                              |
| 1.8 | blends/digraphs                          |
| 2.3 | r-controlled & other letter combinations |
| 2.6 | short vowels & one- & two-syllable words |
| 2.7 | long vowels & one- & two-syllable words  |

# Step-by-Step Alignment

| Read Naturally Live Step           | Primary Reading Component(s) Targeted | How the Step Supports It                                                                                                                                                                   |
|------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cold Timing</b>                 | Fluency • Comprehension (baseline)    | Students complete a one-minute cold read to establish baseline fluency and accuracy before instruction.                                                                                    |
| <b>Read Along (Modeling)</b>       | Fluency • Vocabulary                  | Students read along with audio, hearing fluent expression, pacing, and pronunciation—improving fluency and word recognition. Exposure supports vocabulary through repeated contextual use. |
| <b>Practice (Repeated Reading)</b> | Fluency                               | Students reread the passage until they reach goal rate, improving accuracy, prosody, and automaticity.                                                                                     |
| <b>Prediction</b>                  | Comprehension                         | Students preview title/key words and make a prediction to activate prior knowledge and set a purpose for reading.                                                                          |
| <b>Quiz (Comprehension Check)</b>  | Comprehension                         | Multiple-choice questions require locating evidence, identifying main idea, inference, and detail recall.                                                                                  |
| <b>Retell (Oral or Written)</b>    | Comprehension • Vocabulary            | Students summarize the story in their own words, improving story structure understanding and expressive vocabulary.                                                                        |
| <b>Word List (if used)</b>         | Phonics • Fluency • Vocabulary        | Students practice decoding word patterns and seeing them in connected text—especially valuable for developing readers and intervention groups.                                             |
| <b>Hot Timing</b>                  | Fluency                               | Final one-minute reading measures growth in accuracy, rate, and prosody.                                                                                                                   |



# Training, PD & Support

We are here to support you and your struggling readers every step of the way!

## Read Live Training Options

### 45-Minute Virtual Onboarding – *Get Started Strong!*

- **Free & Personalized:** One-on-one or team sessions via Teams
- **Explore Features:** Learn the tools that make Read Live effective
- **Implementation Tips:** Practical guidance for smooth setup
- **Ask Anything:** Your questions answered, anytime

Jumpstart your program and maximize student success from day one!

- **Cost: Free** - [Click here](#) to schedule.

### Read Live Knowledgebase: *Self-guided Training – Anywhere, anytime, at your own pace.*

- **How-To Articles:** Step-by-step guidance for setup, administration, and troubleshooting
- **Video Tutorials:** Quick demos of key features and best practices
- **Student Resources:** Materials to prepare students and guide program navigation
- **Supplemental Activities:** Extra activities to reinforce learning and support all students
- **Assessment & Placement:** Tools to assess levels and place students effectively

All the tools and guidance you need to implement Read Naturally and maximize student success!

- **Cost: Free** – [Click here](#)

## Read Live Training Options continued.

### **Read Live Virtual Seminars** – *Live hands-on virtual training.*

- Connect virtually with a Read Live expert for personalized professional development. This two-part virtual seminar series provides comprehensive training to help you get the most from Read Naturally Live.  
- **Cost: \$1200** - [Click here](#)

### **Read Live District Training** - *Hands-on in-person training.*

- Let us bring Read Naturally training on-site. Your educators will learn from the best—this training is taught by nationally recognized educators with hands-on experience implementing our programs with students.  
- **Cost:**
  - Option 1: 1 full-day session; 6 hours of training \$2,900 fee plus travel expenses.
  - Option 2: 2 half-day sessions; 3 hours each session; 6 hours of training \$1,450 fee (each session) plus travel expenses.

[Click here](#)

## Read Live Support

Our live customer & technical support agents are available Monday-Friday 8:00-5:00 CST

- Call for assistance by phone.
- Submit a question through our website.
- Search our extensive knowledge base.



# Read Live Trial

Try the full Read Live program with your students for 60 days — absolutely FREE, with no obligation and free live training included!

Click to [www.readnaturally.com/read-live-trial](http://www.readnaturally.com/read-live-trial) to start.

## **What we'll need.**

To set you up, we require some necessary information. If we don't already have it, you will receive an email asking you to provide us with the following:

- The name and email address of the administrator assigned to the trial. (This can be changed at any time)
- The number of students you anticipate taking part. There is no limit.
- The names and email addresses of the teachers you would like to participate. Again, there's no limit.

## **Already Set Up?**

Once we have all the necessary information, we will set you up within 24-48 hours. You and the other participants will receive step-by-step instructions.

Don't worry if you miss any step; we will send you reminders.

If you or your teachers have any questions, our dedicated customer service team and I are always here to help. We want to ensure you have a smooth and successful trial experience.

24 Hours: [customerservice@readnaturally.com](mailto:customerservice@readnaturally.com) Phone: 800-788-4085, 8-5 CST



# Pricing

**Read Live Annual Subscriptions** – Budget-friendly because every student deserves access to high-quality reading intervention.

Read Live includes access to [Read Naturally Live](#), [Word Warm-ups Live](#), [One Minute Reader Live](#), and [Read Naturally Live—Español](#)—four powerful programs, one easy-to-use platform.

| Description                                  | Price                      |
|----------------------------------------------|----------------------------|
| School/Building Site Licensing               | Call for details           |
| 130 + Licenses                               | \$22 Annually per license* |
| 30 – 129 Licenses                            | \$26 Annually per license* |
| 6-29 Licenses                                | \$32 Annually per license* |
| * Yearly 45-minute virtual training Included |                            |

[Click here](#) for more detailed pricing information.



# Contact Information

Peter Hodges – Solutions Manager

Read Naturally, Inc. • Education Technology.  
Company: 800.788.4085 | Direct: 651.286.8739  
1284 Corporate Center Dr, Suite 600 | St. Paul, MN 55121

phodges@readnaturally.com

[www.readnaturally.com](http://www.readnaturally.com)

Access [my calendar](#) to book a call at your convenience.



# **Full Day Kindergarten – Decodable Books**

Elementary Reading



# Introductions



**Ashley Christie**  
Supervisor of Reading



# Goal of Presentation



- Provide information about foundational reading instruction.
- Provide information about decodable book purchase.



5 minutes



# Agenda



**Background**



**Decodable Books**



**Budget**



**Next Steps**

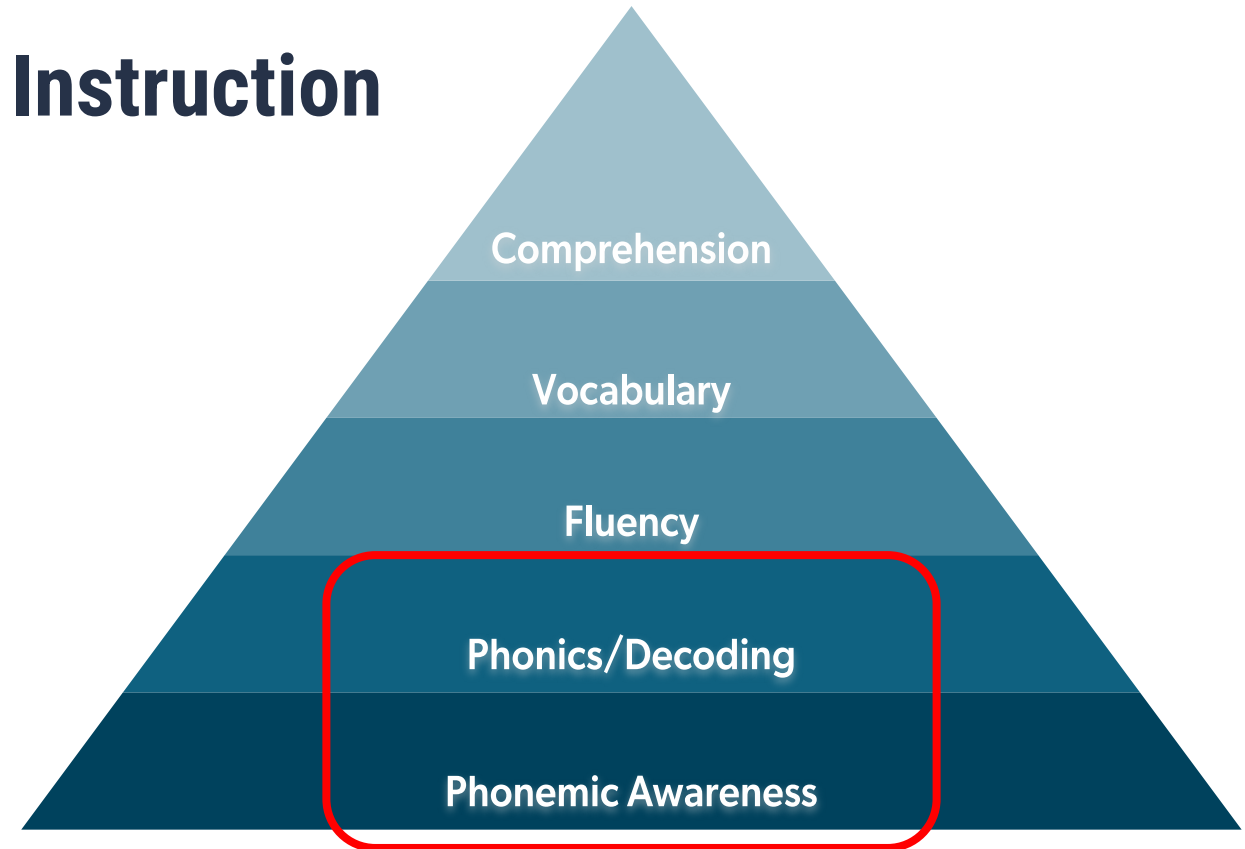
# Background

## Components of Effective Reading Instruction

### National Reading Panel

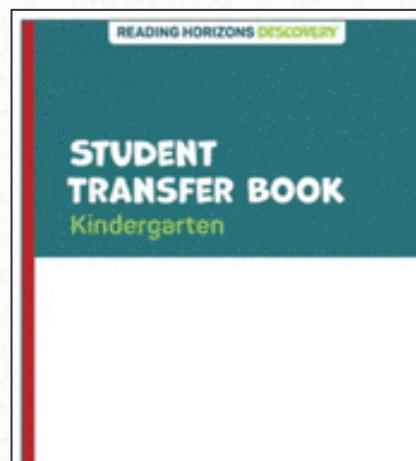
According to the National Reading Panel, word recognition instruction should be

- explicitly taught by the teacher
- systematically planned and organized
- sequenced in a fashion that moves from simple to complex





# Background



| READING HORIZONS <b>DISCOVERY</b> |          |                                                       |                                                                                      |
|-----------------------------------|----------|-------------------------------------------------------|--------------------------------------------------------------------------------------|
| KINDERGARTEN                      |          |                                                       |                                                                                      |
| UNIT                              | LESSON # | BOOK TITLE                                            | SKILLS                                                                               |
| 1                                 | 30       | Letter Group 1: Vowel <i>a</i>                        | Vowel <i>a</i>                                                                       |
|                                   | 31-33    | Letter Group 1: Consonants <i>m</i> and <i>s</i>      | Consonants <i>m</i> and <i>s</i>                                                     |
|                                   | 34-35    | Letter Group 1: Consonants <i>t</i> and <i>p</i>      | Consonants <i>t</i> and <i>p</i>                                                     |
|                                   | 37       | Letter Group 2: Vowel <i>i</i>                        | Vowel <i>i</i>                                                                       |
|                                   | 38-39    | Letter Group 2: Consonants <i>f</i> and <i>n</i>      | Consonants <i>f</i> and <i>n</i>                                                     |
|                                   | 40-42    | Letter Group 2: Consonants <i>g</i> and <i>b</i>      | Consonants <i>g</i> and <i>b</i>                                                     |
|                                   | 44       | Letter Group 3: Vowel <i>o</i>                        | Vowel <i>o</i>                                                                       |
|                                   | 45-46    | Letter Group 3: Consonants <i>r</i> and <i>h</i>      | Consonants <i>r</i> and <i>h</i>                                                     |
|                                   | 47-48    | Letter Group 3: Consonants <i>v</i> and <i>j</i>      | Consonants <i>v</i> and <i>j</i>                                                     |
|                                   | 50       | Letter Group 4: Vowel <i>e</i>                        | Vowel <i>e</i>                                                                       |
|                                   | 51-52    | Letter Group 4: Consonants <i>w</i> and <i>d</i>      | Consonants <i>w</i> and <i>d</i>                                                     |
|                                   | 53-54    | Letter Group 4: Consonants <i>l</i> and <i>y</i>      | Consonants <i>l</i> and <i>y</i>                                                     |
|                                   | 56-57    | Letter Group 5: Vowel <i>u</i> and Consonant <i>q</i> | Vowel <i>u</i> and Consonant <i>q</i>                                                |
|                                   | 58-59    | Letter Group 5: Consonants <i>z</i> and <i>x</i>      | Consonants <i>z</i> and <i>x</i>                                                     |
|                                   | 60-61    | Letter Group 5: Consonants <i>c</i> and <i>k</i>      | Consonants <i>c</i> and <i>k</i>                                                     |
| 2                                 | 62       | Kim and the Cat                                       | Spelling with <i>C</i> and <i>K</i>                                                  |
|                                   | 64-72    | The Path                                              | Digraphs: <i>th</i> , <i>ch</i> , <i>sh</i> , <i>wh</i>                              |
|                                   | 73-76    | Glen and the Clog Club                                | L-Blends                                                                             |
|                                   | 77-81    | A Trip to See Gran                                    | R-Blends                                                                             |
|                                   | 82-87    | Take a Shot                                           | S-Blends                                                                             |
|                                   | 88-90    | Let's Get a Class Pet                                 | Plurals: <i>-s</i> ; Double <i>S</i> , <i>F</i> , and <i>Z</i> ; Plurals: <i>-es</i> |
|                                   | 91-95    | Will's Shell                                          | Double <i>L</i>                                                                      |
|                                   | 96-105   | The Big Stink                                         | Glued Sounds                                                                         |
|                                   | 106-113  | What Can You Do?                                      | Phonetic Skills 1-3, Spelling with <i>-CK</i>                                        |



# Pioneer Kindergarten Feedback

Increase in  
instructional time

More time for small group  
instruction

Time for WIN  
(What I Need)

Need for more decodable  
books for transfer and  
application of  
phonics skills

# Decodable Books



Half-Pint Kids  
Decodable Books  
Level A – Sights &  
Sounds



Pioneer Valley  
MyCodables  
- Bella and Rosie  
Set 1  
- Oliver the Cat  
Set 1  
- Jack and Daisy  
Set 1



The Reading  
League  
Little Learners  
Love Literacy –  
Wild Detective  
Stages 1-4



# Budget



| Books                                        | # of Sets                                                                                                | Cost                                     |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------|
| Half Pint Decodables                         | 18<br><br>(Most buildings would receive one set. Buildings that have 5-6 Kdg sections receive two sets.) | \$288.00/ set<br>TOTAL - \$5,184.00      |
| Pioneer Valley myCodables                    |                                                                                                          | \$600.00/ set<br>TOTAL - \$10,800.00     |
| Reading League Little Learners Love Literacy |                                                                                                          | \$800.00/ set<br>TOTAL - \$14,400.00     |
|                                              | Total                                                                                                    | \$30,384.00 (plus shipping and handling) |





# Next Steps

- Seeking approval for purchase.
- Purchase books.
- Teachers implement in classrooms.
- Students apply and transfer phonics skills.



# Questions



# **Elementary Reading Fluency – Read Naturally Intervention Pilot**

# Introductions



**Ashley Christie**  
Supervisor of Reading



# Goal of Presentation



Seek approval to pilot a reading fluency intervention program for elementary students.



5 Minutes



# Agenda



**Background**



**Read Naturally**



**Budget**



**Next Steps**



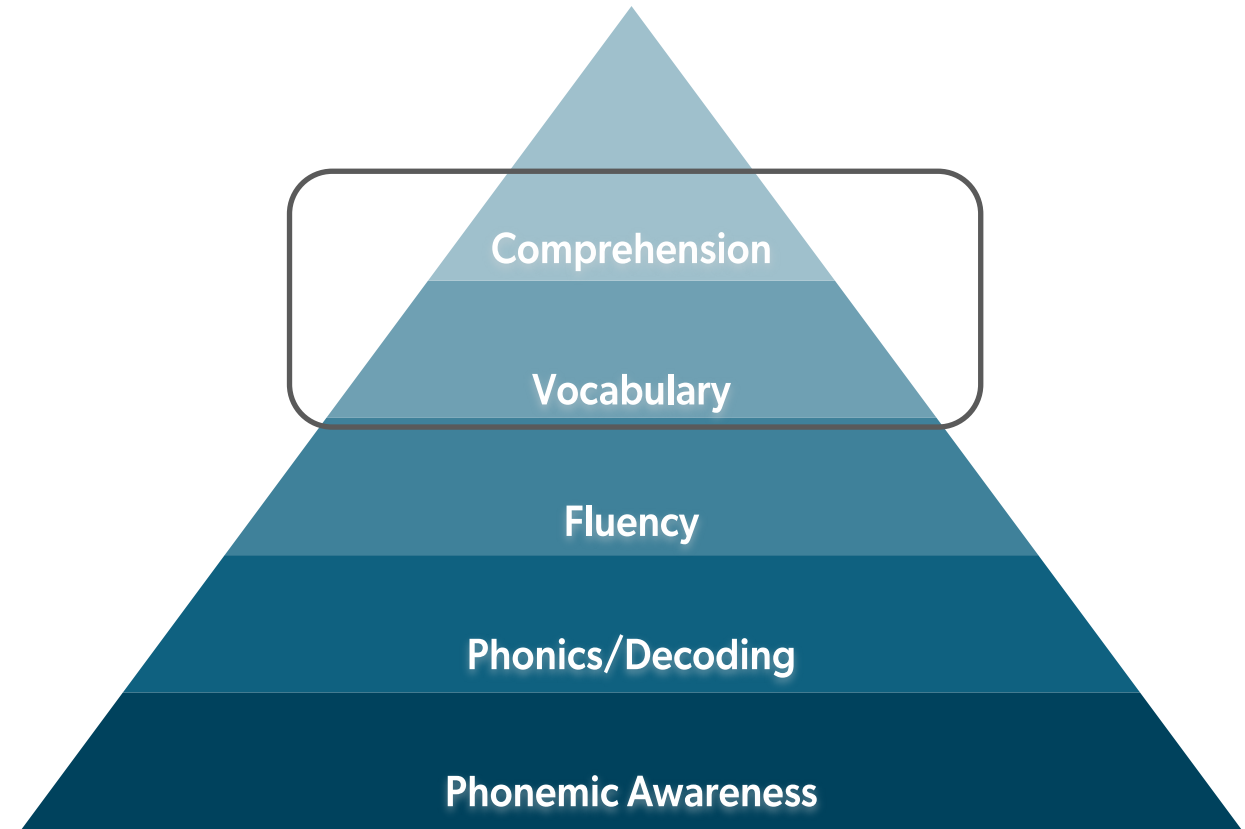
# Background

## Components of Effective Reading Instruction

*National Reading Panel*

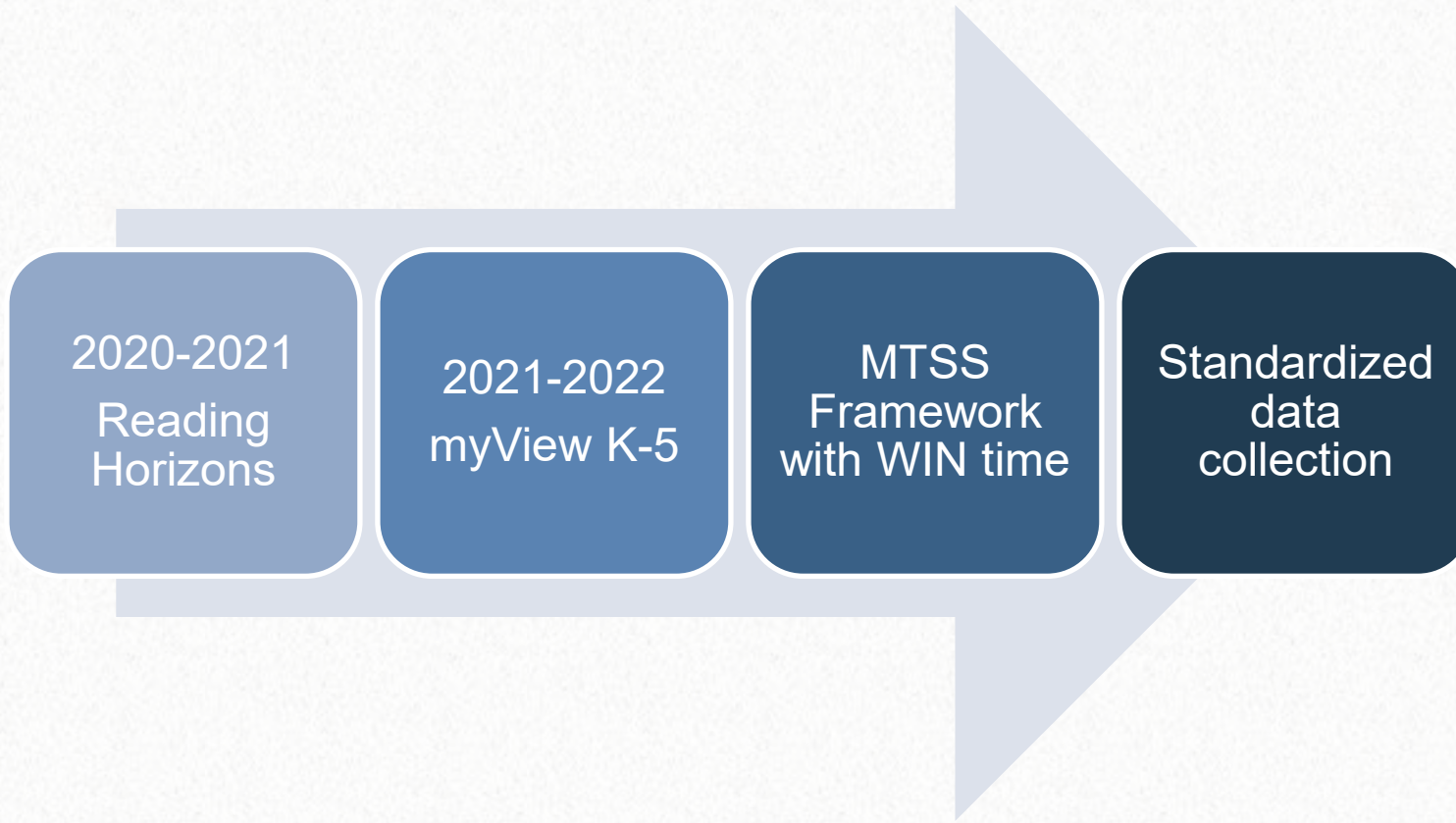


District Goal – “Read by 3”





# Background







# Background

## 3<sup>rd</sup> Grade DIBELS Data

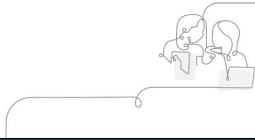
| Year      | Accuracy |     | Words Correct |     |
|-----------|----------|-----|---------------|-----|
|           | MOY      | EOY | MOY           | EOY |
| 2022-2023 | 85%      | 91% | 71%           | 74% |
| 2023-2024 | 83%      | 91% | 70%           | 75% |
| 2024-2025 | 84%      | 90% | 71%           | 75% |
| 2025-2026 | 86%      | 92% | 71%           | 75% |



# How did we choose Read Naturally?

Amplify.

mCLASS Intervention Overview



mCLASS |  
Boost Reading



Read  
Naturally®  
Live



# Why Read Naturally?

## Instruction



- ✓ **Teacher Modeling** – Provides a model for correct reading that helps students learn new words as well as focus on expression, phrasing, and automaticity.
- ✓ **Repeated Reading** – Students read the story multiple times. Repeated reading helps students master difficult words, increase accuracy, and improve expression to become a fluent readers.
- ✓ **Progress Monitoring** – Teachers and students set goals together. The student uses graphs to track progress and meet goals.

