Bermudian Springs Pennsylvania Core'Uwcpf ct f u
Math Framework
Grade 7 Math

Introduction

Bermudian Springs School District, in partnership with all stakeholders, recognizes the importance of our students being able to use mathematics in everyday life and in the workplace. New knowledge, tools, and ways of solving math problems will significantly enhance opportunities for shaping our students future. Math competencies open doors to productive futures. All students should have the opportunity and support necessary to learn significant math with depth and understanding. Pennsylvania Core Standards has provided critical areas designed to bring focus to the standards at each grade by describing key concepts in order to guide instruction. The critical areas for instructional focus for seventh grade math outlined by the *Common Core* include the following four areas:

1. **Developing understanding of and applying proportional relationships.** Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

2. **Developing understanding of operations with rational numbers and working with expressions and linear equations.** Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

3. **Solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume;** Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

4. **Drawing inferences about populations based on samples.** Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Adapted from: commoncore.org, 2013; parcconline.org, 2013; pdesas.org, 2013
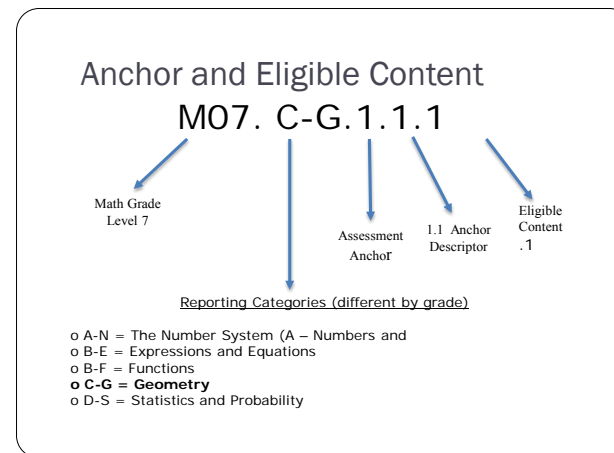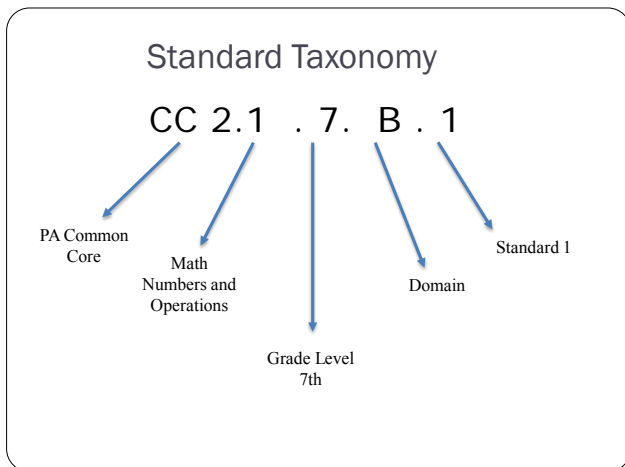
Standards for Mathematical Practice in Seventh Grade

Bermudian Springs School District incorporated the following Mathematical Practices which are expected to be integrated into every mathematics lesson for all students as outlined in the Pennsylvania Core Standards. Below are a few examples of how these mathematical practices may be integrated into some tasks that Bermudian students will apply in seventh grade.

Standards for Mathematical Practice	Explanations and Examples
1. Make sense of problems and persevere in solving them.	In grade 7, students solve problems involving ratios and rates and discuss how they solved the problems. Students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"
2. Reason abstractly and quantitatively.	In grade 7, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
3. Construct viable arguments and critique the reasoning of others.	In grade 7, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). The students further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?" They explain their thinking to others and respond to others' thinking.
4. Model with mathematics.	In grade 7, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students explore covariance and represent two quantities simultaneously. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences, make comparisons and formulate predictions. Students use experiments or simulations to generate data sets and create probability models. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to any problem's context.
5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 7 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Students might use physical objects or applets to generate

