SOUTHERN LEHIGH SCHOOL DISTRICT
5775 Main Street
Center Valley, PA 18034

Scope and Sequence for **Extended Grade 6 Mathematics**

Standards for Mathematical Practice:	
MP1 Make sense of problems and persevere in solving them.	**MP5** Use appropriate tools strategically.
MP2 Reason abstractly and quantitatively.	**MP6** Attend to precision.
MP3 Construct viable arguments and critique the reasoning of others.	**MP7** Look for and make use of structure.
MP4 Model with mathematics.	**MP8** Look for and express regularity in repeated reasoning.

6.RPA – Ratios & Proportional Relationships

CCSSM	PA Core Standards for Mathematics
Understand ratio concepts and use ratio reasoning to solve problems. **6.RPA.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."* **6.RPA.2** Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*[1] [1] Expectations for unit rates in this grade are limited to non-complex fractions. *This section continues on the next page…*	CC.2.1.6.D.1 Understand ratio concepts and use ratio reasoning to solve problems. *This section continues on the next page…*

6.RPA – Ratios & Proportional Relationships – *Continued…*

CCSSM	PA Core Standards for Mathematics

6.RPA.1, 6.RPA.2 *Continued…*
 	
6.RPA.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
  a) Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
  b) Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*
  c) 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 percent.
  d) Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
	CC.2.1.6.D.1 *Continued…*

Pennsylvania System of School Assessment (PSSA)	M06.A-R Ratios and Proportional Relationships

M06.A-R.1 Understand ratio concepts and use ratio reasoning to solve problems

M06.A-R.1.1 Represent and/or solve real-world and mathematical problems using rates, ratios, and/or percents.	**M06.A-R.1.1.1** Use ratio language and notation (such as 3 to 4, 3:4, 3/4) to describe a ratio relationship between two quantities. *Example 1: "The ratio of girls to boys in a math class is 2:3 because for every 2 girls there are 3 boys."* *Example 2: "For every five votes candidate A received, candidate B received four votes."*
	M06.A-R.1.1.2 Find the unit rate *a/b* associated with a ratio *a:b* (with *b* ≠ 0) and use rate language in the context of a ratio relationship. *Example 1: "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar."* *Example 2: "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*
	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. *Example: If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*
	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.

6.NS – The Number System

CCSSM	PA Core Standards for Mathematics
Apply and extend previous understanding of multiplication and division to division to divide fractions by fractions. **6.NS.1** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*.	**CC.2.1.6.E.1** Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

Pennsylvania System of School Assessment (PSSA)	M06.A-N The Number System

M06.A-N.1 Apply and extend previous understanding of multiplication and division to divide fractions by fractions	
M06.A-N.1.1 Solve real-world and mathematical problems involving division of fractions.	**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. *Example 1: Given a story context for (2/3) ÷ (3/4), explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = (a/b) × (d/c) = ad/bc.)* *Example 2: How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?* *Example 3: How many 2 1/4-foot pieces can be cut from a 15 1/2-foot board?*

CCSSM	PA Core Standards for Mathematics
Compute fluently with multi-digit numbers and find common factors and multiples **6.NS.2** Fluently divide multi-digit numbers using the standard algorithm. **6.NS.3** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. *This section continues on the next page…*	**CC.2.1.6.E.2** Identify and choose appropriate processes to compute fluently with multi-digit numbers. *This section continues on the next page…*

6.NS – The Number System – *Continued…*

CCSSM	PA Core Standards for Mathematics
6.NS.2, 6.NS.3 *Continued…*	**CC.2.1.6.E.2** *Continued…*

Pennsylvania System of School Assessment (PSSA)	M06.A-N The Number System
M06.A-N.2 Compute with multi-digit numbers and find common factors and multiples	
M06.A-N.2.1 Compute with multi-digit numbers using the four arithmetic operations with or without a calculator.	**M06.A-N.2.1.1** Solve problems involving operations (+, –, ×, and ÷) with whole numbers, decimals (through thousandths), straight computation, or word problems.

CCSSM	PA Core Standards for Mathematics
6.NS.4 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. Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).*	**CC.2.1.6.E.3** Develop and/or apply number theory concepts to find common factors and multiples.

Pennsylvania System of School Assessment (PSSA)	M06.A-N The Number System
M06.A-N.2 Compute with multi-digit numbers and find common factors and multiples.	
M06.A-N.2.2 Apply number theory concepts (specifically, factors and multiples).	**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. *Example: Express 36 + 8 as 4(9 + 2).*

6.NS – The Number System – *Continued…*

CCSSM	PA Core Standards for Mathematics
Apply and extend previous understanding of numbers to the system of rational numbers	**CC.2.1.6.E.4** Apply and extend previous understandings of numbers to the system of rational numbers.