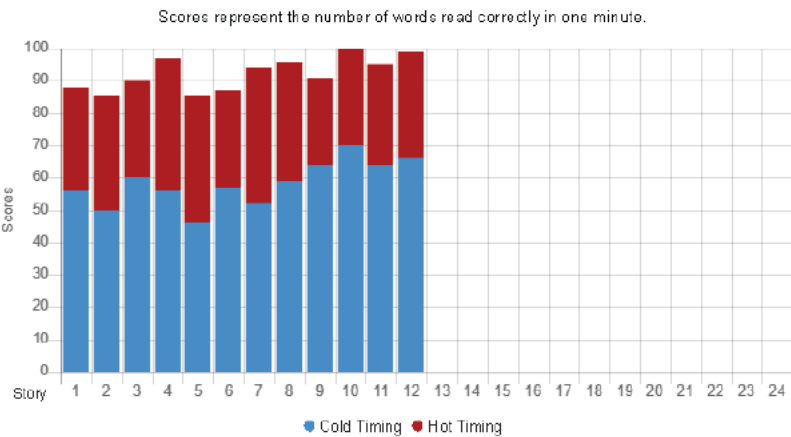


# Why Read Naturally?

## Student Fluency Graph

This bar chart displays a student's cold- and hot-timing scores for all stories passed in a specified series and level. Teachers use this report to track the student's reading fluency in a series/level in order to make instructional decisions that optimize the student's progress.

Fluency Graph



| Order Passed | Story                   | Date Passed | Cold Timing | Cold Timing Errors | Goal (wcpm) | Hot Timing | Hot Timing Errors | Hot Timing Attempts | Expression |
|--------------|-------------------------|-------------|-------------|--------------------|-------------|------------|-------------------|---------------------|------------|
| 1            | Gorilla                 | 09/10/2019  | 56          | 2                  | 85          | 88         | 1                 | 1                   | 3          |
| 2            | Calling All Citizens!   | 09/12/2019  | 50          | 1                  | 85          | 85         | 2                 | 1                   | 3          |
| 3            | Electric Eel            | 09/14/2019  | 60          | 6                  | 85          | 90         | 3                 | 1                   | 3          |
| 4            | Destructive Builders    | 09/17/2019  | 56*         | 1                  | 85          | 97         | 0                 | 1                   | 3          |
| 5            | Trapdoor Spider         | 09/21/2019  | 46*         | 6                  | 85          | 85         | 0                 | 1                   | 3          |
| 6            | The Tree of Life        | 09/22/2019  | 57*         | 4                  | 85          | 87         | 1                 | 1                   | 3          |
| 7            | A Remarkable Friendship | 09/24/2019  | 52*         | 1                  | 85          | 94         | 0                 | 1                   | 3          |
| 8            | Reaching for the Stars  | 09/25/2019  | 59*         | 2                  | 85          | 96         | 1                 | 1                   | 3          |
| 9            | Poison Dart Frog        | 10/04/2019  | 64*         | 1                  | 85          | 91         | 0                 | 1                   | 3          |
| 10           | Painting With Eggs      | 10/06/2019  | 70*         | 0                  | 85          | 100        | 0                 | 1                   | 4          |
| 11           | Ida Lewis               | 10/07/2019  | 64*         | 0                  | 85          | 95         | 2                 | 1                   | 4          |
| 12           | Puffer Fish             | 10/09/2019  | 66*         | 0                  | 85          | 99         | 1                 | 1                   | 4          |





# Why Read Naturally?

## Students At-a-Glance Report

This report includes a student-by-student summary of results for Read Naturally Live stories passed. Teachers use this report to quickly identify students who may not be making adequate progress in fluency and comprehension and therefore may require adjustments in their programs or additional instruction. This report provides trend data so that teachers can easily compare the average scores from the first three stories to the average scores from the last three stories.

Report period: 9/5/2019 to 10/18/2019

Current Lead Teacher: Jane Murray  
School: Springfield Elementary

| Current Grade | Student        | Current Homeroom | Series/Level |                    |                | Fluency                      |                   |                             |                             |                            | Comprehension                   |                                  | Phonics                                    |
|---------------|----------------|------------------|--------------|--------------------|----------------|------------------------------|-------------------|-----------------------------|-----------------------------|----------------------------|---------------------------------|----------------------------------|--------------------------------------------|
|               |                |                  | Series/Level | Date Level started | Stories passed | Cold timing (first 3/last 3) | Goal (first/last) | Hot timing (first 3/last 3) | Expression (first 3/last 3) | Practices (first 3/last 3) | Quiz % correct (first 3/last 3) | Words in Retell (first 3/last 3) | Seconds to read word list (first 3/last 3) |
| 3             | Herr, Lee      | Goss, H.         | Seq/2.5      | 9/5/2019           | 8              | 41 / 48                      | 70/70             | 74 / 80                     | 2 / 3                       | 6 / 5                      | 87 / 93                         | 13 / 24                          | /                                          |
| 3             | Smith, Jeff    | Goss, H.         | Seq/2.0      | 9/5/2019           | 8              | 61 / 64                      | 90/90             | 93 / 97                     | 3 / 3                       | 6 / 3                      | 67 / 83                         | 12 / 20                          | /                                          |
| 4             | Cole, Rob      | Goss, H.         | Seq/3.0      | 9/5/2019           | 9              | 59 / 70                      | 90/90             | 92 / 100                    | 2 / 2                       | 4 / 4                      | 73 / 94                         | 15 / 21                          | /                                          |
| 4             | Stack, Janelle | Goss, H.         | Seq/2.5      | 9/5/2019           | 11             | 47 / 64                      | 75/85             | 78 / 92                     | 2 / 3                       | 6 / 4                      | 80 / 100                        | 15 / 23                          | /                                          |
| 6             | Anderson, John | Goss, H.         | Seq/5.0      | 9/5/2019           | 10             | 101 / 104                    | 140/140           | 141 / 144                   | 2 / 2                       | 6 / 5                      | 76 / 81                         | 18 / 29                          | /                                          |
| 7             | Aubid, Anna    | Goss, H.         | Seq/5.6      | 9/5/2019           | 11             | 82 / 90                      | 120/120           | 124 / 132                   | 2 / 2                       | 6 / 5                      | 78 / 85                         | 23 / 30                          | /                                          |

\* Teacher was not present for one or more of the cold timings used to calculate the first 3 or last 3 cold timing score.



# Budget Impact

|                           | Total Cost               |
|---------------------------|--------------------------|
| 2026-2027<br>60 Day Pilot | \$0                      |
| After the Pilot           | \$22.00/ student license |

**\*\*Note:** At this time, you are not approving the purchase of these resources for “after the pilot”. If the pilot goes well, and we see improved fluency with our students, we will present the results of the pilot and ask for approval of the purchase of this intervention resource for students who show a need.



# Next Steps

- 1 Pilot for 60 days in the fall of the 2026-2027 school year, including teacher training.
- 2 Provide a recommendation based on the results of the pilot.
- 3 Purchase for the remainder of the 2026-2027 school year and beyond, based on student need.
- 4 Provide professional development for teachers.
- 5 Progress monitor the impact on students' reading fluency to ensure continued success and impact.



# Questions





## STEM 6

### The Technology and Engineering Education Department

Course Number: 6651

Course Level: Middle School

Grade: 6

Time/Credit: 22 Periods /.25 Credit

Development Date: 2025 - 2026

School Board Approval:

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on, project-based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines to blend science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

#### 6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
- ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.

#### 7. Equity and Cultural Relevance in STEAM

- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
- Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.

#### 8. Assessment for Learning

- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
- Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.

#### 9. Learning Environments and Pedagogy

- Dewey, J. (1938). *Experience and Education*. Macmillan.
- Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.

#### 10. Reflection and Lifelong Learning

- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
- Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

- the various systems of measurement and scale impact a drawing.
- measuring and technical drawing integrate mathematical concepts and scientific principles, illustrating their practical applications in real-world problem-solving and design.
- basic drafting equipment aids in the development of a final drawing.
- there are specific characteristics that constitute a technical drawing.
- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the world continues to evolve from the engineering design process.
- the engineering design process applies to a wide range of fields and challenges, demonstrating its relevance in addressing real-world issues.
- effective feedback of ideas, processes, and solutions is vital in engineering, as it facilitates collaboration, stakeholder engagement, and the successful implementation of designs.
- using tools and materials responsibly fosters precision, patience, and a deeper respect for craftsmanship and safety.
- functional design blends creativity, engineering, and problem-solving to meet both practical and aesthetic goals.
- how math, science, and art intersect in woodworking through measuring, planning, constructing, and solving real-world design challenges.
- engineers use digital design tools to transform ideas into precise, customized physical creations, enhancing creativity, problem-solving, and innovation in engineering.
- robotics and coding are critical in the modern economy.
- humans are needed in the creation of robotics.
- coding requires a certain sequence and language to automate.

**Central Bucks School District**  
**Essential Questions**

- Why is precision in measurement important in both everyday life and professional fields?
- How to appropriately utilize the proper tool to measure accurately to 1/16<sup>th</sup> of an inch?
- What are the key components of a technical drawing, and how do they communicate design ideas?
- What tools are most effective for creating precise technical drawings, and why?
- How has technology changed the way we measure and create technical drawings?
- Why is it important to follow a systematic approach when solving engineering problems?
- What are the key stages of the engineering design process, and how do they interconnect?
- How do engineers use the engineering design process to solve problems?
- How do different woodworking tools work, and how can you use them safely?
- What are the steps in the building process, and which ones require the most precision?
- How can you sketch a design that's both functional and creative?
- How can you personalize your project while keeping it functional?
- How can we use technology to transform our ideas into physical creations?
- How do digital tools expand or limit what we can create in manufacturing and woodworking?
- How do makers use technology to solve real-world problems?
- What is a robot, and how does it help solve real-world problems?
- What does it mean to innovate with robotics and coding?
- Where is the future of robotics and coding in technology and industry?

## Central Bucks School District – Course of Study Overview

### STEM 6

#### **Desired Results**

Course Description: Students will begin their Science, Technology, ENGINEERING and Mathematics (STEM) middle school experience by continuing their QUEST elementary education as they are reintroduced to the foundations of STEM through minds on, hands-on project-based learning. Students will interact with small woodworking machines and tools, drawing tools, basic physical coding in robotics, computer aided design (CAD), 2D subtractive manufacturing machines such as a laser engraver, vinyl cutter and 3D printing additive technology. Projects may include a technical drawing, a small woodshop project, robotics with microcontrollers and other design and prototype-based activities. Emphasis is placed on individual and teamwork by applying the engineering design and problem-solving process to fun and engaging real world challenges. STEM 6 lays the foundation to develop technological literacy within the STEM framework.

Prerequisite: None

Committee Members: **Kerri Brumbaugh, Bruce Good, Chris Dallas, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1:** Common STEM Engineering Project

**Common Summative Assessment 2:** Common STEM Engineering Process

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEM 6 – Pacing Guide

| Content                                                                        | Days     |
|--------------------------------------------------------------------------------|----------|
| <b>Unit 1 – Developing STEM Design Skills: Measuring and Technical Drawing</b> | <b>7</b> |
| Intro to STEM                                                                  | .5       |
| Measuring                                                                      | 2.5      |
| Technical Drawing                                                              | 4        |
| <b>Unit 2 – STEM Engineering Design Process</b>                                | <b>4</b> |
| Introduction                                                                   | .5       |
| Safety                                                                         | .5       |
| Design Challenge                                                               | 1        |
| Production, Test, Reflect                                                      | 2        |
| <b>Unit 3 – Mission Manufacturing</b>                                          | <b>8</b> |
| Introduction                                                                   | 1        |
| Safety                                                                         | 1        |
| Read a Design/Design a Part                                                    | 3        |
| Construct/Test                                                                 | 3        |
| <b>Unit 4 -Intro. To Robotics</b>                                              | <b>3</b> |
| Introduction                                                                   | .25      |
| Safety                                                                         | .25      |
| Physical Coding Instruction and Application                                    | .25      |
| Coding Challenge                                                               | 1.25     |
| Total                                                                          | 22       |

**Required Texts and Software-** VEX, Crumble kit, technical drawing supplies, woodshop, prototyping materials, laser cutter, vinyl cutter, 3d printer



# Central Bucks School District – Course of Study – STEM 6

## Unit 1 – Precision in Design: Measuring and Technical Drawing

### Desired Results:

#### Essential Questions:

- Why is precision in measurement important in both everyday life and professional fields?
- How to appropriately utilize the proper tool to measure accurately to 1/16<sup>th</sup> of an inch?
- What are the key components of a technical drawing, and how do they communicate design ideas?
- What tools are most effective for creating precise technical drawings, and why?
- How has technology changed the way we measure and create technical drawings?

#### Enduring Understandings:

Students will understand that...

- the various systems of measurement and scale impact a drawing.
- measuring and technical drawing integrate mathematical concepts and scientific principles, illustrating their practical applications in real-world problem-solving and design.
- basic drafting equipment aids in the development of a final drawing.
- there are specific characteristics that constitute a technical drawing.

#### Knowledge:

Students will know...

- measurement to the nearest 1/16<sup>th</sup> of an inch
- the characteristics and procedures of drafting
- how to navigate a Computer Aided Drawing Program

#### Skills:

**Students will be able to...**

- utilize measurement and drafting tools in the accurate creation of a drawing
- how to apply hand drawing skills to create Computer Aided Designs

#### Standards:

##### Priority:

PDE STEELS:

3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

-The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.

##### Supporting:

Math Standards:

-Attend to precision.

-Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

PDE Arts and Humanities:

9.1.8.A Know and use the elements and principles of each art form to create works in the arts and humanities.

## **Acceptable Evidence:**

### **Performance Tasks –**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### Formative Assessment

- Measuring Practice
- Technical Notes
- Sketching

##### Summative Assessment

- Measuring Test
- Technical Drawing Portfolio
- Computer Aided Drawing Portfolio

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Practice reading a ruler
- Utilize a ruler and measure lines
- Display knowledge of measuring on a summative assessment
- Use drafting tools to draw both orthographic and isometric drawings

### Instructional Strategies:

- Direct instruction: measuring and reading a ruler to a  $1/16^{\text{th}}$  of an inch
- Reviewing drafting tools, their purpose and how to use
- Teacher demonstration of drafting a technical drawing
- Deliberate Practice
- Peer teaching model
- Self-check and evaluation

### **Differentiation/Intervention/Enrichment Options:**

- **Differentiated/Intervention:**
  - Adapted Measuring Tools
  - Measuring Video Tutorial
  - Teacher Intervention during I&E
  - Technical Drawing Video Tutorial
  - Peer Tutoring
- **Enrichment:**
  - Sketch a Woodshop Tool
  - Explore Computer Aided Drafting and design a choice object

### **For Language Development:**

- Students will understand measuring terms and verbiage used in the engineering world.

## Central Bucks School District – Course of Study – STEM 6

### Unit 2 – Engineering Design Process

#### **Desired Results:**

##### Essential Questions:

- Why is it important to follow a systematic approach when solving engineering problems?
- What are the key stages of the engineering design process, and how do they interconnect?
- How do engineers use the engineering design process to solve problems?

##### Enduring Understandings:

Students will understand that...

- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the world continues to evolve from the engineering design process.
- the engineering design process applies to a wide range of fields and challenges, demonstrating its relevance in addressing real-world issues.
- effective feedback of ideas, processes, and solutions is vital in engineering, as it facilitates collaboration, stakeholder engagement, and the successful implementation of designs.

##### Knowledge:

Students will know...

- the steps of the Engineering Design Process

##### **Skills:**

**Students will be able to...**

- utilize the steps of the Engineering Design Process to solve a problem.
- apply knowledge and skills from Unit 1 to effectively measure and draw design solutions for design challenges.
- design, build, test and test a solution to a design challenge.
- reflect on their solution discussing problems solved, knowledge gained, and improvements you would have made.

##### **Standards:**

###### Priority:

PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8.LL Compare how different technologies involve different sets of processes.

ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

- Design involves a set of steps, which can be performed in different sequences and repeated as needed.
- The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.
- Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.
- The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

#### Supporting:

#### Core Math Standards:

- Attend to precision.
- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

#### Core Art Standards

- Combine concepts collaboratively to generate innovative ideas for creating art.

### **Acceptable Evidence:**

#### Performance Tasks –

#### Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Technical Notes
- Research and Brainstorming
- Design Sketches

##### Summative Assessment

- Final Design Sketches
- Project Rubric

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- Review the steps of the Engineering Design Process
- Use the steps of the Engineering Design Process to solve an Engineering Challenge

#### Instructional Strategies:

- Direct instruction
- Video overview of Design Process
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

#### Differentiation/Intervention/Enrichment Options:

- **Differentiated/Intervention:**
  - Research vs Design option for student exploration
  - Teacher Intervention during I&E
- **Enrichment:**
  - Small design and problem-solving challenges
  - Explore a type of engineer and the problems they solve

#### For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.
- Students will experience group work and enhance their communication skills.

# Central Bucks School District – Course of Study – STEM 6

## Unit 3- Mission: Manufacturing

### Desired Results:

#### Essential Questions:

- How do different woodworking tools work, and how can you use them safely?
- What are the steps in the building process, and which ones require the most precision?
- How can you sketch a design that's both functional and creative?
- How can you personalize your project while keeping it functional?

#### Enduring Understandings:

Students will understand that...

- Using tools and materials responsibly fosters precision, patience, and a deeper respect for craftsmanship and safety.
- Functional design blends creativity, engineering, and problem-solving to meet both practical and aesthetic goals.
- How math, science, and art intersect in woodworking through measuring, planning, constructing, and solving real-world design challenges.

#### Knowledge:

Students will know...

- The process of taking raw material to create a project.
- How to solve a design challenge in a woodworking project.

#### Skills:

**Students will be able to...**

- safely use woodworking tools and equipment.
- utilize their measuring and drawing skills to aid in the design and creation of a project.

#### Standards:

##### Priority:

PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8.LL Compare how different technologies involve different sets of processes.

ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

-The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.

- Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.

- The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

Supporting:

Common Core Math Standards:

-Attend to precision.

-Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

## **Acceptable Evidence:**

### **Performance Tasks –**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### Formative Assessment

- Technical Notes
- Design Sketches

##### Summative Assessment

- Safety Test
- Project Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Review machine use and safety
- Show proficiency in use of machines and tools
- Use woodworking machines and tools to create a project

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Project-based learning
- Problem-Solving and Critical Thinking
- Guided Reflection

### **Differentiation/Intervention/Enrichment Options:**

- **Differentiated/Intervention:**
  - Use templates or jigs for students who need more structure.
  - Provide checklists, sentence starters for reflection, and graphic organizers for planning.
- **Enrichment:**
  - Invite students to create alternate versions of the project with constraints
  - Pose real-world problems like "How would you mass-produce this board efficiently?"

### **For Language Development:**

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.

