AERO/Common Core Mapping 6-8

Note: In yellow are the AERO Standards and inconsistencies between AERO and Common Core are noted by the strikethrough (~~xxx~~) notation.

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Critical Areas 6-8

Instruction should focus on these critical areas

Critical Areas	6	7	8
Ratio and Proportion	Connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems	Developing understanding of and applying proportional relationships;	
Fractions	Completing understanding of division of fractions and extending the notion of numbers to the system of rational numbers, which includes negative numbers;		
Expressions and Equations	Writing, interpreting, and using expressions and equations;	Developing understanding of operations with rational numbers and working with expressions and linear equations;	Formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations;
Functions			Grasping the concept of a function and using functions to describe quantitative relationships;
Geometry		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;	Analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.
Statistics	Developing understanding of statistical thinking	Drawing inferences about populations based on samples	

Critical Areas Described

Grade 6

1. Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

2. Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

3. Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

4. Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute

deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected. Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane

Grade 7

1. 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. 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. 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. 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

Grade 8

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions (y/x = m or $y = mx$) as special linear equations (y = $mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation. Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres

Standards for Mathematical Practices 6-8

Mathematical Practices Mathematically proficient students...	6	7	8
Make sense of problems and persevere in solving them.	6.MP.1 In grade 6, students solve problems involving ratios and rates and discuss how they solved them. 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?"	7.MP.1 In grade 7, students solve problems involving ratios and rates and discuss how they solved them. 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?".	8.MP.1 In grade 8, 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?"

Mathematical Practices Mathematically proficient students...	6	7	8
Reason abstractly and quantitatively.	6.MP.2 In grade 6, 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.	7.MP.2 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. .	8.MP.2 In grade 8, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. They examine patterns in data and assess the degree of linearity of functions. 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.

Mathematical Practices Mathematically proficient students...	6	7	8
Construct viable arguments and critique the reasoning of others.	6.MP.3 In grade 6, 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.). They 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	7.MP.3 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.). They 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	8.MP.3 In grade 8, 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.). They 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.

Mathematical Practices Mathematically proficient students...	6	7	8
Model with mathematics.	6.MP.4 In grade 6, 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 begin to explore covariance and represent two quantities simultaneously. Students use number lines to compare numbers and represent inequalities. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences about and make comparisons between data sets. 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 a problem context.	7.MP.4 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 a problem context.	8.MP.4 In grade 8, 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 solve systems of linear equations and compare properties of functions provided in different forms. Students use scatterplots to represent data and describe associations between variables. 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 a problem context.

Mathematical Practices Mathematically proficient students...	6	7	8
Use appropriate tools strategically.	6.MP.5 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 6 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Additionally, students might use physical objects or applets to construct nets and calculate the surface area of three-dimensional figures.	7.MP.5 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.	8.MP.5 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 8 may translate a set of data given in tabular form to a graphical representation to compare it to another data set. Students might draw pictures, use applets, or write equations to show the relationships between the angles created by a transversal.

Mathematical Practices Mathematically proficient students...	6	7	8
Attend to precision.	6.MP.6 In grade 6, 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 use appropriate terminology when referring to rates, ratios, geometric figures, data displays, and components of expressions, equations or inequalities.	7.MP.6 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.	8.MP.6 In grade 8, 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 use appropriate terminology when referring to the number system, functions, geometric figures, and data displays.

Mathematical Practices Mathematically proficient students...	6	7	8
Look for and make use of structure.	6.MP.7 Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 2\ (3 + x)$ 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 area and volume.	7.MP.7 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. $6 + 2x = 2\ (3 + x)$ 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.MP.7 Students routinely seek patterns or structures to model and solve problems. In grade 8, students apply properties to generate equivalent expressions and solve equations. Students examine patterns in tables and graphs to generate equations and describe relationships. Additionally, students experimentally verify the effects of transformations and describe them in terms of congruence and similarity.