Apply and extend previous understanding of numbers to the system of rational numbers

6.NS.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
a) Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., -(-3) = 3, and that 0 is its own opposite.
b) Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
c) Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.7 Understand ordering and absolute value of rational numbers.
a) Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right*.
b) Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write -3 °C > -7 °C to express the fact that -3 °C is warmer than -7 °C*.
c) Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars*.
d) Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars*.

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6.NS – The Number System – *Continued…*

CCSSM	PA Core Standards for Mathematics
6.NS.5, 6.NS.6, 6.NS.7 *Continued…* **6.NS.8** Solve real-world and mathematical problems by graphing 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.	**CC.2.1.6.E.4** *Continued…*

Pennsylvania System of School Assessment (PSSA)	M06.A-N The Number System
M06.A-N.3 Apply and extend previous understandings of numbers to the system of rational numbers	
M06.A-N.3.1 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values and locations on the number line and coordinate plane.	**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 Understand ordering and absolute value of rational numbers.	**M06.A-N.3.2.1** Write, interpret, and explain statements of order for rational numbers in real-world contexts. ***Example:*** *Write ⁻3°C > ⁻7°C to express the fact that ⁻3°C is warmer than ⁻7°C*
	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. ***Example:*** *For an account balance of ⁻30 dollars, write |⁻30| = 30 to describe the size of the debt in dollars, and recognize that an account balance less than ⁻30 dollars represents a debt greater than 30 dollars.*
	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.

6.EE – Expressions & Equations

CCSSM	PA Core Standards for Mathematics

Apply and extend previous understanding of arithmetic to algebraic expressions.
 	
6.EE.1 Write and evaluate numerical expressions involving whole-number exponents.
 	
6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers.
  a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 - y.*
  b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.*
  c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length s = 1/2.*
 	
6.EE.3 Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*
 	
6.EE.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*
 	
Reason about and solve one-variable equations and inequalities
 	
6.EE.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
 	
6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
 	
This section continues on the next page…
	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.
	
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6.EE – Expressions & Equations – *Continued…*

CCSSM	PA Core Standards for Mathematics
6.EE.1, 6.EE.2, 6.EE.3, 6.EE.4, 6.EE.5, 6.EE.5 *Continued…* **6.EE.7** Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. **6.EE.8** Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.	**CC.2.2.6.B.1, CC.2.2.6.B.2** *Continued…*

Pennsylvania System of School Assessment (PSSA)	M06.B-E Expressions and Equations
M06.B-E.1 Apply and extend previous understanding of arithmetic to numerical and algebraic expressions.	
M06.B-E.1.1 Identify, write, and evaluate numerical and algebraic expressions.	**M06.B-E.1.1.1** Write and evaluate numerical expressions involving whole-number exponents.
	M06.B-E.1.1.2 Write algebraic expressions from verbal descriptions. ***Example:*** *Express the description "five less than twice a number" as $2y – 5$.*
	M06.B-E.1.1.3 Identify parts of an expression using mathematical terms (e.g., sum, term, product, factor, quotient, coefficient, quantity). ***Example:*** *Describe the expression $2(8 + 7)$ as a product of two factors.*
	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. ***Example:*** *Evaluate the expression $b^2 - 5$ when $b = 4$.*
	M06.B-E.1.1.5 Apply the properties of operations to generate equivalent expressions. ***Example 1:*** *Apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$.* ***Example 2:*** *Apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$.* ***Example 3:*** *Apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.*
M06.B-E.2 Interpret and solve one-variable equations and equalities	
M06.B-E.2.1 Create, solve, and interpret one-variable equations or inequalities in real-world and mathematical problems.	**M06.B-E.2.1.1** Use substitution to determine whether a given number in a specified set 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 by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q, and x are all non-negative rational numbers.
This section continues on the next page…	**M06.B-E.2.1.4** Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem and/or represent solutions of such inequalities on number lines.

6.EE – Expressions & Equations – *Continued…*

CCSSM	PA Core Standards for Mathematics
6.EE.1, 6.EE.2, 6.EE.3, 6.EE.4, 6.EE.5, 6.EE.6, 6.EE.7, 6.EE.8 *Continued…*	**CC.2.2.6.B.1, CC.2.2.6.B.2** *Continued…*

Pennsylvania System of School Assessment (PSSA)	M06.B-E Expressions and Equations

M06.B-E.2 Interpret and solve one-variable equations and equalities

M06.B-E.2.1 Create, solve, and interpret one-variable equations or inequalities in real-world and mathematical problems.	**M06.B-E.2.1.1** Use substitution to determine whether a given number in a specified set 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 by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q, and x are all non-negative rational numbers.
	M06.B-E.2.1.4 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem and/or represent solutions of such inequalities on number lines.