## Central Bucks School District – Course of Study –STEM 6

### Unit 4 – Introduction to Robotics

#### **Desired Results:**

##### Essential Questions:

- What is a robot, and how does it help solve real-world problems?
- What does it mean to innovate with robotics and coding?
- Where is the future of robotics and coding in technology and industry?

##### Enduring Understandings:

##### Students will understand that...

- Robotics and coding are critical in the modern economy
- Humans are needed in the creation of robotics
- Coding requires a certain sequence and language to automate

##### Knowledge:

##### Students will know...

- Programming vocabulary
- Program sequencing
- How to debug, troubleshoot and problem solve

##### **Skills:**

##### **Students will be able to...**

- Understand automation, robotics and coding
- Apply critical thinking and problem solving

##### **Standards:**

##### Priority:

##### Systems & Control

- 3.5.6–8.K — Use devices to control technological systems.
- 3.5.6–8.EE — Differentiate between inputs, processes, outputs, and feedback in technological systems.
- 3.5.6–8.FF — Demonstrate how systems thinking involves considering relationships between every part and the environment.

##### Engineering Design & Problem Solving

- 3.5.6–8.Q — Apply a technology and engineering design thinking process.
- 3.5.6–8.R — Develop innovative products and systems that solve problems and extend capabilities.
- 3.5.6–8.V — Refine design solutions to address criteria and constraints.
- 3.5.6–8.JJ — Apply informed problem-solving strategies to improve devices or processes.

##### Tools, Materials, Mechanisms

- 3.5.6–8.J — Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

##### Supporting:

##### Technology in Society

- 3.5.6–8.F — Analyze technologies that have changed how people think, interact, live, and communicate.
- 3.5.6–8.CC — Consider historical factors that contributed to technological development.



## **Acceptable Evidence:**

**Performance Tasks** – Structure- Learn about the parts of the robot, Motion- Drive the Robot, Control- Use block coding to control the robot

### **Acceptable evidence of learning other than Performance Tasks:**

Formative Assessment

- Research Activity
- Self/partner-checklist

Summative Assessment

- Project Rubric

## **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Explore automation, robotics, and coding
- Display knowledge of coding

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### **Differentiation/Intervention/Enrichment Options:**

- **Differentiated/Intervention:**
  - Tiered Lessons: providing varying levels of complexity
  - Scaffolded Instruction
- **Enrichment:**
  - Choice-Based: Students explore interests

### **For Language Development:**

- Students will utilize technical writing techniques to explore different areas of automation, robotics, and coding.

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** STEM 6

**Date:** 08-06-2026

**Student Level:** Middle School

**Grade Level:** Grade 6

**Characterization of Course of Study:**

STEM 6 is a hands-on, project-based course designed to build upon the technology and engineering concepts introduced in the QUEST Elementary School Program while expanding students' technological literacy, creativity, and problem-solving abilities. Technical design and drawing skills are introduced using drafting tools and CAD, open and closed ended design and engineering challenges are included using prototyping tools such as 3D printers, vinyl cutters and laser engravers. Safety, hand tools and small machines are introduced using the woodshop. Robotics is explored as we teach students to navigate our modern world. Through engaging design challenges and real-world engineering applications, students strengthen their understanding of the engineering design process as they identify problems, develop solutions, construct prototypes, test designs, and refine their work.

**Reasons for Proposed Adoption:**

STEM 6 is a rebranding of our QUEST Grade 6 course for a middle school format to ensure vertical integration and continuation of elementary school STEM concepts. PA STEELS standards are included and were used to guide the development of STEM 6. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## STEM 7

### The Technology and Engineering Education Department

Course Number: 6751

Course Level: Middle School

Grade: 7

Time/Credit: 45 Days/.5 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential**- Students learn by doing, making, and reflecting. Hands-on, minds-on, project-based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning**- Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)**- Real-world problems cross disciplines to blend science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important**- Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social**- Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools** - Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable**- All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective**- Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused**- Space and culture support exploration and innovation. Safe, organized, and adaptable fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential**- Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

#### 6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
- ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.

#### 7. Equity and Cultural Relevance in STEAM

- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
- Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.

#### 8. Assessment for Learning

- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
- Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.

#### 9. Learning Environments and Pedagogy

- Dewey, J. (1938). *Experience and Education*. Macmillan.
- Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.

#### 10. Reflection and Lifelong Learning

- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
- Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District  
Enduring Understandings**

**Students will understand that:**

- the various systems of measurement and scale impact a drawing.
- measuring and technical drawing integrate mathematical concepts and scientific principles, illustrating their practical applications in real-world problem-solving and design.
- basic drafting equipment aids in the development of a final drawing.
- there are specific characteristics that constitute a technical drawing.
- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the world continues to evolve from the engineering design process.
- the engineering design process applies to a wide range of fields and challenges, demonstrating its relevance in addressing real-world issues.
- effective feedback of ideas, processes, and solutions is vital in engineering, as it facilitates collaboration, stakeholder engagement, and the successful implementation of designs.
- using tools and materials responsibly fosters precision, patience, and a deeper respect for craftsmanship and safety.
- functional design blends creativity, engineering, and problem-solving to meet both practical and aesthetic goals.
- how math, science, and art intersect in woodworking through measuring, planning, constructing, and solving real-world design challenges.
- engineers use digital design tools to transform ideas into precise, customized physical creations, enhancing creativity, problem-solving, and innovation in engineering.
- robotics and coding are critical in the modern economy.
- humans are needed in the creation of robotics.
- coding requires a certain sequence and language to automate.

**Central Bucks School District**  
**Essential Questions**

- Why is precision in measurement important in both everyday life and professional fields?
- How to appropriately utilize the proper tool to measure accurately to 1/16<sup>th</sup> of an inch?
- What are the key components of a technical drawing, and how do they communicate design ideas?
- What tools are most effective for creating precise technical drawings, and why?
- How has technology changed the way we measure and create technical drawings?
- Why is it important to follow a systematic approach when solving engineering problems?
- What are the key stages of the engineering design process, and how do they interconnect?
- How do engineers use the engineering design process to solve problems?
- How do different woodworking tools work, and how can you use them safely?
- What are the steps in the building process, and which ones require the most precision?
- How can you sketch a design that's both functional and creative?
- How can you personalize your project while keeping it functional?
- How can we use technology to transform our ideas into physical creations?
- How do digital tools expand or limit what we can create in manufacturing and woodworking?
- How do makers use technology to solve real-world problems?
- What is a robot, and how does it help solve real-world problems?
- What does it mean to innovate with robotics and coding?
- Where is the future of robotics and coding in technology and industry?



## Central Bucks School District – Course of Study Overview

### STEM 7

#### **Desired Results**

Course Description: In STEM 7, students deepen their understanding of engineering concepts by working on more complex designs and projects. Topics will include intermediate physical coding in robotics, energy and structures, applied mathematics skills with architecture and engineering, and continued use of CAD, 3D design and printing with other digital design and cutting tools such as a laser engraver, 3D printer and vinyl cutter. Students will analyze problems, test prototypes, and refine solutions according to the engineering design and problem-solving process while building resilience and persistence in their project-based work. Projects may include CO2 dragsters, mousetrap vehicles, rockets, models and a small woodshop project. Emphasis is placed on connecting classroom learning to real-world applications as they continue their journey in developing technological literacy within STEM.

Prerequisite: None

Committee Members: **Kerri Brumbaugh, Bruce Good, Chris Dallas, Paul Trafford, Adam Paulus, Steve Voorhees, Jon Taylor**

#### **Acceptable Evidence.**

**Common Assessment 1 Title:** Common STEM Engineering Project

**Common Assessment 2 Title:** Common STEM Engineering Process

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEM 7 – Pacing Guide

(Add or delete units and the boxes under each as needed)

| Content                                                                        | Days      |
|--------------------------------------------------------------------------------|-----------|
| <b>Unit 1 – Developing STEM Design Skills: Measuring and Technical Drawing</b> | <b>8</b>  |
| Intro to STEM                                                                  | .5        |
| Measuring                                                                      | 1.5       |
| Technical Drawing                                                              | 6         |
| <b>Unit 2 – STEM Engineering Design Process</b>                                | <b>6</b>  |
| Introduction                                                                   | .5        |
| Safety                                                                         | .5        |
| Design Challenge                                                               | 1         |
| Production, Test, Reflect                                                      | 4         |
| <b>Unit 3 – Concept to Creation</b>                                            | <b>17</b> |
| Introduction                                                                   | 1         |
| Safety                                                                         | 2         |
| Read a Design/Design a Part                                                    | 2         |
| Construct/Test                                                                 | 12        |
| <b>Unit 4 -The Power of Digital Design</b>                                     | <b>8</b>  |
| Introduction                                                                   | .5        |
| Safety                                                                         | .5        |
| Brainstorm/Practice                                                            | 2         |
| Digital Creation                                                               | 5         |
| <b>Unit 5 -Automate and Innovate: Robotics Coding</b>                          | <b>6</b>  |
| Introduction                                                                   | .5        |
| Safety                                                                         | .5        |
| Physical Coding Instruction and Application                                    | 1         |
| Coding Challenge                                                               | 4         |
| Total                                                                          | 45        |

**Required Texts and Software** VEX, Crumble kit, technical drawing supplies, woodshop, prototyping materials, laser cutter, vinyl cutter, 3d printer

# Central Bucks School District – Course of Study – STEM 7

## Unit 1 – Developing STEM Design Skills: Measuring and Technical Drawing

### Desired Results:

#### Essential Questions:

- Why is precision in measurement important in both everyday life and professional fields?
- How to appropriately utilize the proper tool to measure accurately to 1/16<sup>th</sup> of an inch?
- What are the key components of a technical drawing, and how do they communicate design ideas?
- What tools are most effective for creating precise technical drawings, and why?
- How has technology changed the way we measure and create technical drawings?

#### Enduring Understandings:

Students will understand that...

- the various systems of measurement and scale impact a drawing.
- measuring and technical drawing integrate mathematical concepts and scientific principles, illustrating their practical applications in real-world problem-solving and design.
- basic drafting equipment aids in the development of a final drawing.
- there are specific characteristics that constitute a technical drawing.

#### Knowledge:

Students will know...

- measurement to the nearest 1/16<sup>th</sup> of an inch
- the characteristics and procedures of drafting
- how to navigate a Computer Aided Drawing Program

#### Skills:

Students will be able to...

- utilize measurement and drafting tools in the accurate creation of a drawing
- how to apply hand drawing skills to create Computer Aided Designs

#### Standards:

##### Priority:

##### PDE STEELS:

3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

##### ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

-The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.

##### Supporting:

##### Core Math Standards:

-Attend to precision.

-Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

PDE Arts and Humanities:

9.1.8.A Know and use the elements and principles of each art form to create works in the arts and humanities.

## **Acceptable Evidence:**

### **Performance Tasks –**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### Formative Assessment

- Measuring Practice
- Technical Notes
- Sketching

##### Summative Assessment

- Measuring Test
- Technical Drawing Portfolio
- Computer Aided Drawing Portfolio

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Practice reading a ruler
- Utilize a ruler and measure lines
- Display knowledge of measuring on a summative assessment
- Use drafting tools to draw both orthographic and isometric drawings

### Instructional Strategies:

- Direct instruction: measuring and reading a ruler to a  $1/16^{\text{th}}$  of an inch
- Reviewing drafting tools, their purpose and how to use
- Teacher demonstration of drafting a technical drawing
- Deliberate Practice
- Peer teaching model
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Adapted Measuring Tools
  - Measuring Video Tutorial
  - Teacher Intervention during I&E
  - Technical Drawing Video Tutorial
  - Peer Tutoring
- Enrichment:
  - Sketch a Woodshop Tool
  - Explore Computer Aided Drafting and design a choice object

### For Language Development:

- Students will understand measuring terms and verbiage used in the engineering world.

## Central Bucks School District – Course of Study – STEM 7

### Unit 2 – STEM Engineering Design Process

#### **Desired Results:**

##### Essential Questions:

- Why is it important to follow a systematic approach when solving engineering problems?
- What are the key stages of the engineering design process, and how do they interconnect?
- How do engineers use the engineering design process to solve problems?

##### Enduring Understandings:

Students will understand that...

- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the world is ever evolving from the engineering design process.
- the engineering design process applies to a wide range of fields and challenges, demonstrating its relevance in addressing real-world issues.
- effective feedback of ideas, processes, and solutions is vital in engineering, as it facilitates collaboration, stakeholder engagement, and the successful implementation of designs.

##### Knowledge:

Students will know...

- and understand the steps of the Engineering Design Process

##### Skills:

Students will be able to...

- utilize the steps of the Engineering Design Process to solve a problem.
- apply knowledge and skills from Unit 1 to effectively measure and draw design solutions for design challenges.
- design, build, test and test a solution to a design challenge.
- reflect on their solution discussing problems solved, knowledge gained, and improvements you would have made.

##### Standards:

###### Priority:

###### PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8.LL Compare how different technologies involve different sets of processes.

###### ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

- The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.
- Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.
- The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

#### Supporting:

##### Core Math Standards:

- Attend to precision.
- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

##### National Core Art Standards

- Combine concepts collaboratively to generate innovative ideas for creating art.

### **Acceptable Evidence:**

#### **Performance Tasks –**

#### **Acceptable evidence of learning other than Performance Tasks:**

##### Formative Assessment

- Technical Notes
- Research and Brainstorming
- Design Sketches

##### Summative Assessment

- Final Design Sketches
- Project Rubric

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- Review the steps of the Engineering Design Process
- Use the steps of the Engineering Design Process to solve an Engineering Challenge

#### Instructional Strategies:

- Direct instruction
- Video overview of Design Process
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

#### Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Research vs Design option for student exploration
  - Teacher Intervention during I&E
- Enrichment:
  - Small design and problem-solving challenges
  - Explore a type of engineer and the problems they solve

#### For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.
- Students will experience group work and enhance their communication skills.

## Central Bucks School District – Course of Study – STEM 7

### Unit 3 – Concept to Creation

#### Desired Results:

##### Essential Questions:

- How do different woodworking tools work, and how can you use them safely?
- What are the steps in the building process, and which ones require the most precision?
- How can you sketch a design that's both functional and creative?
- How can you personalize your project while keeping it functional?

##### Enduring Understandings:

Students will understand that...

- using tools and materials responsibly fosters precision, patience, and a deeper respect for craftsmanship and safety.
- functional design blends creativity, engineering, and problem-solving to meet both practical and aesthetic goals.
- how math, science, and art intersect in woodworking through measuring, planning, constructing, and solving real-world design challenges.

##### Knowledge:

Students will know...

- the process of taking raw material to create a project.
- how to solve a design challenge in a woodworking project.

##### Skills:

Students will be able to...

- safely use woodworking tools and equipment.
- utilize their measuring and drawing skills to aid in the design and creation of a project.

##### Standards:

###### Priority:

###### PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8.LL Compare how different technologies involve different sets of processes.

###### ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

-The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.

- Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.

- The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

Supporting:

Core Math Standards:

-Attend to precision.

-Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

### **Acceptable Evidence:**

Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment

- Technical Notes
- Design Sketches

Summative Assessment

- Safety Test
- Project Rubric

### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Review machine use and safety
- Show proficiency in use of machines and tools
- Use woodworking machines and tools to create a project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Project-based learning
- Problem-Solving and Critical Thinking
- Guided Reflection

Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Use templates or jigs for students who need more structure.
  - Provide checklists, sentence starters for reflection, and graphic organizers for planning.
- Enrichment:
  - Invite students to create alternate versions of the project with constraints
  - Pose real-world problems like "How would you mass-produce this board efficiently?"

For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.



## Central Bucks School District – Course of Study – STEM 7

### Unit 4 – The Power of Digital Design

#### Desired Results:

##### Essential Questions:

- How can we use technology to transform our ideas into physical creations?
- How do digital tools expand or limit what we can create in manufacturing and woodworking?
- How do makers use technology to solve real-world problems?

##### Enduring Understandings:

Students will understand that...

- engineers use digital design tools to transform ideas into precise, customized physical creations, enhancing creativity, problem-solving, and innovation in engineering.

##### Knowledge:

Students will know...

- how to apply measurement, scaling, and layout principles in digital design.
- use basic digital design software to create files for the use on digital tools.

##### Skills:

Students will be able to...

- apply design techniques to the creation of a digital file
- understand the workflow from digital design to physical production

##### Standards:

##### Priority:

##### PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8.LL Compare how different technologies involve different sets of processes.

#### Acceptable Evidence:

##### Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

##### Formative Assessment

- Design Sketches

##### Summative Assessment

- Project Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Review the steps of creating a digital design
- Understand how a digital design is created through digital fabrication

### Instructional Strategies:

- Blended Learning
- Direction Instruction
- Project-Based Learning
- Problem-Solving and Critical Thinking

### Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Flexible Group to assist through peer support
  - Scaffolded tutorials
- Enrichment:
  - Offer design challenges with choice of tool and project

### For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.

## Central Bucks School District – Course of Study – STEM 7

### Unit 5 – Automate and Innovate: Robotics Coding

#### **Desired Results:**

##### Essential Questions:

- What is a robot, and how does it help solve real-world problems?
- What does it mean to innovate with robotics and coding?
- Where is the future of robotics and coding in technology and industry?

##### Enduring Understandings:

##### Students will understand that...

- robotics and coding are critical in the modern economy
- humans are needed in the creation of robotics
- coding requires a certain sequence and language to automate

##### Knowledge:

##### Students will know...

- programming vocabulary
- program sequencing
- how to debug, troubleshoot and problem solve

##### Skills:

##### Students will be able to...

- Understand automation, robotics and coding
- Apply critical thinking and problem solving

##### Standards:

##### Priority:

##### Systems & Control

- 3.5.6–8.K — Use devices to control technological systems.
- 3.5.6–8.EE — Differentiate between inputs, processes, outputs, and feedback in technological systems.
- 3.5.6–8.FF — Demonstrate how systems thinking involves considering relationships between every part and the environment.

##### Engineering Design & Problem Solving

- 3.5.6–8.Q — Apply a technology and engineering design thinking process.
- 3.5.6–8.R — Develop innovative products and systems that solve problems and extend capabilities.
- 3.5.6–8.V — Refine design solutions to address criteria and constraints.
- 3.5.6–8.JJ — Apply informed problem-solving strategies to improve devices or processes.

##### Supporting:

##### Tools, Materials, Mechanisms

- 3.5.6–8.J — Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

##### Technology in Society

- 3.5.6–8.F — Analyze technologies that have changed how people think, interact, live, and communicate.
- 3.5.6–8.CC — Consider historical factors that contributed to technological development.

#### **Acceptable Evidence:**

##### Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment

- Research Activity
- Self/partner-checklist

Summative Assessment

- Project Rubric

## **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Explore automation, robotics, and coding
- Display knowledge of coding

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Tiered Lessons: providing varying levels of complexity
  - Scaffolded Instruction
- Enrichment:
  - Choice-Based: Students explore interests

For Language Development:

- Students will utilize writing techniques to explore different areas of automation, robotics, and coding.

**CENTRAL BUCKS SCHOOL DISTRICT**

**Course of Study  
Recommendation for Adoption**

**Course:** STEM 7

**Date:** 08-06-2026

**Student Level:** Middle School

**Grade Level:** Grade 7

**Characterization of Course of Study:**

STEM 7 is a hands-on, project-based course designed to build upon the technology and engineering concepts introduced in STEM 6 while furthering students' technological literacy, creativity, and problem-solving abilities. Expanded opportunities in Technical Design and drawing skills are continued using hand design tools and CAD. Open ended design and engineering challenges are included using prototyping tools such as 3D printers, vinyl cutters and laser engravers. Safety, hand tools and small machines are also expanded using the woodshop. Robotics is explored more in depth as we teach students to navigate our modern world. Through engaging design challenges and real-world engineering applications, students strengthen their understanding of the engineering design process as they identify problems, develop solutions, construct prototypes, test designs, and refine their work.

**Reasons for Proposed Adoption:**

STEM 7 is an expanded version of our STEM 6 course to ensure vertical integration and continuation of sixth grade STEM concepts. PA STEELS standards are included and were used to guide the development of STEM 7. This project-based course is designed for students to further expand their technological literacy while improving upon their problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



## STEM 8

The Technology and Engineering Education Department

Course Number: 6851

Course Level: Middle School

Grade: 8

Time/Credit: 45 Days/ .5 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District**  
**Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on, project-based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines to blend science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.



#### 6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
- ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.

#### 7. Equity and Cultural Relevance in STEAM

- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
- Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.

#### 8. Assessment for Learning

- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
- Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.

#### 9. Learning Environments and Pedagogy

- Dewey, J. (1938). *Experience and Education*. Macmillan.
- Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.

#### 10. Reflection and Lifelong Learning

- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
- Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

- the various systems of measurement and scale impact a drawing.
- measuring and technical drawing integrate mathematical concepts and scientific principles, illustrating their practical applications in real-world problem-solving and design.
- basic drafting equipment aids in the development of a final drawing.
- there are specific characteristics that constitute a technical drawing.
- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the world continues to evolve from the engineering design process.
- the engineering design process applies to a wide range of fields and challenges, demonstrating its relevance in addressing real-world issues.
- effective feedback of ideas, processes, and solutions is vital in engineering, as it facilitates collaboration, stakeholder engagement, and the successful implementation of designs.
- using tools and materials responsibly fosters precision, patience, and a deeper respect for craftsmanship and safety.
- functional design blends creativity, engineering, and problem-solving to meet both practical and aesthetic goals.
- how math, science, and art intersect in woodworking through measuring, planning, constructing, and solving real-world design challenges.
- engineers use digital design tools to transform ideas into precise, customized physical creations, enhancing creativity, problem-solving, and innovation in engineering.
- robotics and coding are critical in the modern economy.
- humans are needed in the creation of robotics.
- coding requires a certain sequence and language to automate.