	probability data and use graphing calculators or spreadsheets to manage and represent data in different forms.
6. Attend to precision.	In grade 7, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students define variables, specify units of measure, and label axes accurately. Students use appropriate terminology when referring to rates, ratios, probability models, geometric figures, data displays, and components of expressions, equations or inequalities.
7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables making connections between the constant of proportionality in a table with the slope of a graph. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 3 (2 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality), c=6 by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving scale drawings, surface area, and volume. Students examine tree diagrams or systematic lists to determine the sample space for compound events and verify that they have listed all possibilities.
8. Look for and express regularity in repeated reasoning.	In grade 7, students use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, they may notice that $a/b \div c/d = ad/bc$ and construct other examples and models that confirm their generalization. They extend their thinking to include complex fractions and rational numbers. Students formally begin to make connections between covariance, rates, and representations showing the relationships between quantities. They create, explain, evaluate, and modify probability models to describe simple and compound events.

Mathematical Standards: Development and Progression

	Pre K	K	1	2	3	4	5	6	7	8	HS
2.1 Numbers and Operations	(A) Counting & Cardinality	(A) Counting & Cardinality									
		(B) Number and Operations in Base Ten	(B) Number and Operations in Base Ten	(B) Number and Operations in Base Ten	(B) Number and Operations in Base Ten	(B) Number and Operations in Base Ten	(B) Number and Operations in Base Ten	(D) Ratios and Proportional Relationships			(F) Number and Quantity
					(C) Number and Operations - Fractions	(C) Number and Operations - Fractions	(C) Number and Operations - Fractions	(E) The Number System	(E) The Number System	(E) The Number System	
2.2 Algebraic Concepts		(A) Operations and Algebraic Thinking	(A) Operations and Algebraic Thinking	(A) Operations and Algebraic Thinking	(A) Operations and Algebraic Thinking	(A) Operations and Algebraic Thinking	(A) Operations and Algebraic Thinking	(B) Expressions and Equations	(B) Expressions and Equations	(B) Expressions and Equations	(D) Algebra
										(C) Functions	(C) Functions
2.3 Geometry		(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry	(A) Geometry
2.4 Measurement, Data and Probability		(A) Measurement and Data	(A) Measurement and Data	(A) Measurement and Data	(A) Measurement and Data	(A) Measurement and Data	(A) Measurement and Data	(B) Statistics and Probability	(B) Statistics and Probability	(B) Statistics and Probability	(B) Statistics and Probability

Standard Taxonomy
CC 2.1 . 7. B . 1

PA Common Core

Math Numbers and Operations

Grade Level 7th

Domain

Standard 1

Anchor and Eligible Content
M07. C-G.1.1.1

Math Grade Level 7

Assessment Anchor

1.1 Anchor Descriptor

Eligible Content .1

Reporting Categories (different by grade)
- o A-N = The Number System (A – Numbers and
- o B-E = Expressions and Equations
- o B-F = Functions
- **o C-G = Geometry**
- o D-S = Statistics and Probability

2.1 Number and Operations

Domain: (D) Ratios & Proportional Relationships

Standard: CC.2.1.7.D.1 Analyze proportional relationships and use them to model and solve real-world and mathematical problems.

Assessment Anchor: M07.A-R.1.1 Analyze, recognize, and represent proportional relationships and use them to solve real-world and mathematical problems.

- **M07.A-R.1.1.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *Example: If a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2 / 1/4 miles per hour, equivalently 2 miles per hour*
- **M07.A-R.1.1.2** Determine whether two quantities are proportionally related (e.g., by testing for equivalent ratios in a table, or graphing on a coordinate plane and observing whether the graph is a straight line through the origin).
- **M07.A-R.1.1.3** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships
- **M07.A-R.1.1.4** Represent proportional relationships by equations *Example: If total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = p*
- **M07.A-R.1.1.5** Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate
- **M07.A-R.1.1.6** Use proportional relationships to solve multi-step ratio and percent problems *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease*