Mathematical Practices Mathematically proficient students...	6	7	8
Look for and express regularity in repeated reasoning.	6.MP.8 In grade 6, 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. Students connect place value and their prior work with operations to understand algorithms to fluently divide multi-digit numbers and perform all operations with multi-digit decimals. Students informally begin to make connections between covariance, rates, and representations showing the relationships between quantities	7.MP.8 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.	8.MP.8 In grade 8, students use repeated reasoning to understand algorithms and make generalizations about patterns. Students use iterative processes to determine more precise rational approximations for irrational numbers. They analyze patterns of repeating decimals to identify the corresponding fraction. During multiple opportunities to solve and model problems, they notice that the slope of a line and rate of change are the same value. Students flexibly make connections between covariance, rates, and representations showing the relationships between quantities. .

AERO Performance Indicators Mapped to Common Core Standards 6-8

Cluster	6	7	8
Ratios and Proportions	6.RP.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities 6.RP.2: Understand the concept of a 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 **Compare and use unit cost in practical situations** 6.RP.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 **Compare quantities and solve problems using ratios, rates ~~and percents~~.** **Write and apply ratios in mathematical and practical situations involving measurement and monetary conversions**	7.RP.2: Recognize and represent proportional relationships between quantities 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 **Use unit rates (e.g., miles per hour, words per minutes) to solve problems** 7.RP.3: Use proportional relationships to solve multistep ratio and percent problems. **Write and apply proportions to solve mathematical and practical problems involving measurement and monetary conversions** **Calculate the percentage of increase and decrease of a quantity in real-world and mathematical problems.** **Use percents to make comparisons between groups of unequal size.**	8.EE.5: Graph proportional relationships, interpreting the unit rate as the slope of the graph **Identify proportional relationships in real-world situations, then find and select an appropriate method to determine the solution; justify the reasonableness of the solution.** **Solve contextual problems using ratios, rates, or percents and verify the reasonableness of the solution.** **Apply ratios and proportions to calculate rates and solve mathematical and practical problems using indirect measure.** **Apply ratio and proportionality to solve problems, including percent and simple probability** ~~Calculate percents in monetary problems~~

Cluster	6	7	8
Operations on 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 **Apply the inverse relationship between multiplication and division to make sense of procedures for multiplying and dividing fractions and justify why they work** **Solve problems involving ~~addition, subtraction, multiplication~~, and division of rational numbers and express answers in simplest form** Decide which representation (i.e., fraction or decimal) of a positive number is appropriate in a real-life situation	~~**Model and identify equivalent fractions including conversion of improper fractions to mixed numbers and vice versa.**~~	
Division Multi-digit Numbers	6.NS.2: Fluently divide multi-digit numbers using the standard algorithm. **Use various methods to find quotients for multi-digit division problems. and justify why the procedures work on the basis of place value and number properties**		

Cluster	6	7	8
Operations on Decimals	6.NS.3: Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation **Develop and use strategies for mental computations with non-negative whole numbers, fractions, and decimals.** **Use and explain estimation strategies to predict computational results with positive fractions and decimals** ~~**Read, write, compare, and order groups of decimals**~~		
Factors and Multiples	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 **Identify the greatest common factor for a set of whole numbers.** **Express a whole number as a product of its prime factors, using exponents when appropriate.**	~~**Determine the Greatest Common Factor (GCF) and Least Common Multiple (LCM) of two numbers in the context of problem-solving**~~ ~~**Use the concepts of number theory, including prime and composite numbers, factors, multiples, and the rules of divisibility to solve problems**~~	~~**Apply the concepts of Greatest Common Factor (GCF) and Least Common Multiple (LCM) to monomials with variables**~~

Cluster	6	7	8
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. **Demonstrate the meaning of positive and negative numbers and their opposites in real-life situations** 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. Read, write, ~~compare, and order~~ integers using multiple strategies (e.g., symbols, manipulatives, number line).	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 **Represent rational numbers as fractions, mixed numbers, decimals or percents and convert among various forms as appropriate** **~~Compare and order~~ combinations of rational numbers, including fractions, decimals, percents, and integers** **Develop, analyze, and apply models (including everyday contexts), strategies, and procedures to compute with integers, with an emphasis on negative integers.**	**~~Estimate the answer to an operation involving rational numbers based on the original numbers~~**