**Central Bucks School District**  
**Essential Questions**

- Why is precision in measurement important in both everyday life and professional fields?
- How to appropriately utilize the proper tool to measure accurately to 1/16<sup>th</sup> of an inch?
- What are the key components of a technical drawing, and how do they communicate design ideas?
- What tools are most effective for creating precise technical drawings, and why?
- How has technology changed the way we measure and create technical drawings?
- Why is it important to follow a systematic approach when solving engineering problems?
- What are the key stages of the engineering design process, and how do they interconnect?
- How do engineers use the engineering design process to solve problems?
- How do different woodworking tools work, and how can you use them safely?
- What are the steps in the building process, and which ones require the most precision?
- How can you sketch a design that's both functional and creative?
- How can you personalize your project while keeping it functional?
- How can we use technology to transform our ideas into physical creations?
- How do digital tools expand or limit what we can create in manufacturing and woodworking?
- How do makers use technology to solve real-world problems?
- What is a robot, and how does it help solve real-world problems?
- What does it mean to innovate with robotics and coding?
- Where is the future of robotics and coding in technology and industry?

## Central Bucks School District – Course of Study Overview

### STEM 8

#### **Desired Results**

Course Description: In 8th grade STEM, students are challenged to integrate their accumulated knowledge from previous STEM courses into advanced, multi-step projects. They will use woodshop machines and tools, interact with robotic controllers, code and sensors, observe and explore 3D printing and vinyl cutting with higher level CAD techniques. Students will work by themselves and in teams to tackle closed and open-ended engineering problems. Projects that may include CO2 dragsters, mousetrap vehicles, rockets, models and a woodshop project. Technological literacy is strengthened in STEM 8 as they prepare for high school-level Science, Technology, ENGINEERING, Art and Mathematics (STEAM) classes.

Prerequisite: None

Committee Members: **Kerri Brumbaugh, Bruce Good, Chris Dallas, Paul Trafford, Adam Paulus, Steve Voorhees, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1:** Common STEM Engineering Project

**Common Summative Assessment 2:** Common STEM Engineering Process

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEM 8 – Pacing Guide

| Content                                                                          | Days      |
|----------------------------------------------------------------------------------|-----------|
| <b>Unit 1 – Advancing STEM Skills in Design: Measuring and Technical Drawing</b> | <b>8</b>  |
| Measuring                                                                        | 2         |
| Technical Drawing                                                                | 6         |
| <b>Unit 2 – STEM Engineering Design Process</b>                                  | <b>6</b>  |
| Introduction                                                                     | .5        |
| Safety                                                                           | .5        |
| Design Challenge                                                                 | 1         |
| Production, Test, Reflect                                                        | 4         |
| <b>Unit 3 - From Concept to Creation</b>                                         | <b>17</b> |
| Introduction                                                                     | 1         |
| Safety                                                                           | 2         |
| Read a Design/Design a Part                                                      | 2         |
| Construct/Test                                                                   | 12        |
| <b>Unit 4 -The Power of Digital Design</b>                                       | <b>8</b>  |
| Introduction                                                                     | .5        |
| Safety                                                                           | .5        |
| Brainstorm/Practice                                                              | 2         |
| Digital Creation                                                                 | 5         |
| <b>Unit 5 -Automate and Innovate: Robotics Coding</b>                            | <b>6</b>  |
| Introduction                                                                     | .5        |
| Safety                                                                           | .5        |
| Coding Instruction                                                               | 1         |
| Coding Challenge                                                                 | 4         |

**Required Texts and Software** VEX, Crumble kit, technical drawing supplies, woodshop, prototyping materials, laser cutter, vinyl cutter, 3d printer

**Central Bucks School District – Course of Study – STEM 8**  
**Unit 1 – Advancing STEM Skills in Design: Measuring and Technical Drawing**

**Desired Results:**

Essential Questions:

- Why is precision in measurement important in both everyday life and professional fields?
- How to appropriately utilize the proper tool to measure accurately to 1/16<sup>th</sup> of an inch?
- What are the key components of a technical drawing, and how do they communicate design ideas?
- What tools are most effective for creating precise technical drawings, and why?
- How has technology changed the way we measure and create technical drawings?

Enduring Understandings:

Students will understand that...

- the various systems of measurement and scale impact a drawing.
- measuring and technical drawing integrate mathematical concepts and scientific principles, illustrating their practical applications in real-world problem-solving and design.
- basic drafting equipment aids in the development of a final drawing.
- there are specific characteristics that constitute a technical drawing.

Knowledge:

Students will know...

- measurement to the nearest 1/16<sup>th</sup> of an inch
- the characteristics and procedures of drafting
- how to navigate a Computer Aided Drawing Program

Skills:

Students will be able to...

- utilize measurement and drafting tools in the accurate creation of a drawing
- how to apply hand drawing skills to create Computer Aided Designs

Standards:

Priority:

PDE STEELS:

3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

-The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.

Supporting:

Core Math Standards:

-Attend to precision.

-Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

PDE Arts and Humanities:

9.1.8.A Know and use the elements and principles of each art form to create works in the arts and humanities.

### **Acceptable Evidence:**

Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment

- Measuring Practice
- Technical Notes
- Sketching

Summative Assessment

- Measuring Test
- Technical Drawing Portfolio
- Computer Aided Drawing Portfolio

### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Practice reading a ruler
- Utilize a ruler and measure lines
- Display knowledge of measuring on a summative assessment
- Use drafting tools to draw both orthographic and isometric drawings

Instructional Strategies:

- Direct instruction: measuring and reading a ruler to a  $1/16^{\text{th}}$  of an inch
- Reviewing drafting tools, their purpose and how to use
- Teacher demonstration of drafting a technical drawing
- Deliberate Practice
- Peer teaching model
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Adapted Measuring Tools
  - Measuring Video Tutorial
  - Teacher Intervention during I&E
  - Technical Drawing Video Tutorial
  - Peer Tutoring
- Enrichment:
  - Sketch a Woodshop Tool
  - Explore Computer Aided Drafting and design a choice object

For Language Development:

- Students will understand measuring terms and verbiage used in the engineering world.

## Central Bucks School District – Course of Study – STEM 8

### Unit 2 – STEM Engineering Design Process

#### **Desired Results:**

##### Essential Questions:

- Why is it important to follow a systematic approach when solving engineering problems?
- What are the key stages of the engineering design process, and how do they interconnect?
- How do engineers use the engineering design process to solve problems?

##### Enduring Understandings:

Students will understand that...

- the engineering design process is a structured framework that guides problem-solving and innovation, emphasizing the importance of following systematic steps to achieve effective solutions.
- the world is ever evolving from the engineering design process.
- the engineering design process applies to a wide range of fields and challenges, demonstrating its relevance in addressing real-world issues.
- effective feedback of ideas, processes, and solutions is vital in engineering, as it facilitates collaboration, stakeholder engagement, and the successful implementation of designs.

##### Knowledge:

Students will know...

- and understand the steps of the Engineering Design Process

##### Skills:

Students will be able to...

- utilize the steps of the Engineering Design Process to solve a problem
- apply knowledge and skills from Unit 1 to effectively measure and draw design solutions for design challenges
- design, build, test and test a solution to a design challenge
- reflect on their solution discussing problems solved, knowledge gained, and improvements you would have made

##### Standards:

###### Priority:

###### PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8LL Compare how different technologies involve different sets of processes.

###### ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.



- The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.
- Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.
- The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

#### Supporting:

##### Core Math Standards:

- Attend to precision.
- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

##### National Core Art Standards

- Combine concepts collaboratively to generate innovative ideas for creating art.

### **Acceptable Evidence:**

#### Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Technical Notes
- Research and Brainstorming
- Design Sketches

#### Summative Assessment

- Final Design Sketches
- Project Rubric

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- Review the steps of the Engineering Design Process
- Use the steps of the Engineering Design Process to solve an Engineering Challenge

#### Instructional Strategies:

- Direct instruction
- Video overview of Design Process
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

#### Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Research vs Design option for student exploration
  - Teacher Intervention during I&E
- Enrichment:
  - Small design and problem-solving challenges
  - Explore a type of engineer and the problems they solve

#### For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.
- Students will experience group work and enhance their communication skills.

## Central Bucks School District – Course of Study – STEM 8

### Unit 3 – From Concept to Creation

#### **Desired Results:**

##### Essential Questions:

- How do different woodworking tools work, and how can you use them safely?
- What are the steps in the building process, and which ones require the most precision?
- How can you sketch a design that's both functional and creative?
- How can you personalize your project while keeping it functional?

##### Enduring Understandings:

Students will understand that...

- using tools and materials responsibly fosters precision, patience, and a deeper respect for craftsmanship and safety.
- functional design blends creativity, engineering, and problem-solving to meet both practical and aesthetic goals.
- how math, science, and art intersect in woodworking through measuring, planning, constructing, and solving real-world design challenges.

##### Knowledge:

Students will know...

- the process of taking raw material to create a project.
- how to solve a design challenge in a woodworking project.

##### Skills:

Students will be able to...

- safely use woodworking tools and equipment.
- utilize their measuring and drawing skills to aid in the design and creation of a project.

##### Standards:

##### Priority:

##### PDE STEELS:

3.5.6-8.Q Apply a technology and engineering design thinking process.

3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

3.5.6-8.KK Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.

3.5.6-8.V Refine design solutions to address criteria and constraints.

3.5.6-8.LL Compare how different technologies involve different sets of processes.

##### ITEEA Standards for Technological Literacy:

-Make two-dimensional and three-dimensional representations of the designed solution.

-Design involves a set of steps, which can be performed in different sequences and repeated as needed.

-The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.

- Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.
- The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

#### Supporting:

Core Math Standards:

- Attend to precision.
- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

### **Acceptable Evidence:**

Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment

- Technical Notes
- Design Sketches

Summative Assessment

- Safety Test
- Project Rubric

### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Review machine use and safety
- Show proficiency in use of machines and tools
- Use woodworking machines and tools to create a project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Project-based learning
- Problem-Solving and Critical Thinking
- Guided Reflection

Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Use templates or jigs for students who need more structure.
  - Provide checklists, sentence starters for reflection, and graphic organizers for planning.
- Enrichment:
  - Invite students to create alternate versions of the project with constraints
  - Pose real-world problems like "How would you mass-produce this board efficiently?"

For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.

## Central Bucks School District – Course of Study – STEM 8

### Unit 4 – The Power of Digital Design

#### Desired Results:

##### Essential Questions:

- How can we use technology to transform our ideas into physical creations?
- How do digital tools expand or limit what we can create in manufacturing and woodworking?
- How do makers use technology to solve real-world problems?

##### Enduring Understandings:

Students will understand that...

- engineers use digital design tools to transform ideas into precise, customized physical creations, enhancing creativity, problem-solving, and innovation in engineering.

##### Knowledge:

Students will know...

- how to apply measurement, scaling, and layout principles in digital design.
- use basic digital design software to create files for the use on digital tools.

##### Skills:

Students will be able to...

- apply design techniques to the creation of a digital file.
- understand the workflow from digital design to physical production.

##### Standards:

##### Priority:

##### Systems & Control

- 3.5.6–8.K — Use devices to control technological systems.
- 3.5.6–8.EE — Differentiate between inputs, processes, outputs, and feedback in technological systems.
- 3.5.6–8.FF — Demonstrate how systems thinking involves considering relationships between every part and the environment.

##### Engineering Design & Problem Solving

- 3.5.6–8.Q — Apply a technology and engineering design thinking process.
- 3.5.6–8.R — Develop innovative products and systems that solve problems and extend capabilities.
- 3.5.6–8.V — Refine design solutions to address criteria and constraints.
- 3.5.6–8.JJ — Apply informed problem-solving strategies to improve devices or processes.

##### Supporting:

##### Tools, Materials, Mechanisms

- 3.5.6–8.J — Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

##### Technology in Society

- 3.5.6–8.F — Analyze technologies that have changed how people think, interact, live, and communicate.
- 3.5.6–8.CC — Consider historical factors that contributed to technological development.

#### Acceptable Evidence:

##### Performance Tasks –

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment

- Design Sketches

#### Summative Assessment

- Project Rubric

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- Review the steps of creating a digital design
- Understand how a digital design is created through digital fabrication

#### Instructional Strategies:

- Blended Learning
- Direction Instruction
- Project-Based Learning
- Problem-Solving and Critical Thinking

#### Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Flexible Group to assist through peer support
  - Scaffolded tutorials
- Enrichment:
  - Offer design challenges with choice of tool and project

#### For Language Development:

- Students will utilize technical writing techniques to understand and reflect upon the process taken and completed for the project through a portfolio.

# Central Bucks School District – Course of Study – STEM 8

## Unit 5 – Automate and Innovate: Robotics Coding

### **Desired Results:**

#### Essential Questions:

- What is a robot, and how does it help solve real-world problems?
- What does it mean to innovate with robotics and coding?
- Where is the future of robotics and coding in technology and industry?

#### Enduring Understandings:

##### Students will understand that...

- robotics and coding are critical in the modern economy
- humans are needed in the creation of robotics
- coding requires a certain sequence and language to automate

#### Knowledge:

##### Students will know...

- programming vocabulary
- program sequencing
- how to debug, troubleshoot and problem solve

#### Skills:

##### Students will be able to...

- Understand automation, robotics and coding
- Apply critical thinking and problem solving

#### Standards:

##### Priority:

##### Systems & Control

- 3.5.6–8.K — Use devices to control technological systems.
- 3.5.6–8.EE — Differentiate between inputs, processes, outputs, and feedback in technological systems.
- 3.5.6–8.FF — Demonstrate how systems thinking involves considering relationships between every part and the environment.

##### Engineering Design & Problem Solving

- 3.5.6–8.Q — Apply a technology and engineering design thinking process.
- 3.5.6–8.R — Develop innovative products and systems that solve problems and extend capabilities.
- 3.5.6–8.V — Refine design solutions to address criteria and constraints.
- 3.5.6–8.JJ — Apply informed problem-solving strategies to improve devices or processes.

##### Supporting:

##### Tools, Materials, Mechanisms

- 3.5.6–8.J — Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

##### Technology in Society

- 3.5.6–8.F — Analyze technologies that have changed how people think, interact, live, and communicate.
- 3.5.6–8.CC — Consider historical factors that contributed to technological development.

### **Acceptable Evidence:**

#### Performance Tasks –

#### Acceptable evidence of learning other than Performance Tasks:

#### Formative Assessment

- Research Activity

- Self/partner-checklist

#### Summative Assessment

- Project Rubric

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- Explore automation, robotics, and coding
- Display knowledge of coding

#### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

#### Differentiation/Intervention/Enrichment Options:

- Differentiated/Intervention:
  - Tiered Lessons: providing varying levels of complexity
  - Scaffolded Instruction
- Enrichment:
  - Choice-Based: Students explore interests

#### For Language Development:

- Students will utilize writing techniques to explore different areas of automation, robotics, and coding.

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEM 8

**Date:** 08-06-2026

**Student Level:** Middle School

**Grade Level:** Grade 8

### **Characterization of Course of Study:**

STEM 8 is a hands-on, project-based course designed to build upon the technology and engineering concepts introduced in STEM 7 while furthering students' technological literacy, creativity, and problem-solving abilities. Expanded opportunities in Technical Design and drawing skills are increased using hand tools and CAD. Open ended design and engineering challenges are included using prototyping tools such as 3D printers, vinyl cutters and laser engravers. Safety, hand tools and larger machines are also expanded using the woodshop. Robotics is utilized once again with more complicated challenges as we teach students to navigate our modern world. Through engaging design challenges and real-world engineering applications, students solidify their understanding of the engineering design process as they identify problems, develop solutions, construct prototypes, test designs, and refine their work.

### **Reasons for Proposed Adoption:**

STEM 8 is an expanded version of our STEM 7 course to ensure vertical integration and continuation of STEM concepts. PA STEELS standards are included and were used to guide the development of STEM 8. This project-based course is designed for students to maintain and expand their technological literacy while preparing them for high school problem-solving, collaboration, and innovation skillsets necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_





STEAM Robotics 1  
The Technology and Engineering Education Department

Course Number: 6861

Course Level: High School

Grade: 9,10,11,12

Time/Credit: 45 Days (2 Marking Periods)/.5 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District**  
**Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

**Central Bucks School District – Course of Study Overview**  
**STEAM Robotics 1**

**Desired Results**

Course Description: This introductory Science, Technology, ENGINEERING, Art and Mathematics (STEAM) Robotics, 9 Weeks course invites students to experience the foundations of Robotics. Students will explore mechanical design, basic electronics, and programming concepts while learning how to build, wire, and operate robots to complete tasks and challenges. Emphasis is placed on creativity, problem-solving, and teamwork as students apply STEAM principles to design innovative solutions using VEX and other smaller microcontrollers. This course provides a foundation in physical coding techniques and wiring while furthering students' technological literacy from robotics and coding in middle school within the expanded STEAM framework. Students who complete STEAM Robotics 1, 9 weeks with a C or better can take STEAM Robotics 2.

Prerequisite: None

Committee Members: **Corey Detweiler, Travis Jovais, Luke Drake, Jon Taylor**

**Acceptable Evidence.**

**Common Summative Assessment 1 Title:** STEAM Robotics Project

**Common Summative Assessment 2 Title:** STEAM Robotics Portfolio

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Robotics 1 – Pacing Guide

(Add or delete units and the boxes under each as needed)

| Content                                                       | Days      |
|---------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Robotics 1</b>              | <b>1</b>  |
| Course Overview and Syllabus                                  | .5        |
| College and Career                                            | .5        |
| <b>Unit 2 – Measuring, CAD and 3D Print</b>                   | <b>7</b>  |
| Measurement- Metric/Imperial                                  | 1         |
| Ohm’s Law                                                     | 1         |
| CAD Design for Robotic Components                             | 4         |
| Slicing for 3D Printing                                       | 1         |
| <b>Unit 3 – Robotics Kit Components Overview</b>              | <b>1</b>  |
| Component Kit- Microcontroller and Kit Accessories Overview   | .5        |
| Integrated Development Environment                            | .5        |
| <b>Unit 4 – Robotics Kit Methods</b>                          | <b>3</b>  |
| LED’s and Code                                                | 1         |
| Sensors and Code                                              | 1         |
| Motors and Code                                               | 1         |
| <b>Unit 5 -STEAM Engineering and Robotics Project Process</b> | <b>30</b> |
| Engineering Robotics Project Loop- Ongoing throughout course  | #         |
| Plan- Read Kit Directions and gather components needed        | 5         |
| Design and Build- Design, Print and Assemble Robotic Device   | 15        |
| Code- Drag or Type Code into IDE                              | 5         |
| Troubleshoot- Execute Code and fix issues                     | 5         |
| <b>Unit 6- STEAM Robotics Portfolio</b>                       | <b>3</b>  |
| Data/Photo Collection                                         | 1         |
| Desktop Publishing                                            | 2         |
|                                                               |           |
| Total Days                                                    | 45        |

### Required Texts and Software-

The Ruler Game - Learn to Read a Ruler

Cad.onshape.com

Bambu Labs P2S

Bambu Labs Software

ELEGOO UNO R3 Project Most Complete Starter Kit with Tutorial Compatible with Arduino IDE (200+ Components) or comparable along with- Arduino Tutorial 1: Setting Up and Programming the Arduino for Absolute Beginners,

VEX Classroom V5 - VEX Robotics, kits and online coding software



**Central Bucks School District – Course of Study – STEAM Robotics 1**  
**Unit 1 – Introduction to STEAM Robotics 1**

**Desired Results:**

- Essential Questions:
- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

**Enduring Understandings:**

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

**Knowledge:**

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

**Skills:**

Students will be able to...

- learn about the expectations and structure of the course.
- learn about the importance of technological and engineering literacy and the different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

**Standards:**

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

**Supporting:**

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

**Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about Robotics

History of Robotics- History of Industrial

Robots | Robots.com

Case Study- The World's Leading

Robotics Company | Boston Dynamics

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- N/A

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Learn about the history of robotics and explore robotics companies

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed

**Central Bucks School District – Course of Study – STEAM Robotics 1**  
**Unit 2 – Measuring, CAD and 3D Print**

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- What happens when technologies from different disciplines are combined or integrated?
- What is the value of iteration (repetition) in the design process?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: CAD- Computer Aided Drawing, English and Metric measuring systems, Ohm's Law, iteration, slicing

Skills:

Students will be able to...

- measure accurately
- complete simple Ohm's Law math problems
- draw objects accurately in Onshape CAD software using 2D and 3D tools to export a file and slice it on a 3D printing slicer

Standards:

Priority:

3.5.9-12.P Apply a broad range of design skills to a design thinking process.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.U Evaluate and define the purpose of a design.

3.5.9-12.X Implement the best possible solution to a design using an explicit process.

Supporting:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, Ohm's Law math problems, Onshape tutorial completion, Robotic design, sliced file

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Ruler game
- Ohm's Law
- Onshape tutorials
- Slicer

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed

**Central Bucks School District – Course of Study – STEAM Robotics 1**  
**Unit 3 – Robotics Kit Components Overview**

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.

Knowledge:

Students will know... the identity of the different components of the kits and the competition area

- Vocabulary: breadboard, LED, motor, resistor, gears, remote control, screws, spacers, sensors

Skills:

- Students will be able to identify the different parts of the Elegoo and VEX kits

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

Supporting:

3.5.9-12.CC Analyze how technology transfer occurs when a user applies an existing innovation developed for one function for a different purpose.