Represent and analyze quantitative relationships between dependent and independent variables **6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.	**CC.2.2.6.B.3** Represent and analyze quantitative relationships between dependent and independent variables.

Pennsylvania System of School Assessment (PSSA)	M06.B-E Expressions and Equations

M06.B-E.3 Represent and analyze quantitative relationships between dependent and independent variables.

M06.B-E.3.1 Use variables to represent two quantities in a real-world problem that change in relationship to one another.	**M06.B-E.3.1.1** Write an equation to express the relationship between the dependent and independent variables. ***Example:*** *In a problem involving motion at a constant speed of 65 units, write the equation d = 65t to represent the relationship between distance and time.*
	M06.B-E.3.1.2 Analyze the relationship between the dependent and independent variables using graphs and tables and/or relate these to an equation.

6.G – Geometry

CCSSM	PA Core Standards for Mathematics
Solve real-world and mathematical problems involving area, surface area, and volume **6.G.1** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. **6.G.2** Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\,w\,h$ and $V = b\,h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. **6.G.3** Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. **6.G.4** Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	**CC.2.3.6.A.1** Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

Pennsylvania System of School Assessment (PSSA)	M06.C-G Geometry
M06.C-G.1 Solve real-world and mathematical problems involving area, surface area, and volume.	

M06.C-G.1.1	M06.C-G.1.1.1
Find area, surface area, and volume by applying formulas and using various strategies	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. *Example: Find the area of a room in the shape of an irregular polygon by composing and/or decomposing.*
	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.**

6.SP – Statistics & Probability

CCSSM	PA Core Standards for Mathematics

Develop understanding of statistical variability
 	
6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages*.
 	
6.SP.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
 	
6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.
 	
Summarize and describe distributions
 	
6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
 	
6.SP.5 Summarize numerical data sets in relation to their context, such as by:
  a. Reporting the number of observations.
  b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
  c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
  d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.
 	
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	CC.2.4.6.B.1
	Demonstrate an understanding of statistical variability by displaying, analyzing, and summarizing distributions.
	
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6.SP – Statistics & Probability – *Continued…*

CCSSM	PA Core Standards for Mathematics
6.SP.1, 6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5 *Continued…*	**CC.2.4.6.B.1** *Continued…*

Pennsylvania System of School Assessment (PSSA)	M06.D-S Statistics and Probability
M06.D-S.1 Demonstrate understanding of statistical variability by summarizing and describing distributions

M06.D-S.1.1 Display, analyze, and summarize numerical data sets in relation to their context.	**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.

7.RP – Ratios and Proportional Relationships

CCSSM	PA Core Standards for Mathematics

Analyze proportional relationships and use them to solve real-world and mathematical problems.
 	
7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. ***For example***, *if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction ½ / ¼ per hour, equivalently 2 miles per hour.*
 	
7.RP.2 Recognize and represent proportional relationships between quantities
    a. Decide whether two quantities are in a proportional relationship, 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.
    b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
    c. Represent proportional relationships by equations. For 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 = pn.
    d. 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.
 	
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	CC.2.1.7.D.1
	Analyze proportional relationships and use them to model and solve real-world and mathematical problems.
	
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7.RP – Ratios and Proportional Relationships – *Continued…*

CCSSM	PA Core Standards for Mathematics
7.RP.1, 7.RP.2 *Continued...* **7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. ***Examples:*** *simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	**CC.2.1.7.D.1** *Continued…*

Pennsylvania System of School Assessment (PSSA)	M07.A-R Ratios and Proportional Relationships

M07.A-R.1 Demonstrate an understanding of proportional relationships.

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 ½ / ¼ 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 = pn.* **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.*

7.NS – The Number System

CCSSM	PA Core Standards for Mathematics

Apply and extend previous understanding of operations with fractions.
 	
7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
  a. Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.
  b. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
  c. Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
  d. Apply properties of operations as strategies to add and subtract rational numbers.
 	
7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
  a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
  b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then –(p/q) = (–p)/q = p/(–q). Interpret quotients of rational numbers by describing real-world contexts.
  c. Apply properties of operations as strategies to multiply and divide rational numbers.
  d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
 	
7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.
 	
This section continues on the next page…
	CC.2.1.7.E.1
	Apply and extend previous understandings of operations with fractions to operations with rational numbers.
	
	This section continues on the next page…

7.NS – The Number System – *Continued…*

CCSSM	PA Core Standards for Mathematics
7.NS.1, 7.NS.2, 7.NS.3 *Continued...*	**CC.2.1.7.E.1** *Continued…*
Pennsylvania System of School Assessment (PSSA)	M07.A-N The Number System
M07.A-N.1 Apply and extend previous understandings of operations to add, subtract, multiply, and divide rational numbers.	
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.