Cluster	6	7	8
Ordering Rational Numbers	6.NS.7: Understand ordering and absolute value of rational numbers. **Explain the meaning and relationship between absolute value and opposites** **Compare positive fractions, decimals, and positive and negative integers using symbols (i.e., <, =, >) and number lines** **Determine the equivalency between and among fractions, decimals, and percents in contextual situations** **Identify and use place value positions of whole numbers and decimals to thousandths** **Determine decimal ~~and percent~~ equivalents including approximations for common fractions (i.e., ¼, ½, ¾, and 1 whole)** **Compute equivalent representations of fractions and decimals (i.e., halves, thirds, fourths, fifths, eighths, tenths, hundredths) ~~Represent percents in various forms using numbers, pictures, models, or circle graphs and solve problems involving percentages greater than 100 and less than 1~~.**		

Problem Solving	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. **Model addition and subtraction of integers with physical materials and the number line**.	7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers. (NOTE: Computations with rational numbers extend the rules for manipulating fractions to complex fractions **Determine the reasonableness of answers involving positive fractions and decimals by comparing them to estimates** **Set up and solve simple percent problems using various strategies, including mental math** **Calculate simple interest in monetary problem**	

Cluster	6	7	8
Irrational Numbers		~~**Express fractions as terminating or repeating decimals.**~~	8.NS.1: Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational. **Classify numbers as rational or irrational.** **Analyze, describe and compare the characteristics of rational and irrational numbers.** 8.NS.2: Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions **Represent and compare rational and irrational numbers symbolically and on a number line.** **Use rational and irrational numbers to solve real-world and mathematical problems.**

Cluster	6	7	8
Expressions	6.EE.1: Write and evaluate numerical expressions involving whole- number exponents. **Evaluate formulas and algebraic expressions using whole number values** **Formulate algebraic expressions, ~~equations, and inequalities~~ to reflect a given situation.** **Write simple expressions ~~and equations~~ using variables to represent mathematical situations** **~~Determine the rule, output or input; given an input/output model using one operation,~~ write an algebraic expression for the rule and use to identify other input/output values.** 6.EE.2: Write, read, and evaluate expressions in which letters stand for numbers. **Create algebraic expressions that correspond to real-world situations; use the expressions to solve problems** 6.EE.3: Apply the 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. **Use the order of operations to simplify and/or evaluate whole numbers (including exponents and grouping symbols).** **Simplify algebraic expressions by combining like terms** **Formulate algebraic expressions, equations, and inequalities to reflect a given situation and vice versa.** 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. **Evaluate formulas and algebraic expressions for given integer values**	8.EE.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions. **Simplify and evaluate expressions using order of operations and use real number properties to justify solutions** 8.EE.2: Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

Cluster	6	7	8
Scientific Notation		~~**Analyze and describe simple exponential number patterns (e.g., 3, 9, 27 or 31, 32, 33)**~~ ~~**Use inductive reasoning to extend patterns to predict the nth term (e.g., powers and triangular numbers).**~~ ~~**Write, identify, and use(standard and expanded form) powers of 10 from 10^{-3} through 10^{6}**~~ ~~**Explain the relationship between standard form and scientific notation.**~~	8.EE.3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other **Recognize and appropriately use exponential and scientific notation.** 8.EE.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. **Represent numbers using scientific notation in mathematical and practical situations.**

Cluster	6	7	8
Expressions	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) ~~**Create and use tables and charts to extend a pattern in order to describe a rule and find missing terms in a sequence**~~	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 **Solve problems by creating an input/output function table(including, but not limited to, spreadsheets) to predict future values, given a real-world situation involving rational numbers.** ~~**Compare, order, and**~~ **differentiate among integers, decimals, fractions, and irrational numbers using multiple representations (e.g., symbols, manipulatives, graphing on a number line).**	~~**Identify missing information or suggest a strategy for solving a real-life, rational-number problem**~~ ~~**Simplify and evaluate numerical and algebraic expressions.**~~ ~~**Model inequalities (and their solutions) on a number line.**~~ ~~**Find the missing term in a numerical sequence or a pictorial representation of a sequence**~~ ~~**Evaluate formulas and algebraic expressions using rational numbers**~~