Key Concepts	Key Vocabulary
- Unit Rates - proportionality - percents	unit rate, proportional, constant of proportionality, equations (direct variation), coordinate plane, ratio, percent (related to fractions, decimals), circle graphs, simple interest, tax, markup, markdown, tips, fee, percent increase, percent decrease

Competencies
Describe what students should be able to do (key skills) as a result of this instruction

- Determine unit rates in real world situations
- Use proportions to make predictions
- Calculate total cost of a grocery bill or dinner out
- Calculate population changes
- Calculate the height of a structure using similar triangles
- Interpret percents and fractions from a circle graph

2.1 Number and Operations
Domain: (E) The Number System
Standard: CC.2.1.7.E.1 Apply and extend previous understandings of operations with fractions to operations with rational numbers
Assessment Anchor: M07.A-N.1.1 Solve real-world and mathematical problems involving the four operations with rational numbers. • **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 repeats

Key Concepts	Key Vocabulary
• Integers – add, subtract, multiply, divide; • Rational Numbers – add, subtract, multiply, divide	Number line, integer, order of operations, rational number, terminating decimal, repeating decimal, reciprocal
Competencies *Describe what students should be able to do (key skills) as a result of this instruction*	
• Solve problems using four operations • Represent word problems using the four operations (and any combination of them)	

2.2 Algebraic Concepts
Domain: (B) Expressions and Equations
Standard: CC.2.2.7.B.1 Apply properties of operations to generate equivalent expressions.
Assessment Anchor: M07.B-E.1.1 Use properties of operations to generate equivalent expressions. • **M07.B-E.1.1.1** Apply properties of operations to add, subtract, factor, and expand linear expressions with rational coefficients. *Example 1: The expression 1/2 • (x + 6) is equivalent to 1/2 • x + 3. Example 2: The expression 5.3 – y + 4.2 is equivalent to 9.5 – y (or – y + 9.5). Example 3: The expression 4w – 10 is equivalent to 2(2w – 5).*
Standard: CC.2.2.7.B.3 Model and solve real- world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.
Assessment Anchor: M07.B-E.2.1 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers. • **M07.B-E.2.1.1** Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate. *Example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50 (or 1.1 × $25 = $27.50).*
Assessment Anchor: M07.B-E.2.2 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems. • **M07.B-E.2.2.1** Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. *Example: The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* • **M07.B-E.2.2.2** Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers, and graph the solution set of the inequality. E*xample: A salesperson is paid $50 per week plus $3 per sale. This week she wants her pay to be at least $100. Write an inequality for the number of sales the salesperson needs to make, and describe the solutions*
Assessment Anchor: M07.B-E.2.3 Determine the reasonableness of the answer(s) in problem-solving situations. • **M07.B-E.2.3.1** Determine the reasonableness of an answer(s), or interpret the solution(s) in the context of the problem. *Example: If you want to place a towel bar that is 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation*

Key Concepts	**Key Vocabulary**
• Simplifying expressions • Solving equations • Solving inequalities	equivalent expressions, distributive property, combining like terms, coefficient, constant, like terms, one-step equation, two-step equation, multi-step equation, solution, sense, inequality, one-step inequality, two-step inequality

Competencies *Describe what students should be able to do (key skills) as a result of this instruction*

- Use distribution and combining like terms to accurately simplify algebraic expressions
- Use equations and inequalities to represent real-world situations
- Solve equations based on real-world situations
- Solve inequalities based on real-world situations

2.3 Geometry

Domain: (A) Geometry

Standard: CC.2.3.7.A.1 Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume.

Assessment Anchor: M07.C-G.2.1 Identify, use and describe properties of angles and their measures.
- **M07.C-G.2.1.1** Identify and use properties of supplementary, complementary, and adjacent angles in a multistep problem to write and solve simple equations for an unknown angle in a figure
- **M07.C-G.2.1.2** Identify and use properties of angles formed when two parallel lines are cut by a transversal (e.g., angles may include alternate interior, alternate exterior, vertical, corresponding).