7.EE – Expressions and Equations

CCSSM	PA Core Standards for Mathematics
Use properties of operations to generate equivalent expressions. **7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	**CC.2.2.7.B.1** Apply properties of operations to generate equivalent expressions.
Pennsylvania System of School Assessment (PSSA)	M07.B-E Expressions and Equations
M07.B-E.1 Represent expressions in equivalent forms.	
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 $1/2 \cdot (x + 6)$ is equivalent to $1/2 \cdot x + 3$. 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 $2(2w – 5)$.*
7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, $a + 0.05a = 1.05a$ means that "increase by 5%" is the same as "multiply by 1.05."* **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** **7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For 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. If you want to place a towel bar 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.* *This section continues on the next page…*	**CC.2.2.7.B.3** Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations. *This section continues on the next page…*

7.EE – Expressions and Equations – *Continued…*

CCSSM	PA Core Standards for Mathematics
7.EE.2, 7.EE.3 *Continued...*	**CC.2.2.7.B.3** *Continued…*
7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. **a.** 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. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. ***For example***, *the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* **b**. 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. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.	

Pennsylvania System of School Assessment (PSSA)	M07.B-E Expressions and Equations
M07.B-E.2 Solve real-life and mathematical problems using numerical and algebraic expressions, equations, and inequalities	
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).*
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. ***Example:*** *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.*
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.*

7.G – Geometry

CCSSM	PA Core Standards for Mathematics
Draw, construct, and describe geometrical figures and describe the relationships between them. **7.G.1** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. **7.G.2** Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. **7.G.3** Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	**CC.2.3.7.A.2** Visualize and represent geometric figures and describe the relationships between them.

Pennsylvania System of School Assessment (PSSA)	M07.C-G Geometry
M07.C-G.1 Demonstrate an understanding of geometric figures and their properties	
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. ***Example:*** *Describe plane sections of right rectangular prisms and right rectangular pyramids.*

Solve real-life and mathematical problems involving angle measure, area, surface, area, and volume. **7.G.4** Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. **7.G.5** Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. **7.G.6** 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. ***This section continues on the next page…***	**CC.2.3.7.A.1** Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume. ***This section continues on the next page…***

7.G – Geometry – *Continued…*

CCSSM	PA Core Standards for Mathematics
7.G.4 , **7.G.5, 7.G.6** *Continued...*	**CC.2.3.7.A.1** *Continued...*

<table>
<tr><td colspan="2">Pennsylvania System of School Assessment (PSSA)   M07.C-G Geometry</td></tr>
<tr><td colspan="2">M07.C-G.2 Solve real-world and mathematical problems involving angle measure, circumference, area, surface area, and volume.</td></tr>
<tr>
<td>M07.C-G.2.1
Identify, use and describe properties of angles and their measures.</td>
<td>M07.C-G.2.1.1 Identify and use properties of supplementary, complementary, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.</td>
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<tr>
<td></td>
<td>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).</td>
</tr>
<tr>
<td>M07.C-G.2.2
Determine circumference, area, surface area, and volume.</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
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7.SP – Statistics and Probability

CCSSM	PA Core Standards for Mathematics
Use random sampling to draw inference about a population. **7.SP.1** Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. **7.SP.2** Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. ***For example,*** *estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*	**CC.2.4.7.B.1** Draw inferences about populations based on random sampling concepts.

Pennsylvania System of School Assessment (PSSA)	M07.D-S Statistics and Probability
M07.D-S.1 Use random sampling to draw inferences about a population.	
M07.D-S.1.1 Use random samples.	**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.*

7.SP – Statistics and Probability – *Continued…*

CCSSM	PA Core Standards for Mathematics
Draw informal comparative inference about two populations. **7.SP.3** Informally assess the degree of visual overlap of two numerical data distributions with similar variabilites, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.* **7.SP.4** Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, 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. **Investigate chance processes and develop, use, and evaluate probability models.** **7.SP.5** Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. 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.	**CC.2.4.7.B.2** Draw informal comparative inferences about two populations.

Pennsylvania System of School Assessment (PSSA)	M07.D-S Statistics and Probability
M07.D-S.2 Draw comparative inferences about populations.	

| **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.* |
| **7.SP.6** Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would*

This section continues on the next page… | **CC.2.4.7.B.3**
Investigate chance processes and develop, use, and evaluate probability models.

This section continues on the next page… |

7.SP – Statistics and Probability – *Continued…*

CCSSM	PA Core Standards for Mathematics

7.SP.6 *Continued...*
 	
 7.SP.7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
     a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*
     b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*
 	
 7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
     a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
     b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
     c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
	CC.2.4.7.B.3 *Continued...*

Pennsylvania System of School Assessment (PSSA)	M07.D-S Statistics and Probability

M07.D-S.3 Investigate chance processes and develop, use, and evaluate probability models.	
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).
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.