**Acceptable Evidence:**

Performance Tasks – Parts Identification and function

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Kit Identification Quiz

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Identify components and their uses in robotics systems

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed

**Central Bucks School District – Course of Study – STEAM Robotics 1**  
**Unit 4 – Robotics Kit Methods**

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use kit components to create a circuit (Arduino) or a structure (VEX) and use the Integrated Development Environment (IDE) to upload code to a controller
- Vocabulary: IDE, Arduino, VEX, problem-solving design and engineering loop

Skills:

Students will be able to use kit components to create a circuit (Arduino) or a structure (VEX) and use the Integrated Development Environment (IDE) to upload code to a controller.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – breadboard circuit (Arduino) and/or created structure with brain (VEX) upload code to perform a task

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- VEX kit and Arduino Kit performance tasks taken from online resources

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed



**Central Bucks School District – Course of Study – STEAM Robotics 1**  
**Unit 5 – STEAM Engineering and Robotics Project Process**

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know how to use the Engineering Design and Problem Solving Loop to make STEAM Robotics projects to solve a problem.

Vocabulary: Structure, Motion, Control

Skills:

Students will be able to use the kits and components to make STEAM Robotics projects to use with or without the competition area.

Standards:

Priority:

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Completed and functional circuit (Arduino) and/or completed and functional robot (VEX)

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- VEX kit and Arduino Kit performance tasks taken from online resources
- IDE
- Competition area

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed

**Central Bucks School District – Course of Study – STEAM Robotics 1**  
**Unit 6 – STEAM Robotics Portfolio**

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know... how to document and organize all of their classwork and projects through the creation of a project portfolio.

- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction

- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEAM Robotics 1

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9,10,11,12

### **Characterization of Course of Study:**

STEAM Robotics 1 is an introductory, project-based course designed to develop students' knowledge and skills in robotics, engineering design, physical computing, and digital fabrication. Through hands-on experiences using Turn-Key Robotics systems, microcontrollers, (CAD), and 3D printing technologies, students explore the principles of mechanical design, electronics, automation, and problem-solving.

Students engage in the engineering design process to design, build, program, test, and improve robotic systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

### **Reasons for Proposed Adoption:**

STEAM Robotics 1 is a finalization of our Pilot Physical Computing courses that were available at CB West for the past two years. This course ensures vertical integration and continuation of middle school STEM concepts with a focus on physical computing and robotics. PA STEELS standards are included and were used to guide the development of STEAM Robotics 1. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Robotics 2  
The Technology and Engineering Education Department

Course Number: 6862

Course Level: High School

Grade: 9,10,11,12

Time/Credit: 45 Days (2 Marking Periods) .5 Credit

Development Date: 09-19-23

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy



- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Robotics 2

#### **Desired Results**

Course Description: Building on the foundations of STEAM Robotics 1, this course challenges students to design, program, and optimize more advanced VEX and other microcontroller robotics systems. Students will explore topics such as sensor integration, autonomous control, and iterative design to solve complex engineering challenges. STEAM Robotics 2 encourages innovation, leadership, and portfolio-ready project development to prepare students for after school real world experiences in STEAM career and education pathways.

Prerequisite: STEAM Robotics 1

Committee Members: **Corey Detweiler, Travis Jovais, Luke Drake, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Robotics Project

**Common Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** Portfolio

**Common Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Robotics 2 – Pacing Guide

(Add or delete units and the boxes under each as needed)

| Content                                                                | Days      |
|------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Robotics 2</b>                       | <b>1</b>  |
| Course Overview and Syllabus                                           | .5        |
| College and Career                                                     | .5        |
| <b>Unit 2 – Measuring, CAD and 3D Print</b>                            | <b>7</b>  |
| Measurement- Metric/Imperial                                           | 1         |
| Ohm's Law                                                              | 1         |
| Advanced CAD Design for Robotic Components                             | 4         |
| Advanced Slicing for 3D Print                                          | 1         |
| <b>Unit 3 – Advanced Robotics Kit Components Overview</b>              | <b>1</b>  |
| Component Kit- Microcontroller and Kit Accessories Overview            | .5        |
| Integrated Development Environment                                     | .5        |
| <b>Unit 4 – Advanced Robotics Kit Methods</b>                          | <b>3</b>  |
| LED's and Code                                                         | 1         |
| Sensors and Code                                                       | 1         |
| Motors and Code                                                        | 1         |
| <b>Unit 5 -Advanced STEAM Engineering and Robotics Project Process</b> | <b>30</b> |
| Engineering Robotics Project Loop- Ongoing throughout course           | #         |
| Plan- Read Kit Directions and gather components needed                 | 5         |
| Design and Build- Design, Print and Assemble Robotic Device            | 15        |
| Code- Drag or Type Code into IDE                                       | 5         |
| Troubleshoot- Execute Code and fix issues                              | 5         |
| <b>Unit 6- STEAM Robotics Portfolio</b>                                | <b>3</b>  |
| Data/Photo Collection                                                  | 1         |
| Desktop Publishing                                                     | 2         |
|                                                                        |           |
| Total Days                                                             | 45        |

### Required Texts and Software-

Rulers, calipers, Meters, etc.

Cad.onshape.com

Bambu Labs P2S

Bambu Labs Software

Amazon.com: Arduino Engineering Kit REV2 [AKX00022] - Advanced Hands-On Learning Kit for Engineering, Robotics, and Automation with Full Curriculum and Real-World Projects : Electronics

Or Continue with Elegoo Super Starter Kit

Amazon.com: ELEGOO UNO Project Super Starter Kit with Tutorial and UNO R3 Board Compatible with Arduino IDE : Electronics

Maker 101 - YouTube

Instructables.com

VEX Classroom V5 - VEX Robotics, kits and online coding software or VEX V5 Competition Super Kit - VEX Robotics

VEX competition area kits

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- learn about the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about Robotics 2, syllabus

Research their own Robotics company and research colleges and schools that offer training in Robotics, find research about robotics and their impacts on society and the environment

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- N/A

#### **Suggested Learning Experiences and Instruction**

Learning Experiences: research their own information to share about Robotics and their impacts on society

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed



**Central Bucks School District – Course of Study – STEAM Robotics 2**  
**Unit 2 – Measuring, CAD and 3D Print**

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- What happens when technologies from different disciplines are combined or integrated?
- What is the value of iteration (repetition) in the design process?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: CAD- Computer Aided Drawing, English and Metric measuring systems, calipers, Ohm's Law, Digital Multimeter, iteration, slicing

Skills:

Students will be able to... measure accurately and complete more complex Ohm's Law math problems and use a digital multimeter, draw advanced objects accurately in Onshape CAD software using 2D and 3D tools to export a file and slice it on a 3D printing slicer.

Standards:

Priority:

3.5.9-12.P Apply a broad range of design skills to a design thinking process.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.U Evaluate and define the purpose of a design.

3.5.9-12.X Implement the best possible solution to a design using an explicit process.

Supporting:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, Ohm’s Law math problems, Onshape tutorial completion, Robotic design (gears, mechanisms), sliced file

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers’ Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Ruler game
- Ohm’s Law
- Onshape tutorials
- Slicer

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed

## Central Bucks School District – Course of Study – STEAM Robotics 2

### Unit 3 – Advanced Robotics Kit Components Overview

#### **Desired Results:**

##### Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What happens when technologies from different disciplines are combined or integrated?

##### Enduring Understandings:

Students will understand that...

- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.

##### Knowledge:

Students will know...

- the identity of the different components of the kit
- Vocabulary: breadboard, LED, motor, resistor, gears, remote control, screws, spacers, sensors

##### Skills:

Students will be able to review and identify the different parts of the Elegoo and VEX kits

##### Standards:

###### Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

###### Supporting:

3.5.9-12.CC Analyze how technology transfer occurs when a user applies an existing innovation developed for one function for a different purpose.

#### **Acceptable Evidence:**

Performance Tasks – Parts Identification and function

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Kit Identification Quiz

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- Identify components and their uses in robotics systems

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed
- ID parts are available in native language when needed

**Central Bucks School District – Course of Study – STEAM Robotics 2**  
**Unit 4 – Advanced Robotics Kit Methods**

**Desired Results:**

**Essential Questions:**

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

**Enduring Understandings:**

**Students will understand that...**

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

**Knowledge:**

**Students will know...**

- how to use kit components to create an advanced circuit (Arduino) or an advanced structure (VEX) and use the Integrated Development Environment (IDE) to upload code to a controller.
- Vocabulary: IDE, Arduino, VEX, problem-solving design and engineering loop

**Skills:**

Students will be able to use kit components to create an advanced circuit (Arduino) or an advanced structure (VEX) and use the Integrated Development Environment (IDE) to upload code to a controller.

**Standards:**

**Priority:**

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.
- 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

### **Acceptable Evidence:**

Performance Tasks – breadboard circuit (Arduino) and/or created structure with brain (VEX) upload code to perform a task

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- VEX kit and Arduino Kit performance tasks taken from online resources

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed
- Native language is available for VEX and Arduino online

**Central Bucks School District – Course of Study – STEAM Robotics 2**  
**Unit 5 – Advanced STEAM Engineering and Robotics Project Process**

**Desired Results:**

**Essential Questions:**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

**Enduring Understandings:**

**Students will understand that...**

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Knowledge:**

**Students will know...**

- how to plan, design, create and improve an advanced robotics project to solve a complex problem.
- vocabulary: Structure, Motion, Control
- how to work together competitively in the competition arena with various games from VEX website

**Skills:**

Students will be able to build an advanced robot to perform a task and compete.

**Standards:**

**Priority:**

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Completed and functional advanced circuit (Arduino) and/or completed and advanced functional robot (VEX)

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Arduino Kit and VEX Classroom/Competition Kit performance tasks taken from online resources

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed



**Central Bucks School District – Course of Study – STEAM Robotics 2**  
**Unit 6 – STEAM Robotics Portfolio**

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know...

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Encourage students to view videos in native language when needed
- Presentation available in native language when needed

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** STEAM Robotics 2

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9,10,11,12

**Characterization of Course of Study:**

STEAM Robotics 2 is an advanced project-based course designed to further students' knowledge and skills in robotics, engineering design, physical computing, and digital fabrication. Through hands-on experiences using Turn-Key Robotics systems, microcontrollers, (CAD), and 3D printing technologies, students will challenge themselves with more complex principles of mechanical design, electronics, automation, and problem-solving. Students engage with more experience from the first level robotics course in the engineering design process to design, build, program, test, and improve robotic systems that solve authentic challenges. The course re-emphasizes creativity, innovation, collaboration, and critical thinking while reintroducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

**Reasons for Proposed Adoption:**

STEAM Robotics 2 is a continuation of STEAM Robotics 1. This course ensures additional experience with robotics and physical computing. PA STEELS standards are included and were used to guide the development of STEAM Robotics 1. This project-based course is designed to further strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Design 1 Exploring  
The Technology and Engineering Education Department

Course Number: 6560

Course Level: High School

Grade: 9,10,11,12

Time/Credit: 45 Days (1 Marking Period) .5 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential**- Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning**- Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)**- Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important**- Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social**- Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools** - Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable**- All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective**- Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused**- Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential**- Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District  
Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.



## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Design 1 Exploring

#### **Desired Results**

Course Description: This introductory Science, Technology, ENGINEERING, Art and Mathematics (STEAM) Design 1, 9 Weeks course invites students to explore design and engineering in a project-based setting. Traditional drafting tables and tools will complement modern computerized technology like CAD software, laser cutter, vinyl cutter and advanced 3D printers, giving students experience in both manual and digital design methods and outputs. Project examples include scale model building through the application of residential architectural and engineering design principles as well as smaller design and digitally fabricated projects. Emphasizing the engineering design process, problem-solving, creativity and developing technical skills, the course provides a foundation in manual design, digital design, building information management (BIM), and model building while furthering their technological literacy from middle school within the expanded STEAM framework. Students who complete STEAM Design 1 Exploring 9 weeks with a C or better can take STEAM Design 2.

Prerequisite: None

Committee Members: **Corey Detweiler, John Benedix, Luke Drake, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** STEAM Design Project

**Common Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** STEAM Design Portfolio

**Common Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Design 1 Exploring– Pacing Guide

| Content                                                                       | Days      |
|-------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Design 1 Exploring</b>                      | <b>1</b>  |
| Course Overview and Syllabus                                                  | .5        |
| Career and College                                                            | .5        |
| <b>Unit 2 – Measuring</b>                                                     | <b>3</b>  |
| Ruler                                                                         | 1         |
| Architect’s Scale                                                             | 1         |
| Measurement Activities                                                        | 1         |
| <b>Unit 3 – Conventional Design Tools and Modelling Methods</b>               | <b>3</b>  |
| Sketching                                                                     | 1         |
| Basic Drafting Tools for Technical Design                                     | 1         |
| Basic Model Tools for Model Building                                          | 1         |
| <b>Unit 4 – Digital and Machine Design Tools and Modelling Methods</b>        | <b>7</b>  |
| Architecture CAD Software                                                     | 2         |
| Engineering CAD/CAM Software                                                  | 2         |
| Laser- Engraving and Cutting                                                  | 1         |
| 3D Printer- Slicing and Printing                                              | 1         |
| Vinyl Machine- Cutting and Weeding                                            | 1         |
| <b>Unit 5 -STEAM Engineering and Design Project Process</b>                   | <b>26</b> |
| Engineering and Architecture Project Loop- Ongoing throughout course          | #         |
| Plan- Design Problem, sketching, technical drawing, cost estimating, planning | 3         |
| Design and Build- CAD/CAM, model cutting and fitting, gluing                  | 15        |
| Finish- Assembly of Model                                                     | 5         |
| Evaluate                                                                      | 3         |
| <b>Unit 6- STEAM Design Portfolio</b>                                         | <b>5</b>  |
| Data/Photo collection                                                         | 2         |
| Desktop Publishing                                                            | 3         |

**Required Texts and Software-** AutoDesk- AutoCAD Architecture, REVIT, Laser Cutter, 3D printer, Vinyl Cutter, computer lab, model building supplies, model building tools

Central Bucks School District – Course of Study – STEAM Design 1 Exploring  
Unit 1 – Introduction to STEAM Design 1 Exploring

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- learn about the expectations and structure of the course.
- learn about the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Design 1 Exploring, syllabus

Define STEAM as it relates to Design and Architecture and Engineering

History of Design and Engineering

Design examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession
- learn about the fields of architecture and design as a career
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1 Exploring  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and an architect's scale

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, How to Read an Architect's scale worksheet

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

### For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1 Exploring  
Unit 3 – Conventional Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting tools and hand tools using tutorials

- Vocabulary: pencil, paper

Skills:

Students will be able to use hand drafting tools and modelling tools to create design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.



3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – floor plan, physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Complete technical sketching
- Utilize xacto knife following safety protocols
- Create models

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1 Exploring  
Unit 4 – Digital and Machine Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting and CAD tools using tutorials

- Vocabulary: CAD, Vector, Raster, laser cut, vinyl cut, 3D print

Skills:

Students will be able to use CAD tools to create a project using a tutorial.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – floor plan, physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1 Exploring  
Unit 5 – STEAM Engineering and Design Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know how to use the Engineering Design and Problem Solving Loop to make STEAM Design projects to solve a problem.

- Vocabulary: CAD, scale, 2D CAD, 3D CAD, 3D slicing and printing, Vinyl Cutting, model building, raster and vector

Skills:

Students will be able to use drawing and digital tools and machines make STEAM Design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Supporting:**

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Floor Plan, Elevation Plan, Product Design, Vinyl Sticker, 3D printer

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

## Unit 6 – STEAM Design Portfolio

### **Desired Results:**

#### Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### Enduring Understandings:

##### Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

#### Knowledge:

Students will know how to document and organize all of their classwork and projects through the creation of a project portfolio.

- Vocabulary: Engineers' Notebook/Portfolio

#### Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

#### Standards:

##### Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

##### Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

### **Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

### **Suggested Learning Experiences and Instruction**

#### Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

#### Instructional Strategies:

- Direct instruction

- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEAM Design 1 Exploring

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9,10,11,12

### **Characterization of Course of Study:**

STEAM Design 1 Exploring is a 9 Week introductory, project-based course designed to develop students' knowledge and skills in architectural design, engineering design, CAD, and model building. Through hands-on experiences using technical sketching techniques, measuring using a scale, CAD, physical and digital modelling technologies, students explore residential and mechanical design while developing their problem-solving abilities. Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

### **Reasons for Proposed Adoption:**

STEAM Design 1 Exploring is a more modern version of our former Engineering and Architecture (South and West) and Architectural Design (East) course. This course ensures vertical integration and continuation of middle school STEM concepts with a focus on technical sketching, CAD, model creation and measuring accurately using a scale within the architectural and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Design 1 Exploring. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_





STEAM Design 1  
The Technology and Engineering Education Department

Course Number: 6561

Course Level: High School

Grade: 9,10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 -2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Design 1

#### **Desired Results**

Course Description: This expanded, introductory Science, Technology, ENGINEERING, Art and Mathematics (STEAM) Design, 18 Weeks course invites students to experience design and engineering in a project-based setting. Traditional drafting tables and tools will complement modern computerized technology like CAD software, laser cutter, vinyl cutter and advanced 3D printers, giving students experience in both manual and digital design methods and outputs. Project examples include scale model building through the application of residential architectural and engineering design principles as well as smaller design and digitally fabricated projects. Emphasizing engineering design and problem-solving process, creativity, and developing technical skills, this longer course provides a foundation in manual design, digital design, building information management (BIM), and model building while furthering their technological literacy from middle school within the expanded STEAM framework. Students who complete STEAM Design 1, 18 weeks with a C or better can take STEAM Design 2.

Prerequisite: None

Committee Members: **Corey Detweiler, John Benedix, Luke Drake, Jon Taylor**

#### **Acceptable Evidence.**

**Common Assessment 1 Title:** Residential Design Project

**Common Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Assessment 2 Title:** Portfolio

**Common Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Design 1– Pacing Guide

(Add or delete units and the boxes under each as needed)

| Content                                                                       | Days      |
|-------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Design 1</b>                                | <b>2</b>  |
| Course Overview and Syllabus                                                  | 1         |
| Career and College                                                            | 1         |
| <b>Unit 2 – Measuring</b>                                                     | <b>3</b>  |
| Ruler                                                                         | 1         |
| Architect’s Scale                                                             | 1         |
| Measurement Activities                                                        | 1         |
| <b>Unit 3 – Conventional Design Tools and Modelling Methods</b>               | <b>6</b>  |
| Sketching                                                                     | 3         |
| Basic Drafting Tools for Technical Design                                     | 2         |
| Basic Model Tools for Model Building                                          | 1         |
| <b>Unit 4 – Digital and Machine Design Tools and Modelling Methods</b>        | <b>9</b>  |
| Architecture CAD Software                                                     | 3         |
| Engineering CAD/CAM Software                                                  | 3         |
| Laser- Engraving and Cutting                                                  | 1         |
| 3D Printer- Slicing and Printing                                              | 1         |
| Vinyl Machine- Cutting and Weeding                                            | 1         |
| <b>Unit 5 -STEAM Engineering and Design Project Process</b>                   | <b>62</b> |
| Engineering and Architecture Project Loop- Ongoing throughout course          | #         |
| Plan- Design Problem, sketching, technical drawing, cost estimating, planning | 5         |
| Design and Build- CAD/CAM, model cutting and fitting, gluing                  | 42        |
| Finish- Assembly of Model                                                     | 10        |
| Evaluate                                                                      | 5         |
| <b>Unit 6- STEAM Design Portfolio</b>                                         | <b>8</b>  |
| Data/Photo collection                                                         | 4         |
| Desktop Publishing                                                            | 4         |
|                                                                               |           |
| Total                                                                         | 90        |

**Required Texts and Software-** AutoDesk- AutoCAD Architecture, REVIT, Laser Cutter, 3D printer, Vinyl Cutter, computer lab, model building supplies, model building tools



Central Bucks School District – Course of Study – STEAM Design 1  
Unit 1 – Introduction to STEAM Design 1

**Desired Results:**

- Essential Questions:
- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

**Enduring Understandings:**

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

**Knowledge:**

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

**Skills:**

Students will be able to...

- learn about the expectations and structure of the course.
- learn about the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

**Standards:**

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Design 1, syllabus

Define STEAM as it relates to Design and Architecture and Engineering

History of Design and Engineering

Design examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession
- learn about the fields of architecture and design as a career
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and an architect's scale

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, How to Read an Architect's scale worksheet

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1  
Unit 3 – Conventional Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting tools and hand tools using tutorials

- Vocabulary: pencil, paper,

Skills:

Students will be able to use hand drafting tools and modelling tools to create design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – floor plan, physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Complete technical sketching
- Utilize xacto knife following safety protocols
- Create models

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1  
Unit 4 – Digital and Machine Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting and CAD tools using tutorials

- Vocabulary: CAD, Vector, Raster, laser cut, vinyl cut, 3D print

Skills:

Students will be able to... use CAD tools to create a project using a tutorial.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – floor plan, physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products to create project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed



Central Bucks School District – Course of Study – STEAM Design 1  
Unit 5 – STEAM Engineering and Design Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know... how to use the Engineering Design and Problem Solving Loop to make STEAM Design projects to solve a problem.

- Vocabulary: CAD, scale, 2D CAD, 3D CAD, 3D slicing and printing, Vinyl Cutting, model building, raster and vector

Skills:

Students will be able to use drawing and digital tools and machines make STEAM Design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Supporting:**

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Floor Plan, Elevation Plan, Product Design, Vinyl Sticker, 3D printer

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 1  
Unit 6 – STEAM Design Portfolio

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know... how to document and organize all of their classwork and projects through the creation of a project portfolio.

- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** STEAM Design 1

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9,10,11,12

**Characterization of Course of Study:**

STEAM Design 1 is an 18 Week introductory, project-based course designed to develop students' knowledge and skills in architectural design, engineering design, CAD, and model building. Through hands-on experiences using technical sketching techniques, measuring using a scale, CAD, physical and digital modelling technologies, students explore residential and mechanical design while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

**Reasons for Proposed Adoption:**

STEAM Design 1 is a more modern version of our former Engineering and Architecture (South and West) and Architectural Design (East). This course ensures vertical integration and continuation of middle school STEM concepts with a focus on technical sketching, CAD, model creation and measuring accurately using a scale within the architectural and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Design 1. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Design 2  
The Technology and Engineering Education Department

Course Number: 6562

Course Level: High School

Grade: 10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy



- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Design 2

#### **Desired Results**

Course Description: Building on the foundations of STEAM Design 1, 9 Weeks Exploring OR STEAM Design 1, 18 Weeks, this course challenges students to apply and expand their design skills through more advanced projects. Students will deepen their proficiency with CAD and BIM software with precision drafting, slicing, vector generation, and technical drawing, while integrating advanced methods and use of the vinyl cutter, laser cutter, and 3D printer to create innovative designs and models. Emphasis is placed on design thinking, collaboration, and problem-solving as students move from guided assignments to more independent design challenges with scale model building through application of commercial architectural and engineering design principles. This course encourages students to produce original project solutions, preparing them for advanced study in engineering and design as they reach a higher understanding of technological literacy. Students who complete STEAM Design 2, 18 weeks with a C or better can take STEAM Design 3.

Prerequisite: STEAM Design 1 Exploring OR STEAM Design 1

Committee Members: **Corey Detweiler, John Benedix, Luke Drake, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Commercial Design Project

**Common Summative Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** Portfolio

**Common Summative Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Design 2– Pacing Guide

(Add or delete units and the boxes under each as needed)

| Content                                                                             | Days      |
|-------------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Design 2</b>                                      | <b>2</b>  |
| Course Overview and Syllabus                                                        | 1         |
| Career and College                                                                  | 1         |
| <b>Unit 2 – Measuring</b>                                                           | <b>3</b>  |
| Ruler                                                                               | 1         |
| Architect’s Scale                                                                   | 1         |
| Measurement Activities                                                              | 1         |
| <b>Unit 3 – Intermediate Conventional Design Tools and Modelling Methods</b>        | <b>6</b>  |
| Sketching                                                                           | 3         |
| Basic Drafting Tools for Technical Design                                           | 2         |
| Basic Model Tools for Model Building                                                | 1         |
| <b>Unit 4 – Intermediate Digital and Machine Design Tools and Modelling Methods</b> | <b>9</b>  |
| Architecture CAD Software                                                           | 3         |
| Engineering CAD/CAM Software                                                        | 3         |
| Laser- Engraving and Cutting                                                        | 1         |
| 3D Printer- Slicing and Printing                                                    | 1         |
| Vinyl Machine- Cutting and Weeding                                                  | 1         |
| <b>Unit 5 -Intermediate STEAM Engineering and Design Project Process</b>            | <b>62</b> |
| Engineering and Architecture Project Loop- Ongoing throughout course                | #         |
| Plan- Design Problem, sketching, technical drawing, cost estimating, planning       | 5         |
| Design and Build- CAD/CAM, model cutting and fitting, gluing                        | 42        |
| Finish- Assembly of Model                                                           | 10        |
| Evaluate                                                                            | 5         |
| <b>Unit 6- STEAM Design Portfolio</b>                                               | <b>8</b>  |
| Data/Photo collection                                                               | 4         |
| Desktop Publishing                                                                  | 4         |
|                                                                                     |           |
| Total                                                                               | 90        |

**Required Texts and Software** Autodesk- AutoCAD Architecture, REVIT, Laser Cutter, 3D printer, Vinyl Cutter, computer lab, model building supplies, model building tools

Central Bucks School District – Course of Study – STEAM Design 2  
Unit 1 – Introduction to STEAM Design 2

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- learn about the expectations and structure of the course.
- learn about the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Design 2, syllabus

Define STEAM as it relates to commercial Design and Architecture and Engineering

Current trends in commercial Design and Engineering

Commercial Design examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession
- learn about the fields of architecture and design as a career
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 2  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and an architect's scale

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, How to Read an Architect's scale worksheet

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric



## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

### For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 2  
Unit 3 – Intermediate Conventional Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting tools and hand tools using tutorials

- Vocabulary: pencil, paper

Skills:

Students will be able to use hand drafting tools and modelling tools to create intermediate design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – floor plan, electrical plan, plumbing plan, elevation plan, intermediate physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Complete technical sketching
- Utilize xacto knife following safety protocols
- Create models

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 2  
Unit 4 – Intermediate Digital and Machine Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting and CAD tools using tutorials

- Vocabulary: CAD, Vector, Raster, laser cut, vinyl cut, 3D print

Skills:

Students will be able to use intermediate CAD tools to create a project using a tutorial.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – intermediate commercial floor plan, electrical, plumbing plan, elevation plan, physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 2  
Unit 5 – Intermediate STEAM Engineering and Design Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know... how to use the Engineering Design and Problem Solving Loop to make STEAM Design projects to solve a problem.

- Vocabulary: CAD, scale, 2D CAD, 3D CAD, 3D slicing and printing, Vinyl Cutting, model building, raster and vector

Skills:

Students will be able to use drawing and digital tools and machines to make intermediate STEAM Design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Supporting:**

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – intermediate Floor Plan, Elevation Plan, Product Design, Vinyl Sticker, 3D printer

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know...

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction



- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** STEAM Design 2

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 10,11,12

**Characterization of Course of Study:**

STEAM Design 2 is an 18 Week project-based course designed to develop students' knowledge and skills in architectural design, engineering design, CAD, and model building. Through hands-on experiences using technical sketching techniques, measuring using a scale, CAD, physical and digital modelling technologies, students explore commercial and intermediate mechanical design while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

**Reasons for Proposed Adoption:**

STEAM Design 2 is a more modern version of our former Engineering and Architecture (South and West) and Architectural Design (East). This course ensures vertical integration and continuation of high school STEAM concepts with a focus on technical sketching, CAD, model creation and measuring accurately using a scale within the architectural and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Design 2. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Design 3  
The Technology and Engineering Education Department

Course Number: 6563

Course Level: High School

Grade: 10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?



## Central Bucks School District – Course of Study Overview

### STEAM Design 3

#### **Desired Results**

Course Description: In this advanced course, students take greater ownership of the design process, moving from concept development to fully realized prototypes. Using CAD software, drafting tools, and equipment from STEAM Design 2, students will complete independent and collaborative projects that emphasize innovation, precision, and real-world application. Projects are more open-ended to encourage students to apply creativity, problem-solving, and technical expertise to design solutions. STEAM Design 3 encourages innovation, leadership, and portfolio-ready project development to prepare students for after school real world experiences in STEAM career and education pathways.

Prerequisite: STEAM Design 2

Committee Members: **Corey Detweiler, John Benedix, Luke Drake, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Industrial Design Project

**Common Summative Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** Portfolio

**Common Summative Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90% Summative, 10% Formative

### STEAM Design 3– Pacing Guide

| Content                                                                         | Days      |
|---------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Design 3</b>                                  | <b>2</b>  |
| Course Overview and Syllabus                                                    | 1         |
| Career and College                                                              | 1         |
| <b>Unit 2 – Measuring</b>                                                       | <b>3</b>  |
| Ruler                                                                           | 1         |
| Architect’s Scale                                                               | 1         |
| Measurement Activities                                                          | 1         |
| <b>Unit 3 – Advanced Conventional Design Tools and Modelling Methods</b>        | <b>6</b>  |
| Sketching                                                                       | 3         |
| Basic Drafting Tools for Technical Design                                       | 2         |
| Basic Model Tools for Model Building                                            | 1         |
| <b>Unit 4 – Advanced Digital and Machine Design Tools and Modelling Methods</b> | <b>9</b>  |
| Architecture CAD Software                                                       | 3         |
| Engineering CAD/CAM Software                                                    | 3         |
| Laser- Engraving and Cutting                                                    | 1         |
| 3D Printer- Slicing and Printing                                                | 1         |
| Vinyl Machine- Cutting and Weeding                                              | 1         |
| <b>Unit 5 -Advanced STEAM Engineering and Design Project Process</b>            | <b>62</b> |
| Engineering and Architecture Project Loop- Ongoing throughout course            | #         |
| Plan- Design Problem, sketching, technical drawing, cost estimating, planning   | 5         |
| Design and Build- CAD/CAM, model cutting and fitting, gluing                    | 42        |
| Finish- Assembly of Model                                                       | 10        |
| Evaluate                                                                        | 5         |
| <b>Unit 6- STEAM Design Portfolio</b>                                           | <b>8</b>  |
| Data/Photo collection                                                           | 4         |
| Desktop Publishing                                                              | 4         |
|                                                                                 |           |
| Total                                                                           | 90        |

**Required Texts and Software** AutoDesk- AutoCAD Architecture, REVIT, Laser Cutter, 3D printer, Vinyl Cutter, computer lab, model building supplies, model building tools

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- learn about the expectations and structure of the course.
- learn about the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Design 3, syllabus

Define STEAM as it relates to industrial Design and Architecture and Engineering

Current trends in industrial Design and Engineering

Industrial Design examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession
- learn about the fields of architecture and design as a career
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 3  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and an architect's scale

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, How to Read an Architect's scale worksheet

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

### For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 3  
Unit 3 – Advanced Conventional Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting tools and hand tools using tutorials

- Vocabulary: pencil, paper

Skills:

Students will be able to use hand drafting tools and modelling tools to create advanced design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – advanced design plans

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Complete technical sketching
- Utilize xacto knife following safety protocols
- Create models

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed



Central Bucks School District – Course of Study – STEAM Design 3  
Unit 4 – Advanced Digital and Machine Design Tools and Modelling Methods

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting and CAD tools using tutorials

- Vocabulary: CAD, Vector, Raster, laser cut, vinyl cut, 3D print

Skills:

Students will be able to use advanced CAD tools to create a project using a tutorial.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks advanced industrial designs, advanced physical model

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 3  
Unit 5 – Advanced STEAM Engineering and Design Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know how to use the Engineering Design and Problem Solving Loop to make STEAM Design projects to solve a problem.

- Vocabulary: CAD, scale, 2D CAD, 3D CAD, 3D slicing and printing, Vinyl Cutting, model building, raster and vector

Skills:

Students will be able to use drawing and digital tools and machines make advanced STEAM Design projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Supporting:**

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – advanced industrial designs, Product Design, Vinyl Sticker, 3D printer

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw and Adobe products

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Design 3  
Unit 6 – STEAM Design Portfolio

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know... how to document and organize all of their classwork and projects through the creation of a project portfolio.

- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction

- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEAM Design 3

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 10,11,12

### **Characterization of Course of Study:**

STEAM Design 3 is an 18 Week project-based course designed to develop students' knowledge and skills in architectural design, engineering design, CAD, and model building. Through hands-on experiences using technical sketching techniques, measuring using a scale, CAD, physical and digital modelling technologies, students explore industrial and advanced mechanical design while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

### **Reasons for Proposed Adoption:**

STEAM Design 3 is a more modern version of our former Engineering and Architecture (South and West) and Architectural Design (East). This course ensures vertical integration and continuation of high school level 2 STEAM concepts with a focus on technical sketching, CAD, model creation and measuring accurately using a scale within the architectural and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Design 3. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Fabrication 1 Exploring  
The Technology and Engineering Education Department

Course Number: 6460

Course Level: High School

Grade: 9,10,11,12

Time/Credit: 45 Days (1 Marking Period) .5 Credit

Development Date: 09-19-23

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901



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**Central Bucks School District**  
**Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Fabrication 1 Exploring

#### **Desired Results**

Course Description: This introductory, 9 week Science, Technology, ENGINEERING, Art and Mathematics (STEAM) Fabrication course gives students hands-on experience in vector designing and machining, fabricating, and industrial output through a combination of traditional and modern tools. Students will explore safe and effective use of a woodshop, small and industrial robotics with the CNC router and laser cutter, additive manufacturing with 3D printers, vinyl cutter and hand tools to create functional and artistic projects that may include a wooden inlay logo sign, folding stool or clock. Emphasizing the engineering design and problem-solving process, creativity, and developing technical skills, students will establish a foundation of practical knowledge in manual and digital fabrication, material selection, and workshop safety while furthering their technological literacy from middle school within the expanded STEAM framework. Students who complete STEAM Fabrication 1 Exploring 9 weeks with a C or better can take **STEAM Fabrication 2**.

Prerequisite: None

Committee Members: **Mick Marmor, Travis Jovais, Trent Errett, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** STEAM Fabrication Project

**Common Summative Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** STEAM Fabrication Portfolio

**Common Summative Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Fabrication 1 Exploring– Pacing Guide

| Content                                                                                                                                       | Days      |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Fabrication 1 Exploring</b>                                                                                 | <b>1</b>  |
| Course Overview, Syllabus                                                                                                                     | .5        |
| Career and College                                                                                                                            | .5        |
| <b>Unit 2 – Measuring</b>                                                                                                                     | <b>2</b>  |
| Ruler                                                                                                                                         | 1         |
| Measurement Activities                                                                                                                        | 1         |
| <b>Unit 3 - Conventional Fabrication Tools and Machines</b>                                                                                   | <b>10</b> |
| Machine and Tool Safety                                                                                                                       | 7         |
| Machine Tests                                                                                                                                 | 3         |
| <b>Unit 4 -Digital and Robotic Fabrication Tools and Machines</b>                                                                             | <b>10</b> |
| Subtractive Manufacturing: CNC Router                                                                                                         | 2         |
| Subtractive Manufacturing: Laser Engraver                                                                                                     | 2         |
| Subtractive Manufacturing: Vinyl Cutter                                                                                                       | 2         |
| Additive Manufacturing: 3D Printer                                                                                                            | 2         |
| CAD/CAM Software                                                                                                                              | 2         |
| <b>Unit 5- STEAM Engineering and Fabrication Project Process</b>                                                                              | <b>19</b> |
| Engineering Project Loop- Ongoing throughout course                                                                                           | #         |
| <b>Plan-</b> Sketching and designing, Reading drawings and specifications, selecting materials creating Bill of Materials and cost estimating | 3         |
| <b>Build-</b> Material processing, cutting, assembling, and gluing                                                                            | 11        |
| <b>Finish-</b> Sanding, staining, painting, Clear Coat Finishing                                                                              | 3         |
| <b>Evaluate</b>                                                                                                                               | 2         |
| <b>Unit 6- STEAM Fabrication Portfolio</b>                                                                                                    | <b>3</b>  |
| Data/photo collection                                                                                                                         | 1         |
| Desktop Publishing                                                                                                                            | 2         |
|                                                                                                                                               |           |
| Total Days                                                                                                                                    | 45        |

**Required Texts and Software-** Corel Draw/Adobe, OnShape, Bambu Labs, Aspire/Vetric, AutoDesk FUSION, Vinyl Master, Laser, CNC, Vinyl Cutter, WoodShop tools and equipment

Central Bucks School District – Course of Study – STEAM Fabrication 1 Exploring  
Unit 1 – Introduction to STEAM Fabrication 1 Exploring

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- learn about the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.



3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Fabrication 1 Exploring, syllabus

Define STEAM as it relates to Fabrication

History of Manufacturing and Engineering

Fabrication examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession and manufacturing careers
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1 Exploring  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and tape measure

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game, How to Read an Architect's scale worksheet

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1 Exploring  
Unit 3 – Conventional Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know... how to use drafting tools and hand tools using tutorials

- Vocabulary: pencil, paper, Radial Arm Saw, Jointer, Planer, Miter Saw, Steps to square a board

Skills:

Students will be able to learn about safety to safely use the machines and tools of the shop.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – level 1 woodshop project, safety tests

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric, Common Safety Tests

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- using approved machines following all safety protocols to make a level 1 project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1 Exploring  
Unit 4 – Digital and Robotic Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use a computer to design, modify and create raster to vector images to be used on an industrial robotic machine called a Computer Numerical Control machine using either subtractive or additive manufacturing, also known as Computer Aided Manufacturing- CAM
- Vocabulary: CAD, CAM, Vector, Raster, laser cut, vinyl cut, 3D print, CNC

Skills:

Students will be able to use CAD/CAM tools to create a digitally made project and upload it to a robotic machine using a tutorial.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Digitally Created Fabrication Project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Aspire/Vetric, slicing, toolpath creation, Fusion, and CNC products to complete project
- Move from raster to vector creation

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1 Exploring  
Unit 5 – STEAM Engineering and Fabrication Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know how...

- to use the Engineering Design and Problem Solving Loop to make STEAM Fabrication projects to solve a problem.
- Vocabulary: CAD, CAM, 3D slicing and printing, Vinyl Cutting, fabrication project planning, raster and vector,

Skills:

Students will be able to use the tools and machines to make STEAM Fabrication projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.



Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks –Product Design, Vinyl Sticker, 3D printer, CNC project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Fusion, and CNC products to complete project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1 Exploring  
Unit 6 – STEAM Fabrication Portfolio

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know...

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction

- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEAM Fabrication 1 Exploring

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9,10,11,12

### **Characterization of Course of Study:**

STEAM Fabrication 1 Exploring is a 9 Week introductory, project-based course designed to develop students' knowledge and skills in planning and making projects using manual and digital tools and machines. Through hands-on experiences using technical sketching techniques, measuring accurately, CAM, tools and machines, students explore ways to use their hands to build a nice, accurate and highly refined project while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

### **Reasons for Proposed Adoption:**

STEAM Fabrication 1 Exploring is a more modern version of our former Materials and Engineering (South and West) and Engineering (East). This course ensures vertical integration and continuation of middle school STEM concepts with a focus on technical sketching, CAM, fine project creation and measuring accurately using a tape measure within the material and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Fabrication 1 Exploring. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Fabrication 1  
The Technology and Engineering Education Department

Course Number: 6461

Course Level: High School

Grade: 9,10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.



**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Fabrication 1

#### **Desired Results**

Course Description: This lengthened, introductory, 18 Week Science, Technology, ENGINEERING, Art and Mathematics (STEAM) Fabrication course gives students hands-on experience in vector designing and machining, fabricating and industrial output through a combination of traditional and modern tools. Students will experience safe and effective use of a woodshop, toolpath generation using small and industrial robotics with the CNC router and laser cutter, additive manufacturing with 3D printers, vinyl cutter and hand tools to create functional and artistic projects that may include an inlay logo sign, folding stool or clock along with other small projects. Emphasizing the engineering design and problem-solving process, creativity, and developing technical skills, the course provides a foundation in manual and digital fabrication, material selection, and workshop safety while furthering their technological literacy from middle school within the expanded STEAM framework. The course provides a longer time for additional fabrication experiences. Students who complete STEAM Fabrication 1, 18 weeks with a C or better can take **STEAM Fabrication 2**.

Prerequisite: None

Committee Members: **Mick Marmor, Travis Jovais, Trent Errett, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Fabrication Project

**Common Summative Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** Portfolio

**Common Summative Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative

## STEAM Fabrication 1– Pacing Guide

| Content                                                                                                                                 | Days      |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1 - Introduction to STEAM Fabrication 1</b>                                                                                     | <b>2</b>  |
| Course Overview, Syllabus                                                                                                               | 1         |
| Career and College                                                                                                                      | 1         |
| <b>Unit 2 – Measuring</b>                                                                                                               | <b>2</b>  |
| Ruler                                                                                                                                   | 1         |
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| <b>Unit 3 - Conventional Fabrication Tools and Machines</b>                                                                             | <b>10</b> |
| Machine and Tool Safety                                                                                                                 | 7         |
| Machine Tests                                                                                                                           | 3         |
| <b>Unit 4 -Digital and Robotic Fabrication Tools and Machines</b>                                                                       | <b>20</b> |
| Subtractive Manufacturing: CNC Router                                                                                                   | 4         |
| Subtractive Manufacturing: Laser Engraver                                                                                               | 4         |
| Subtractive Manufacturing: Vinyl Cutter                                                                                                 | 4         |
| Additive Manufacturing: 3D Printer                                                                                                      | 4         |
| CAD/CAM Software                                                                                                                        | 4         |
| <b>Unit 5- STEAM Engineering and Fabrication Project Process</b>                                                                        | <b>50</b> |
| Engineering Project Loop- Ongoing throughout course                                                                                     | #         |
| Plan- Sketching and designing, Reading drawings and specifications, selecting materials, creating Bill of Materials and cost estimating | 5         |
| Build- Material processing, cutting, assembling, and gluing                                                                             | 37        |
| Finish- Sanding, staining, painting, Clear Coat Finishing                                                                               | 5         |
| Evaluate                                                                                                                                | 3         |
| <b>Unit 6- STEAM Fabrication Portfolio</b>                                                                                              | <b>6</b>  |
| Data/photo collection                                                                                                                   | 2         |
| Desktop Publishing                                                                                                                      | 4         |
|                                                                                                                                         |           |
| Total Days                                                                                                                              | 90        |

**Required Texts and Software** Corel Draw/Adobe, OnShape, Bambu Labs, Aspire/Vetric, AutoDesk FUSION, Vinyl Master, Laser, CNC, Vinyl Cutter, WoodShop tools and equipment

**Desired Results:**

**Essential Questions:**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

**Enduring Understandings:**

**Students will understand that...**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

**Knowledge:**

**Students will know...**

- Vocabulary: Technological and Engineering Literacy, STEAM

**Skills:**

**Students will be able to...**

- identify the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

**Standards:**

**Priority:**

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

**Supporting:**

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Fabrication 1, syllabus

Define STEAM as it relates to Fabrication

History of Manufacturing and Engineering

Fabrication examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession and manufacturing careers
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and tape measure

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.  
3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.  
3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.  
3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game,

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

### For Language Development:

- Presentation is available in native language when needed



Central Bucks School District – Course of Study – STEAM Fabrication 1  
Unit 3 – Conventional Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use drafting tools and hand tools using tutorials
- Vocabulary: pencil, paper, Radial Arm Saw, Jointer, Planer, Miter Saw, Steps to square a board

Skills:

Students will be able to learn about safety to safely use the machines and tools of the shop.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

#### **Acceptable Evidence:**

Performance Tasks – level 1 woodshop project, safety tests

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric, Common Safety Tests

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- using pencil/paper and approved tools and machines following all safety protocols to make a level 1 project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1  
Unit 4 – Digital and Robotic Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use a computer to design, modify and create raster to vector images to be used on an industrial robotic machine called a Computer Numerical Control machine using either subtractive or additive manufacturing, also known as Computer Aided Manufacturing- CAM
- Vocabulary: CAD, CAM, Vector, Raster, laser cut, vinyl cut, 3D print, CNC

Skills:

Students will be able to... use CAD/CAM tools to create a digitally made project and upload it to a robotic machine using a tutorial.