Cluster	6	7	8
Equations and inequalities	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. **Represent the relationship in an input-output situation using a simple equation, graph, table, or word description** 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, **Describe how changes in one quantity or variable result in changes in another** **Identify and describe patterns represented by tables, graphs, and sequences**	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. **Solve equations that represent algebraic and real-world problems using multiple methods including the real number properties.** **Create tables and graphs to analyze and describe patterns** **Solve and graphically represent equations and inequalities in one variable with integer solutions** **Generate and graph a set of ordered pairs to represent a linear equation**	

	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.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. **Solve and graphically represent equations and inequalities in one variable with integer solutions** **Solve simple equations using guess-and-check, diagrams, properties, or inspection, explaining the process used** **Solve and graphically represent equations and inequalities in one variable with integer solutions**		8.EE.7: Solve linear equations in one variable. **Solve linear equations ~~and inequalities~~ and represent the solution graphically** **Solve and graphically represent equations ~~and inequalities~~ in one variable including absolute value** ~~Add and subtract binomials~~

Cluster	6	7	8
	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. **Solve and graphically represent equations and inequalities in one variable with integer solutions**		
Simultaneous Equations			8.EE.8: Analyze and solve pairs of simultaneous linear equations.

Cluster	6	7	8
Functions			8.F.1: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output **Identify, model, and describe linear functions** 8.F.2: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions) **Translate among verbal descriptions, graphic, tabular, and algebraic representations of mathematical situations** 8.F.3: Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. **Distinguish between and explain when real-life numerical patterns are linear/arithmetic (i.e., grows by addition) or exponential/geometric (i.e., grows by multiplication**

Cluster	6	7	8
Functions			8.F.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, *y)* values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values 8.F.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. **Compare linear relationships to non-linear relationships;**

Cluster	6	7	8
Problem Solving Geometric Measurement	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 **Select appropriate tools and units to determine the measurements needed for calculating perimeter, circumference, area, ~~surface area~~ ,and volume** **Convert units within a given measurement system to solve problems.** **~~Use formulas to determine the Determine the radius, diameter, and circumference of a circle and explain the relationship of circumference of a circle to its diameter, linking to pi.~~**	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 **Use formulas and strategies, such as decomposition, to compute the perimeter and area of triangles, parallelograms, trapezoids, the circumference and area of circles, and find the area of more complex shapes.** **Estimate and compare corresponding units of measure for area and volume/capacity between customary and metric systems.** 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. **Estimate and compare corresponding units of measure for area and volume/capacity between customary and metric systems**	8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. **Use two-dimensional representations of three dimensional objects to visualize and solve problems; e.g., those involving surface area and volume** **Estimate and convert units of measure for mass and capacity within the same measurement system (customary and metric).** **~~Estimate and convert units of measure for mass and capacity within the same measurement system (customary and metric)~~** **~~Select an appropriate degree of precision when using measurements for calculations~~**
Problem Solving Geometric Measurement	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.	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	8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. **Use two-dimensional representations of**

Construct Geometric figures	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 **Draw and label the components of the coordinate plane; i.e., coordinates, quadrants, origin, x- and y-axes** 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. **Identify, classify, compare, and draw regular and irregular quadrilaterals** **Make a two-dimensional drawing of a three-dimensional figure** **Construct circles, angles, and triangles based on given measurements using a variety of methods and tools including compass, straight edge, paper folding, and technology** **Construct three-dimensional figures using manipulatives and generalize the relationships among vertices, faces, and edges (~~such as Euler's Formula).~~**	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. **Represent shapes using coordinate geometry** 7.G.A.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. **Identify, classify, and compare, and draw regular and irregular polygons** **Classify triangles based on side and angle measurements;**	~~**Construct geometric figures using a variety of tools**~~ ~~**Use two-dimensional representations (nets) of three-dimensional objects to describe objects from various perspectives.**~~ ~~**Classify and compare three-dimensional shapes using their properties.**~~

Cluster	6	7	8
		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 **Construct two-dimensional representations of three-dimensional objects.** **Make a model of a three-dimensional figure from a two-dimensional drawing.** **Build and sketch three-dimensional solids; e.g., using nets, manipulatives.**	