Assessment Anchor: M07.C-G.2.2 Determine circumference, area, surface area, and volume.
- **M07.C-G.2.2.1** Find the area and circumference of a circle. Solve problems involving area and circumference of a circle(s). **Formulas will be provided**
- **M07.C-G.2.2.2** Solve real-world and mathematical problems involving area, volume, and surface area of two-and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. **Formulas will be provided**

Standard: CC.2.3.7.A.2 Visualize and represent geometric figures and describe the relationships between them.

Assessment Anchor: M07.C-G.1.1 Describe and apply properties of geometric figures.
- **M07.C-G.1.1.1** Solve problems involving scale drawings of geometric figures, including finding length and area.
- **M07.C-G.1.1.2** Identify or describe the properties of all types of triangles based on angle and side measure
- **M07.C-G.1.1.3** Use and apply the triangle inequality theorem
- **M07.C-G.1.1.4** Describe the two-dimensional figures that result from slicing three-dimensional figures

Key Concepts	Key Vocabulary
- Angle measures - Two- and three-dimensional objects - Triangles	supplementary, complimentary, adjacent, parallel lines, transversal, alternate interior, alternate exterior, vertical, corresponding, cross-section, area, circumference, volume, surface area, quadrilateral, polygon, right prism, properties, triangle, inequality theorem

Competencies
Describe what students should be able to do (key skills) as a result of this instruction

- Identify the relationship between different angle measures
- Calculate angle measures given enough appropriate information
- Use formulas to calculate area, volume, and surface area
- Relate triangles

2.4 Measurement, Data and Probability
Domain: (B) Statistics and Probability
Standard: CC.2.4.7.B.1 Draw inferences about populations based on random sampling concepts.
Assessment Anchor: M07.C-G.2.2 Determine circumference, area, surface area, and volume. • **M07.D-S.1.1.1** Determine whether a sample is a random sample given a real-world situation • **M07.D-S.1.1.2** Use data from a random sample to draw inferences about a population with an unknown characteristic of interest *Example 1: Estimate the mean word length in a book by randomly sampling words from the book Example 2: Predict the winner of a school election based on randomly sampled survey data.*
Standard: CC.2.4.7.B.2 Draw informal comparative inferences about two populations.
Assessment Anchor: M07.D-S.2.1 Use statistical measures to compare two numerical data distributions. • **M07.D-S.2.1.1** Compare two numerical data distributions using measures of center and variability. *Example 1: The mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team. This difference is equal to approximately twice the variability (mean absolute deviation) on either team. On a line plot, note the difference between the two distributions of heights. Example 2: Decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book*
Standard: CC.2.4.7.B.3 Investigate chance processes and develop, use, and evaluate probability models.
Assessment Anchor: M07.D-S.3.1 Predict or determine the likelihood of outcomes. • **M07.D-S.3.1.1** Predict or determine whether some outcomes are certain, more likely, less likely, equally likely, or impossible. (i.e., a probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event)
Assessment Anchor: M07.D-S.3.2 Use probability to predict outcomes. • **M07.D-S.3.2.1** Determine the probability of a chance event given relative frequency. Predict the approximate relative frequency given the probability. *Example: When rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times* • **M07.D-S.3.2.2** Find the probability of a simple event, including the probability of a simple event **not** occurring. *Example: What is the probability of **not** rolling a 1 on a number cube?* • **M07.D-S.3.2.3** Find probabilities of independent compound events using organized lists, tables, tree diagrams, and simulation.

Key Concepts	Key Vocabulary
• Sampling • Measures of central tendency and dispersion • Probability	Random, stratified, systematic, mean, median, mode, range, absolute deviation, (line plot, stem-and-leaf warm-ups), spectrum, predictions, simple events (not), compound events, independent events, (dependent events to help out Alg 1A?)

Competencies
Describe what students should be able to do (key skills) as a result of this instruction
• Identify the different types of sampling and when one is a better option than the other
• Create, conduct, and interpret survey data
• Compare data sets using measures of central tendency and dispersion
• Calculate probability of simple and compound events including using it to make predictions