Standards:

Priority:

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.
- 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Digitally Created Fabrication Project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Aspire/Vetric, slicing, toolpath creation, Fusion, and CNC products to complete project
- Move from raster to vector creation

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1  
Unit 5 – STEAM Engineering and Fabrication Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know...

- how to use the Engineering Design and Problem Solving Loop to make STEAM Fabrication projects to solve a problem.
- Vocabulary: CAD, CAM, 3D slicing and printing, Vinyl Cutting, fabrication project planning, raster and vector

Skills:

Students will be able to use the tools and machines to make STEAM Fabrication projects.

Standards:

Priority:

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Product Design, Vinyl Sticker, 3D printer, CNC project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Fusion, and CNC products to complete project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 1  
Unit 6 – STEAM Fabrication Portfolio

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know...

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- N/A

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed



# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEAM Fabrication 1

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 9,10,11,12

### **Characterization of Course of Study:**

STEAM Fabrication 1 is an 18 Week introductory, project-based course designed to develop students' knowledge and skills in planning and making projects using manual and digital tools and machines. Through hands-on experiences using technical sketching techniques, measuring accurately, CAM, tools and machines, students explore ways to use their hands to build a nice, accurate and highly refined project while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

### **Reasons for Proposed Adoption:**

STEAM Fabrication 1 is a more modern version of our former Materials and Engineering (South and West) and Engineering (East). This course ensures vertical integration and continuation of middle school STEM concepts with a focus on technical sketching, CAM, fine project creation and measuring accurately using a tape measure within the material and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Fabrication 1. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Fabrication 2  
The Technology and Engineering Education Department

Course Number: 6462

Course Level: High School

Grade: 10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential**- Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning**- Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)**- Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important**- Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social**- Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools** - Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable**- All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective**- Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused**- Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential**- Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Fabrication 2

#### **Desired Results**

Course Description: Building on the foundations of STEAM Fabrication 1, 9 Weeks Exploring OR STEAM Fabrication 1, 18 Weeks, this course challenges students to take their fabrication and engineering skills to the next level. Students will engage in more complex projects that integrate advanced fabrication shop techniques in materials, higher level vector design and toolpath generation with small/ industrial robotics CNC machining, advanced slicing and 3D printing and more complex laser cutting/engraving while continuing to refine their use of hand tools and machines. Emphasis is placed on problem-solving, precision, and creative innovation as students move from guided activities to more independent, project-based work. The course encourages students to design, prototype, and produce original project solutions while preparing them for advanced study in engineering, design, and fabrication to become higher level technologically literate citizens. Students who complete STEAM Fabrication 2, 18 weeks with a C or better can take STEAM Fabrication 3.

Prerequisite: STEAM Fabrication 1 Exploring OR STEAM Fabrication 1

Committee Members: **Mick Marmor, Travis Jovais, Trent Errett, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Intermediate Fabrication Project

**Common Summative Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** Portfolio

**Common Summative Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90 Percent Summative, 10 Percent Formative



## STEAM Fabrication 2– Pacing Guide

| Content                                                                                                                                 | Days      |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1 – STEAM Fabrication 2</b>                                                                                                     | <b>2</b>  |
| Course Overview, Syllabus                                                                                                               | 1         |
| Career and College                                                                                                                      | 1         |
| <b>Unit 2 – Measuring</b>                                                                                                               | <b>2</b>  |
| Ruler                                                                                                                                   | 1         |
| Measurement Activities                                                                                                                  | 1         |
| <b>Unit 3 – Intermediate Conventional Fabrication Tools and Machines</b>                                                                | <b>10</b> |
| Machine and Tool Safety                                                                                                                 | 7         |
| Machine Tests                                                                                                                           | 3         |
| <b>Unit 4 – Intermediate Digital and Robotic Fabrication Tools and Machines</b>                                                         | <b>20</b> |
| Subtractive Manufacturing: CNC Router                                                                                                   | 4         |
| Subtractive Manufacturing: Laser Engraver                                                                                               | 4         |
| Subtractive Manufacturing: Vinyl Cutter                                                                                                 | 4         |
| Additive Manufacturing: 3D Printer                                                                                                      | 4         |
| CAD/CAM Software                                                                                                                        | 4         |
| <b>Unit 5- Intermediate STEAM Engineering and Fabrication Project Process</b>                                                           | <b>50</b> |
| Engineering Project Loop- Ongoing throughout course                                                                                     | #         |
| Plan- Sketching and designing, Reading drawings and specifications, selecting materials, creating Bill of Materials and cost estimating | 5         |
| Build- Material processing, cutting, assembling, and gluing                                                                             | 37        |
| Finish- Sanding, staining, painting, Clear Coat Finishing                                                                               | 5         |
| Evaluate                                                                                                                                | 3         |
| <b>Unit 6- STEAM Fabrication Portfolio</b>                                                                                              | <b>6</b>  |
| Data/photo collection                                                                                                                   | 2         |
| Desktop Publishing                                                                                                                      | 4         |
|                                                                                                                                         |           |
| Total Days                                                                                                                              | 90        |

**Required Texts and Software** Corel Draw/Adobe, OnShape, Bambu Labs, Aspire/Vetric, AutoDesk FUSION, Vinyl Master, Laser, CNC, Vinyl Cutter, WoodShop tools and equipment

Central Bucks School District – Course of Study – STEAM Fabrication 2  
Unit 1 – Introduction to STEAM Fabrication 2

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- identify the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Fabrication 2, syllabus

Define STEAM as it relates to Fabrication

Current Trends Manufacturing and Engineering

Intermediate Fabrication examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession and manufacturing careers
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 2  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and tape measure

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.  
3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.  
3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.  
3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

### For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 2  
Unit 3 – Intermediate Conventional Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use drafting tools and hand tools using tutorials
- Vocabulary: pencil, paper, Radial Arm Saw, Jointer, Planer, Miter Saw, Steps to square a board

Skills:

Students will be able to learn about safety to safely use the machines and tools of the shop.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

#### **Acceptable Evidence:**

Performance Tasks – intermediate fabrication project, safety tests

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric, Common Safety Tests

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- using pencil/paper and approved tools and machines following all safety protocols to make a level 1 project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 2  
Unit 4 – Intermediate Digital and Robotic Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use a computer to design, modify and create raster to vector images to be used on an industrial robotic machine called a Computer Numerical Control machine using either subtractive or additive manufacturing, also known as Computer Aided Manufacturing- CAM
- Vocabulary: CAD, CAM, Vector, Raster, laser cut, vinyl cut, 3D print, CNC

Skills:

Students will be able to... use CAD/CAM tools to create a digitally made project and upload it to a robotic machine using a tutorial.

Standards:

Priority:

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.
- 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.



Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Digitally Created Fabrication Project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Aspire/Vetric, slicing, toolpath creation, Fusion, and CNC products to complete project
- Move from raster to vector creation

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 2  
Unit 5 – Intermediate STEAM Engineering and Fabrication Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know...

- how to use the Engineering Design and Problem Solving Loop to make STEAM Fabrication projects to solve a problem.
- Vocabulary: CAD, CAM, 3D slicing and printing, Vinyl Cutting, fabrication project planning, raster and vector

Skills:

Students will be able to use the tools and machines to make STEAM Fabrication projects.

Standards:

Priority:

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Product Design, Vinyl Sticker, 3D printer, CNC project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Fusion, and CNC products to complete project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 2  
Unit 6 – Intermediate STEAM Fabrication Portfolio

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know...

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- N/A

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

# **CENTRAL BUCKS SCHOOL DISTRICT**

## **Course of Study Recommendation for Adoption**

**Course:** STEAM Fabrication 2

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 10,11,12

### **Characterization of Course of Study:**

STEAM Fabrication 2 is an 18 Week project-based course designed to continue students' knowledge and skills in planning and making projects using manual and digital tools and machines learned in STEAM Fabrication 1 Exploring OR STEAM Fabrication 1. Through hands-on experiences using technical sketching techniques, measuring accurately, CAM, tools and machines, students explore intermediate ways to use their hands to build a nice, accurate and highly refined project while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

### **Reasons for Proposed Adoption:**

STEAM Fabrication 2 is a more modern version of our former Materials and Engineering (South and West) and Engineering (East). This course ensures vertical integration and continuation of high school beginner level STEAM concepts with a focus on technical sketching, CAM, fine project creation and measuring accurately using a tape measure within the material and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Fabrication 2. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



STEAM Fabrication 3  
The Technology and Engineering Education Department

Course Number: 6463

Course Level: High School

Grade: 10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District  
20 Welden Drive  
Doylestown, PA 18901

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**Central Bucks School District  
Teaching and Learning Principles**

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)-** Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important-** Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social-** Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools -** Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective-** Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential-** Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

**Documents Considered:**

1. Experiential and Constructivist Learning
  - Bruner, J. (1966). *Toward a Theory of Instruction*. Harvard University Press.
  - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.
2. Design Thinking and Engineering Design
  - IDEO. (2012). *Design Thinking for Educators Toolkit*. IDEO.
  - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL)*. Washington, DC: National Academies Press.
3. Integrated STEAM Learning
  - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research*. National Academies Press.
  - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education*. In *PATT-19 Conference: Research on Technology Education*.
4. Creativity and Innovation in Education
  - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative*. Capstone Publishing.
  - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education*.
5. Collaborative and Social Learning
  - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. *Educational Researcher*, 38(5), 365–379.
  - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
  - ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL)*.
7. Equity and Cultural Relevance in STEAM
- Banks, J. A. (2008). *An Introduction to Multicultural Education*. Pearson Education.
  - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy*. *American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
- Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning*. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
  - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*. Jossey-Bass.
9. Learning Environments and Pedagogy
- Dewey, J. (1938). *Experience and Education*. Macmillan.
  - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. ASCD.
10. Reflection and Lifelong Learning
- Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning*. Routledge.
  - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

**Central Bucks School District**  
**Enduring Understandings**

**Students will understand that:**

**Applying, Maintaining, and Assessing Technological Products and Systems**

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

**Impacts of Technology**

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

**Influence of Society on Technological Development**

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

**Design in Technology and Engineering Education**

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

**Integration of Knowledge, Technologies, and Practices**

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

## **Central Bucks School District**

### **Essential Questions**

#### **Applying, maintaining, and assessing technological products and systems**

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

#### **Impacts of technology**

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

#### **Influence of society on technological development**

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

#### **Design in Technology and Engineering Education**

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

#### **Integration of knowledge, technologies, and practices**

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

## Central Bucks School District – Course of Study Overview

### STEAM Fabrication 3

#### **Desired Results**

Course Description: STEAM Fabrication 3 is the highest-level class students can take to conclude their high school project-based learning experience in fabrication and engineering knowledge. Opportunities include more independent and collaborative design, challenges and projects. Utilizing machines, tools and equipment in STEAM Fabrication 2, students will focus on advanced techniques, precision crafting, and application of creative engineering design and problem-solving processes. Emphasis is placed on designing and producing original, high-quality projects from concept through completion, with expectations to incorporate digital design, prototyping, small and industrial robotics and iterative improvement. STEAM Fabrication 3 encourages innovation, leadership, and portfolio-ready project development to prepare students for after school real world experiences in STEAM career and higher education pathways.

Prerequisite: STEAM Fabrication 2

Committee Members: **Mick Marmor, Travis Jovais, Trent Errett, Jon Taylor**

#### **Acceptable Evidence.**

**Common Summative Assessment 1 Title:** Advanced Fabrication Project

**Common Summative Assessment 1 Grading Criteria:** Common Engineering Rubric

**Common Summative Assessment 2 Title:** Portfolio

**Common Summative Assessment 2 Grading Criteria:** Common Portfolio Rubric

**Course Grading:** 90% Summative, 10% Formative

## STEAM Fabrication 3– Pacing Guide

| Content                                                                                                                                 | Days      |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1 – STEAM Fabrication 3</b>                                                                                                     | <b>2</b>  |
| Course Overview, Syllabus                                                                                                               | 1         |
| Career and College                                                                                                                      | 1         |
| <b>Unit 2 – Measuring</b>                                                                                                               | <b>2</b>  |
| Ruler                                                                                                                                   | 1         |
| Measurement Activities                                                                                                                  | 1         |
| <b>Unit 3 – Advanced Conventional Fabrication Tools and Machines</b>                                                                    | <b>10</b> |
| Machine and Tool Safety                                                                                                                 | 7         |
| Machine Tests                                                                                                                           | 3         |
| <b>Unit 4 -Advanced Digital and Robotic Fabrication Tools and Machines</b>                                                              | <b>20</b> |
| Subtractive Manufacturing: CNC Router                                                                                                   | 4         |
| Subtractive Manufacturing: Laser Engraver                                                                                               | 4         |
| Subtractive Manufacturing: Vinyl Cutter                                                                                                 | 4         |
| Additive Manufacturing: 3D Printer                                                                                                      | 4         |
| CAD/CAM Software                                                                                                                        | 4         |
| <b>Unit 5- Advanced STEAM Engineering and Fabrication Project Process</b>                                                               | <b>50</b> |
| Engineering Project Loop- Ongoing throughout course                                                                                     | #         |
| Plan- Sketching and designing, Reading drawings and specifications, selecting materials, creating Bill of Materials and cost estimating | 5         |
| Build- Material processing, cutting, assembling, and gluing                                                                             | 37        |
| Finish- Sanding, staining, painting, Clear Coat Finishing                                                                               | 5         |
| Evaluate                                                                                                                                | 3         |
| <b>Unit 6- STEAM Fabrication Portfolio</b>                                                                                              | <b>6</b>  |
| Data/photo collection                                                                                                                   | 2         |
| Desktop Publishing                                                                                                                      | 4         |
|                                                                                                                                         |           |
| Total Days                                                                                                                              | 90        |

**Required Texts and Software** Corel Draw/Adobe, OnShape, Bambu Labs, Aspire/Vetric, AutoDesk FUSION, Vinyl Master, Laser, CNC, Vinyl Cutter, WoodShop tools and equipment

Central Bucks School District – Course of Study – STEAM Fabrication 3  
Unit 1 – Introduction to STEAM Fabrication 3

**Desired Results:**

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know...

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to...

- identify the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.

3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

#### **Acceptable Evidence:**

Performance Tasks – Introduce course, excite students about STEAM Fabrication 1, syllabus

Define STEAM as it relates to Fabrication

Future Trends in Manufacturing and Engineering

Advanced Fabrication examples

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- learn about the engineering profession and manufacturing careers
- learn about owning your own business
- define STEAM

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed



Central Bucks School District – Course of Study – STEAM Fabrication 3  
Unit 2 – Measuring

**Desired Results:**

Essential Questions:

- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:

Students will understand that...

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:

Students will know...

- Vocabulary: English and Metric measuring systems

Skills:

Students will be able to measure accurately using a ruler and tape measure

Standards:

Priority:

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.  
3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.  
3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.  
3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:

3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

**Acceptable Evidence:**

Performance Tasks – satisfactory score on ruler game

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

## **Suggested Learning Experiences and Instruction**

### Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

### Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

### Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

### For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 3  
Unit 3 – Advanced Conventional Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use drafting tools and hand tools using tutorials
- Vocabulary: pencil, paper, Radial Arm Saw, Jointer, Planer, Miter Saw, Steps to square a board

Skills:

Students will be able to learn about safety to safely use the machines and tools of the shop.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

#### **Acceptable Evidence:**

Performance Tasks – Advanced fabrication project, safety tests

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric, Common Safety Tests

#### **Suggested Learning Experiences and Instruction**

Learning Experiences:

- using pencil/paper and approved tools and machines following all safety protocols to make a level 1 project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 3  
Unit 4 – Advanced Digital and Robotic Fabrication Tools and Machines

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that...

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know...

- how to use a computer to design, modify and create raster to vector images to be used on an industrial robotic machine called a Computer Numerical Control machine using either subtractive or additive manufacturing, also known as Computer Aided Manufacturing- CAM
- Vocabulary: CAD, CAM, Vector, Raster, laser cut, vinyl cut, 3D print, CNC

Skills:

Students will be able to... use CAD/CAM tools to create a digitally made project and upload it to a robotic machine using a tutorial.

Standards:

Priority:

- 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
- 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
- 3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.
- 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Digitally Created Advanced Fabrication Project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Aspire/Vetric, slicing, toolpath creation, Fusion, and CNC products to complete project
- Move from raster to vector creation

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Central Bucks School District – Course of Study – STEAM Fabrication 3  
Unit 5 – Advanced STEAM Engineering and Fabrication Project Process

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that...

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know...

- how to use the Engineering Design and Problem Solving Loop to make STEAM Fabrication projects to solve a problem.
- Vocabulary: CAD, CAM, 3D slicing and printing, Vinyl Cutting, fabrication project planning, raster and vector

Skills:

Students will be able to use the tools and machines to make STEAM Fabrication projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

**Acceptable Evidence:**

Performance Tasks – Product Design, Vinyl Sticker, 3D printer, CNC project

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Fusion, and CNC products to complete project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed



Central Bucks School District – Course of Study – STEAM Fabrication 3  
Unit 6 – Advanced STEAM Fabrication Portfolio

**Desired Results:**

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that...

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know...

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

**Acceptable Evidence:**

Performance Tasks – Engineers' Notebook/Portfolio

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- N/A

Summative Assessment- Project Portfolio Rubric

**Suggested Learning Experiences and Instruction**

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

**CENTRAL BUCKS SCHOOL DISTRICT**  
**Course of Study**  
**Recommendation for Adoption**

**Course:** STEAM Fabrication 3

**Date:** 08-06-2026

**Student Level:** High School

**Grade Level:** Grade 10,11,12

**Characterization of Course of Study:**

STEAM Fabrication 3 is an 18 Week project-based course designed to continue students' knowledge and skills in planning and making projects using manual and digital tools and machines learned in STEAM Fabrication 2. Through hands-on experiences using technical sketching techniques, measuring accurately, CAM, tools and machines, students explore advanced ways to use their hands to build a nice, accurate and highly refined project while developing their problem-solving abilities.

Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges. The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.

**Reasons for Proposed Adoption:**

STEAM Fabrication 3 is a more modern version of our former Materials and Engineering (South and West) and Engineering (East). This course ensures vertical integration and continuation of high school level 2 STEAM concepts with a focus on technical sketching, CAM, fine project creation and measuring accurately using a tape measure within the material and engineering world. PA STEELS standards are included and were used to guide the development of STEAM Fabrication 3. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.