Cluster	6	7	8
Congruence and Similarity	~~**Generalize the relationship between line symmetry and rotational symmetry for two-dimensional shapes.**~~ ~~**Compare, classify, and construct transformations (reflections, translations, and rotations).**~~	~~**Analyze geometric properties and the relationships among the properties of triangles, congruence, similarity, and transformations to make deductive arguments.**~~ ~~**Perform transformations (rigid and non-rigid motions) on two-dimensional figures using the coordinate plane.**~~	8.G.1: Verify experimentally the properties of rotations, reflections, and translations: 8.G.2: Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them 8.G.3: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates **Draw the results of a combination of transformations in the coordinate plane; i.e., reflections, rotations, and translations**

Cluster	6	7	8
			8.G.4: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them **Apply the properties of equality and proportionality to find missing attributes of congruent or similar shapes** 8.G.5: Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles **Locate and identify angles formed by parallel lines cut by a transversal(s) (e.g., adjacent, vertical, complementary, supplementary, corresponding, alternate interior, and alternate exterior).** ~~**Find and verify the sum of the measures of interior angles of triangles**~~

Cluster	6	7	8
Pythagorean Theorem	**~~Model slope (pitch, angle of inclination) using concrete objects and practical examples~~**	~~Create an argument using the Pythagorean Theorem principles to show that a triangle is a right triangle.~~ **~~Determine the measure of the missing side of a right triangle~~** **~~Determine slope of a line, midpoint of a segment and the horizontal and vertical distance between two points using coordinate geometry~~**	8.G.6: Explain a proof of the Pythagorean Theorem and its converse. 8.G.7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. **Explain the Pythagorean Theorem and apply it to solve routine and non-routine problems.** **Determine the measure of the missing side of a right triangle.** **Apply strategies and procedures to find the coordinates of the missing vertex of a square, rectangle, or right triangle when given the coordinates of the polygon's other vertices.** 8.G.8: Apply the Pythagorean Theorem to find the distance between two points in a coordinate system **Calculate slope, midpoint, and distance using equations and formulas**

			Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b

Cluster	6	7	8
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. **Formulate questions that guide the collection of data** 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. **Analyze and solve application problems involving measures of central tendency (mean, median, mode) and dispersion (range) from data, graphs, tables, and experiments use appropriate technology to compare two sets of data** 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.	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. **Make and test conjectures to explain observed mathematical relationships and to develop logical arguments to justify conclusions** 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. **Formulate questions that guide the collection of data** **Interpolate and extrapolate from data to make predictions for a given set of data**	~~**Formulate questions and design a study that guides the collection of data**~~ ~~**Represent logical relationships using conditional statements**~~

Cluster	6	7	8
Data Distributions	6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **Use a variety of graphical representations including circle graphs and scatter plots to organize and represent data** 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.	7. SP.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. **Make and test conjectures to explain observed mathematical relationships and to develop logical arguments to justify conclusions** 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. **Determine which measure of central tendency (mean, median) provides the most useful information in a given context.** **Use the appropriate graphical representations to organize and represent data**	8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. **Use appropriate graphical representations to organize, display, and read data .** **Draw inferences, make conjectures and construct convincing arguments involving different effects that changes in data values have on measures of central tendency misuses of statistical or numeric information, based on data analysis of same and different sets of data** 8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

Cluster	6	7	8
Probability	~~**Interpret and explain line graphs, double bar graphs, frequency plots, stem-and-leaf plots, histograms, and box-and-whisker plots.**~~ ~~**Determine combinations and permutations by constructing sample spaces (e.g., listing, tree diagrams, frequency distribution tables).**~~	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. 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 .	~~**Compare the experimental and theoretical probability of a given situation (including compound probability of a dependent and independent event).**~~ ~~**Find the number of combinations possible in mathematical and practical situations**~~ ~~**Analyze problem situations, games of chance, and consumer applications using random and non-random samplings to determine probability, make predictions, and identify sources of bias.**~~

		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. 7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation **Determine theoretical probability of an event, make and test predictions through experimentation.** **Determine and explain whether a real-world situation involves permutations or combinations, then use appropriate technology to solve the problem.**	