Principal Approval Date: \_\_\_\_\_

Curriculum Committee Approval Date: \_\_\_\_\_

School Board Approval Date: \_\_\_\_\_



# **Technology and Engineering Education Department**

## **STEM MS and STEAM HS Updates**

**Aug. 06, 2026**

# Introductions



**Jon Taylor**

Tech Eng Ed Coordinator



# Goal of Presentation



**COS Updates**



**15 Min**

# Agenda



**Background**



**Course/Curriculum Overview**



**Next Steps**

# Background



| Late 19 <sup>th</sup><br>Century | Early 20 <sup>th</sup><br>Century | Late 20 <sup>th</sup><br>Century | Early 21 <sup>st</sup><br>Century                       | →Current                                            |
|----------------------------------|-----------------------------------|----------------------------------|---------------------------------------------------------|-----------------------------------------------------|
| <b>Manual<br/>Training</b>       | <b>Industrial<br/>Arts</b>        | <b>Technology<br/>Education</b>  | <b>Technology<br/>and<br/>Engineering<br/>Education</b> | <b>STEM,<br/>STEAM,<br/>Maker, CTE,<br/>FAB LAB</b> |





# Middle School STEM COS

| Grade | 2025 - 2026                | 2026 - 2027 | 2026 – 2027 Units                                                                                                                                                                                                                                    | 2026 – 2027 Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|----------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6     | QUEST Grade 6              | STEM 6      | <ol style="list-style-type: none"><li>1. Introducing STEM Design Skills</li><li>2. STEM Engineering Design Process</li><li>3. Mission Manufacturing</li><li>4. Introduction to Robotics</li></ol>                                                    | <p>STEM 6 is a rebranding of our QUEST Grade 6 course for a middle school format to ensure vertical integration and continuation of elementary school STEM concepts. STEM 6, 7, and 8 provide an opportunity for students to develop their skills from a beginner, to intermediate, to advanced middle school level. This project-based course is designed to strengthen technological literacy while developing the problem-solving, collaboration, and innovation skills necessary for success in an increasingly technological world.</p> <ul style="list-style-type: none"><li>• Technical design and drawing skills are introduced using drafting tools and CAD</li><li>• Open and closed ended design and engineering challenges are included using prototyping tools 3D printers, vinyl cutters and laser engravers.</li><li>• Safety, hand tools and small machines are introduced using the woodshop.</li><li>• Robotics is explored as we teach students to navigate our modern world.</li></ul> |
| 7     | Foundations of Engineering | STEM 7      | <ol style="list-style-type: none"><li>1. Introducing STEM Design Skills</li><li>2. STEM Engineering Design Process</li><li>3. Concept to Creation</li><li>4. The Power of Digital Design</li><li>5. Automate and Innovate: Robotics Coding</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 8     | Principles of Engineering  | STEM 8      | <ol style="list-style-type: none"><li>1. Introducing STEM Design Skills</li><li>2. STEM Engineering Design Process</li><li>3. Concept to Creation</li><li>4. The Power of Digital Design</li><li>5. Automate and Innovate: Robotics Coding</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



# High School STEAM Robotics COS

| Grade | 2025 - 2026                                                        | 2026 - 2027                        | 2026 – 2027 Units                                                                                                                                                                                                                                                                                  | 2026 – 2027 Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------|--------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HS    | Physical Computing Robotics 1 and Physical Computing Robotics C+ + | STEAM Robotics 1, STEAM Robotics 2 | <ol style="list-style-type: none"><li>1. Introduction to STEAM Robotics</li><li>2. Measuring, CAD and 3D Print</li><li>3. Robotics Kit Components Overview</li><li>4. Robotics Kit Methods</li><li>5. STEAM Engineering and Robotics Project Process</li><li>6. STEAM Robotics Portfolio</li></ol> | <p>STEAM Robotics 1 and STEAM Robotics 2 are the final versions of our Robotics courses piloted as Physical Computing Robotics 1 and Physical Computing Robotics C++.</p> <ul style="list-style-type: none"><li>• A project-based course designed to develop students' knowledge and skills in robotics, engineering design, physical computing, and digital fabrication.</li><li>• Students explore the principles of mechanical design, electronics, automation, and problem-solving through hands-on experiences using Turn-Key Robotics systems, microcontrollers, (CAD), and 3D printing technologies.</li><li>• The course emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.</li><li>• Courses focus on all aspects of Robotics, physical computing, electronics, measurement, structure/motion/control and are located in a traditional classroom.</li></ul> |



# High School STEAM Design COS

| Grade | 2025 - 2026                                                                                                                                                                                                                                                                      | 2026 - 2027                                                              | 2026 – 2027 Units                                                                                                                                                                                                                                                                                                                                                                                        | 2026 – 2027 Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HS    | Exploring Engineering and Architecture, Engineering and Architecture 1, Engineering and Architecture 2, Engineering and Architecture 3 (CB South and CB West), Exploratory Architecture Design, Architectural Design 1, Architectural Design 2, Architectural Design 3 (CB East) | STEAM Design 1 Exploring, STEAM Design 1, STEAM Design 2, STEAM Design 3 | <ol style="list-style-type: none"><li>1. Introducing STEAM Design</li><li>2. Measuring</li><li>3. Conventional Design Tools and Modeling Methods</li><li>4. Digital and Machine Design tools and Modeling Methods (Exploring) or Digital and Robotic Design Tools and Modeling Methods (level 1 – 3)</li><li>5. STEAM Engineering and Design Project Process</li><li>6. STEAM Design Portfolio</li></ol> | <p>STEAM Design 1 Exploring, STEAM Design 1, STEAM Design 2, and STEAM Design 3 are a more modern version of our former Engineering and Architecture (South and West) and Architectural Design (East) courses.</p> <ul style="list-style-type: none"><li>• These are project-based courses designed to develop students' knowledge and skills in architectural design, engineering design, CAD, and model building</li><li>• Students explore residential and mechanical design while developing their problem-solving abilities through hands-on experiences using technical sketching techniques, measuring using a scale, CAD, physical and digital modelling technologies,.</li><li>• Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges.</li></ul> |



# High School STEAM Fabrication COS

| Grade | 2025 - 2026                                                                                                                                                                | 2026 - 2027                                                                                  | 2026 – 2027 Units                                                                                                                                                                                                                                                | 2026 – 2027 Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HS    | Exploratory Materials Engineering, Materials Engineering 1, Materials Engineering 2, Materials Engineering 3 (CB South and CB West) Engineering 1, Engineering 2 (CB East) | STEAM Fabrication 1 Exploring, STEAM Fabrication 1, STEAM Fabrication 2, STEAM Fabrication 3 | <ol style="list-style-type: none"><li>1. Introducing STEAM Fabrication</li><li>2. Measuring</li><li>3. Conventional Fabrication Tools and Machines</li><li>4. STEAM Engineering and Fabrication Project Process</li><li>5. STEAM Fabrication Portfolio</li></ol> | <p>STEAM Fabrication 1 Exploring, STEAM Fabrication 1, STEAM Fabrication 2, and STEAM Fabrication 3 are a more modern version of our former Materials and Engineering (South and West) and Engineering (East) level high school courses.</p> <ul style="list-style-type: none"><li>• These course ensures vertical integration and continuation of middle school STEM concepts with a focus on technical sketching, CAM, fine project creation and measuring accurately using a tape measure within the material and engineering world.</li><li>• Focus on Materials and Engineering, CAM, measurement, real-building, project-based, located in a Wood Lab</li><li>• Students engage in the engineering design process to design, build, program, test, and improve design systems that solve authentic challenges.</li><li>• These courses emphasizes creativity, innovation, collaboration, and critical thinking while introducing industry-relevant technologies and career pathways in engineering, manufacturing, automation, and computer science.</li></ul> |



# Next Steps



**Requesting Approval of All Courses**

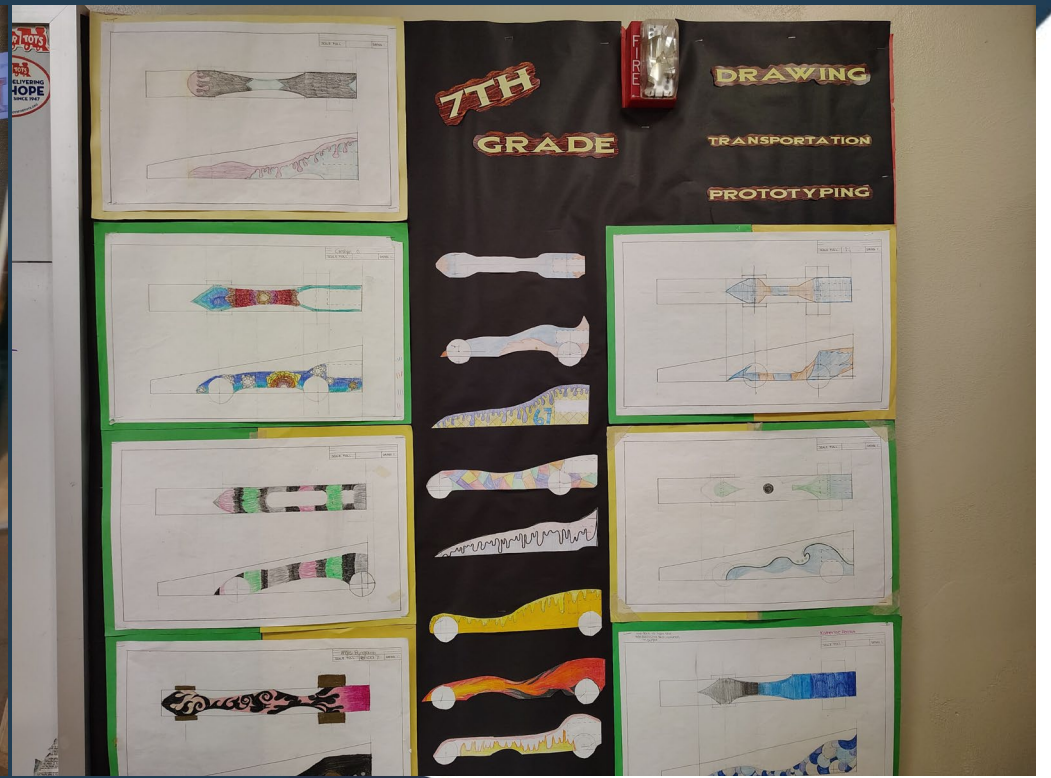
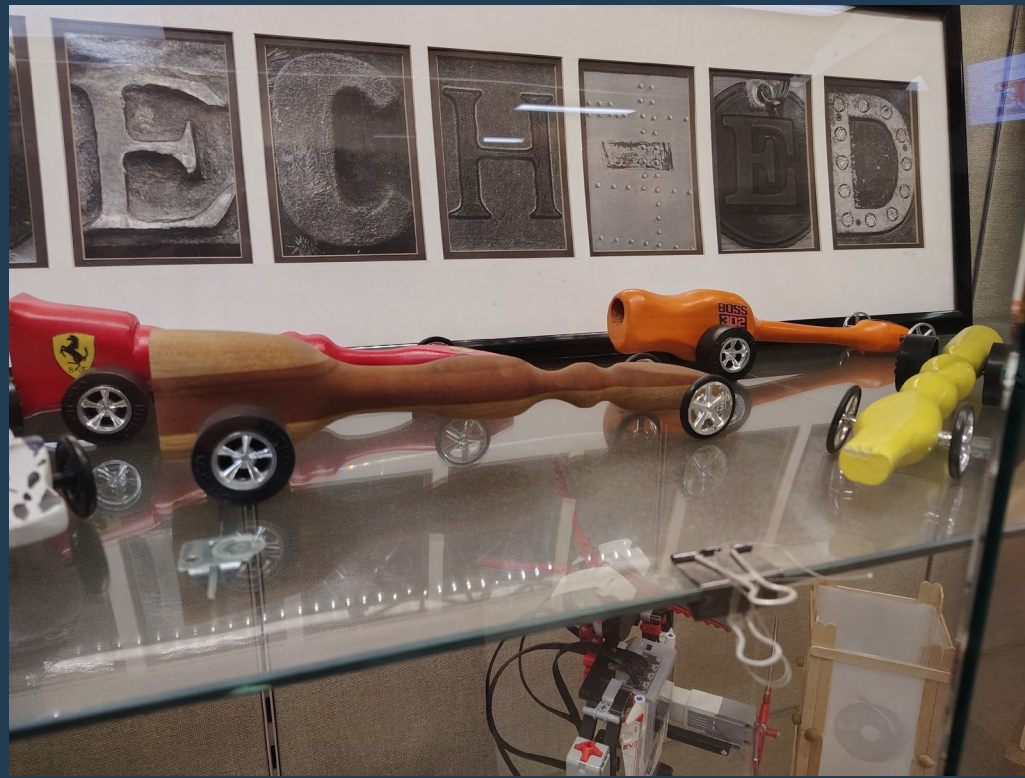


**Continue Professional Learning Opportunities**



**Monitor Implementation and Make Adjustments as Needed**





# Thank you!

Aug. 06, 2026

# **MTSS Management Programs**

**August 6, 2026**

# Introductions



**Cassie Oshinsky**

MTSS Supervisor



# Goal of Presentation



- Seeking approval to **pilot Branching Minds & Infinite Campus MTSS tool**, digital platforms to help to manage MTSS intervention plans and data.



10 minutes

# Agenda



**Background**



**Timeline**



**Branching Minds & Infinite Campus**



**Budget and Next Steps**

# Background & Rationale



- A key component of MTSS is the development of intervention plans and the implementation of data-driven instructional decisions.
- Act 47 of 2025 requires literacy/reading intervention plans for students by the year 2027.



# Background & Rationale Continued

## Essential Components of MTSS



Screening



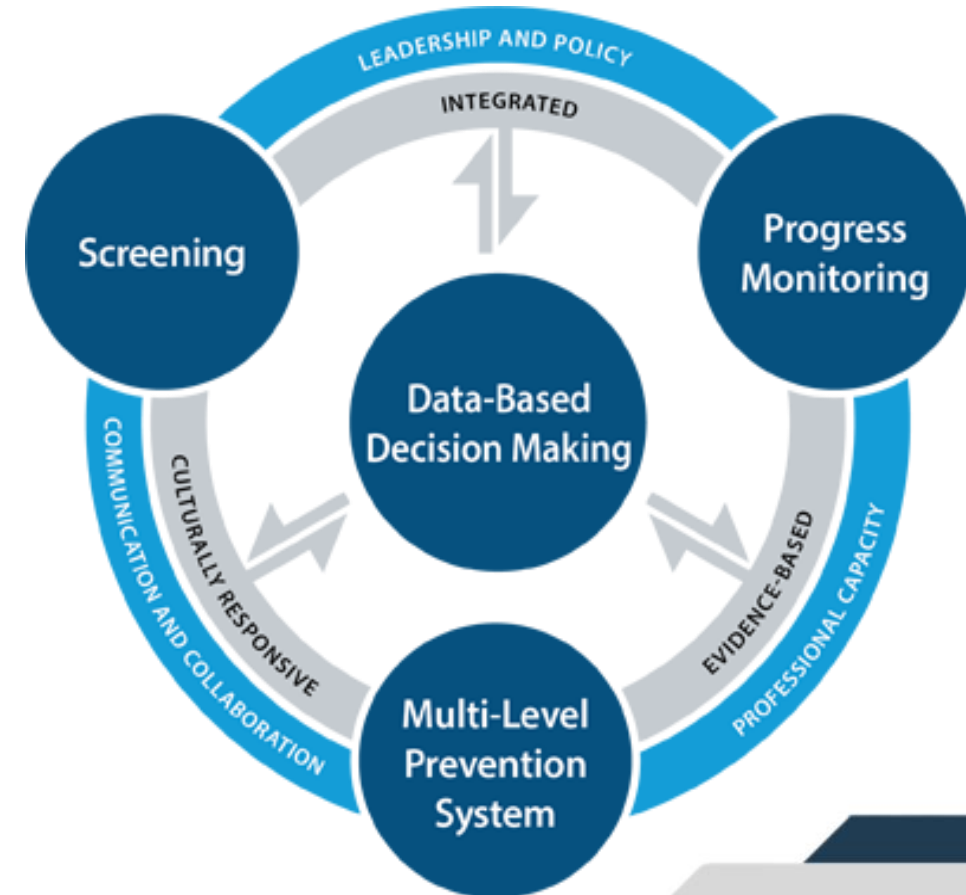
Multi-Level Prevention System



Progress Monitoring



Data-Based Decision Making



# Timeline

## **September-December 2025**

Began evaluating data systems within MTSS with the District MTSS Leadership Team.

## **March 2026**

MTSS Leadership Team determined need for intervention management tool through goal setting and data planning.

## **August 2026**

Recommendation to pilot Branching Minds & Infinite Campus MTSS Tool in 6 buildings within the district during the 26-27 SY.

## **January 2026**

Completed Tools Inventory to evaluate degree to which we are using our current tools to support MTSS.

## **April-June 2026**

CARE-I report recommendation of automating processes supported review of multiple MTSS solution tools. Team completed rubric to evaluate programs abilities to meet CB need.

# Overview

## MTSS Management Pilot



Branching Minds



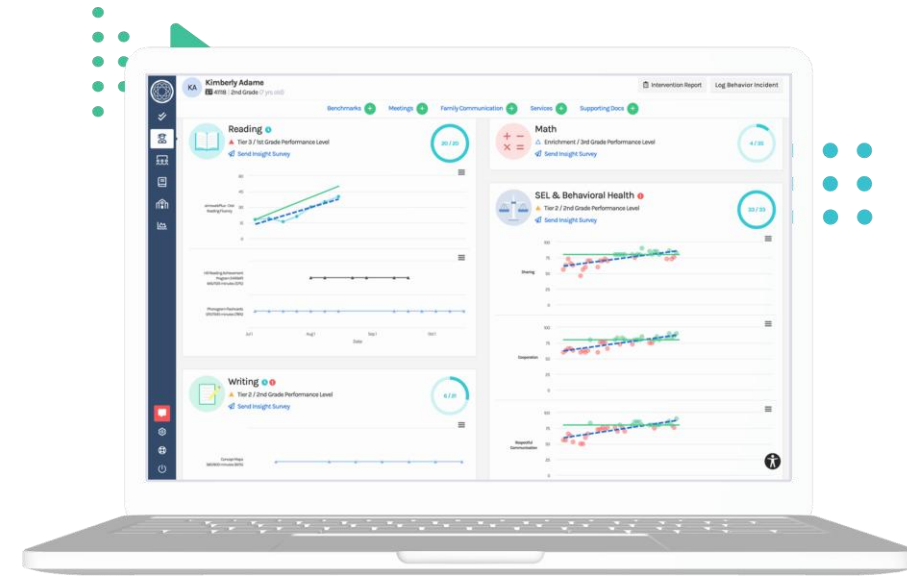
Infinite Campus

# Branching Minds



**Brings together academic, behavior, and attendance data with intervention planning in one space.**

- Automatic and manual data integrations.
- Creation & historical maintenance of intervention plans.
- Customizable to fit district needs.
- Workflow solution to support teachers and administrators.



# Branching Minds Cont.

- Access to create intervention plans with all necessary components.
- Reduces manual entry of data into spreadsheets.
- Visualization of progress monitoring scores to support data-based decision making.
- Maintains data over time to identify trends and areas of need.
- Provides automatic MTSS data analysis.
- Ability to evaluate holistic MTSS data as a district.

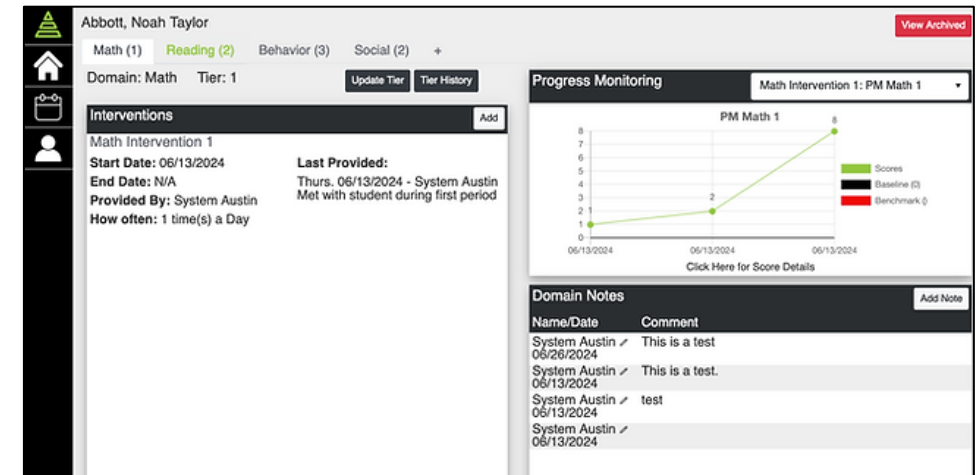


# Infinite Campus



**A whole-student framework built into the Infinite Campus student information system to track screening, monitor progress, and manage academic, behavior, and attendance interventions.**

- Full integration with Infinite Campus.
- Customizable settings and options.
- MTSS dashboard used to initiate an MTSS entry for a student.
- Add customizable domains and interventions.
- Staff dashboard to allow staff to easily view students to access MTSS details, domains, interventions, and monitor progress.
- Intervention dashboard to filter and view all interventions by student.
- Report options are available and being added.



# Infinite Campus Cont.



- Explored previously and improvements have been made.
- Expansion of current Student Information System (SIS).
- Access to create intervention plans with necessary components.
- Reduces manual entry of data into spreadsheets.
- Visualization of progress monitoring scores to support data-based decision making.
- Maintains data over time to identify trends and areas of need.

# Budget – Pilot Cost

| Program                                                                                                                                                                                                                                     | Cost                                            | Resources Included                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>Branching Minds Pilot</i></p> <p>3 Buildings:</p> <ul style="list-style-type: none"> <li>• Barclay</li> <li>• Buckingham</li> <li>• Kutz</li> </ul>  | <p>\$13,850<br/>(after PDE grant allotment)</p> | <ul style="list-style-type: none"> <li>• Branching Minds platform licenses for teachers, staff, and administrators</li> <li>• Success Package – Customer Success Team, Data Implementation Specialist, Data integration, Data extraction</li> <li>• Professional Development – 2 virtual sessions and asynchronous on-demand professional learning</li> </ul> |
| <p><i>Infinite Campus Pilot</i></p> <p>2 Buildings:</p> <ul style="list-style-type: none"> <li>• Bridge Valley</li> <li>• Jamison</li> </ul>             | <p>\$0<br/>(Included with our IC Bundle)</p>    | <ul style="list-style-type: none"> <li>• All staff can access the MTSS platform</li> <li>• Staff dashboard to allow staff to easily view students to access MTSS details, domains, interventions, and monitor progress.</li> <li>• Professional Development – Initial set-up with the vendor and ongoing training.</li> </ul>                                 |

# Budget – Recurring Cost

| Program                                                                                                       | Cost                                        |
|---------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <i>Branching Minds</i><br>   | \$73,000-\$104,000                          |
| <i>Infinite Campus</i><br> | \$25,000 for MTSS<br>\$25,000 for Spotlight |

# Next Steps



**September 2026:** Training MTSS Teams & Data Integration



**Spring 2027:** Review feedback with MTSS Leadership Team to determine next steps