Grade 6, instructional time should focus on four critical areas:
  (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems;
  (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers;
  (3) writing, interpreting, and using expressions and equations; and
  (4) developing understanding of statistical thinking.

(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.

Information from the *PARCC Model Content Framework for Mathematics*
Grade 6

The following are examples of *Key Advances* from Grade 5 to Grade 6
- Students' prior understanding of and skill with multiplication, division and fractions contribute to their study of ratios, proportional relationships and unit rates (6.RP).
- Students begin using properties of operations systematically to work with variables, variable expressions and equations (6.EE).
- Students extend their work with the system of rational numbers to include using positive and negative numbers to describe quantities (6.NS.5), extending the number line and coordinate plane to represent rational numbers and ordered pairs (6.NS.6), and understanding ordering and absolute value of rational numbers (6.NS.7).
- Having worked with measurement data in previous grades, students begin to develop notions of statistical variability, summarizing and describing distributions (6.SP).

Fluency Expectations or Examples of Culminating Standards
6.NS.2   Students fluently divide multidigit numbers using the standard algorithm. This is the culminating standard for several years' worth of work with division of whole numbers.
6.NS.3   Students fluently add, subtract, multiply and divide multidigit decimals using the standard algorithm for each operation. This is the culminating standard for several years' worth of work relating to the domains of Number and Operations in Base Ten, Operations and Algebraic Thinking, and Number and Operations — Fractions.
6.NS.1   Students interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions. This completes the extension of operations to fractions.

Examples of Major Within-Grade Dependencies
- Equations of the form $px = q$ (6.EE.7) are unknown-factor problems; the solution will sometimes be the quotient of a fraction by a fraction (6.NS.1).
- Solving problems by writing and solving equations (6.EE.7) involves not only an appreciation of how variables are used (6.EE.6) and what it means to solve an equation (6.EE.5) but also some ability to write, read and evaluate expressions in which letters stand for numbers (6.EE.2).
- Students must be able to place rational numbers on a number line (6.NS.7) before they can place ordered pairs of rational numbers on a coordinate plane (6.NS.8). The former standard about ordering rational numbers is much more fundamental.

Standards for Mathematical Practice

The 2011 framework introduces Standards for Mathematical Practice. These standards complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years. These standards are the same at all grades from Prekindergarten to 12th grade. These eight practices can be clustered into the following categories as shown in the chart below:

Habits of Mind of a Productive Mathematical Thinker: MP.1: Make sense of problems and persevere in solving them. MP.6: Attend to precision.	***Reasoning and Explaining***
	MP.2: Reason abstractly and quantitatively.
	MP.3: Construct viable arguments and critique the reasoning of others
	Modeling and Using Tools
	MP.4: Model with mathematics.
	MP.5: Use appropriate tools strategically.
	Seeing Structure and Generalizing
	MP.7: Look for and make use of structure.
	MP.8: Look for and express regularity in repeated reasoning.

The Standards for Mathematical Practice in Grade 6

The Pre-K – 12 Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. The following lists examples of what the practice standards look like in Grade 6.

Standards	*Explanations and Examples*
Students are expected to: **1. Make sense of problems and persevere in solving them**.	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?"
Students are expected to: **2. Reason abstractly and quantitatively.**	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.

Standards	*Explanations and Examples*
Students are expected to: **3. Construct viable arguments and critique the reasoning of others.**	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.
Students are expected to: **4. Model with mathematics.**	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.
Students are expected to: **5. Use appropriate tools strategically.**	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 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.
Students are expected to: **6. Attend to precision.**	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.

Standards	*Explanations and Examples*
Students are expected to: **7. Look for and make use of structure.**	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 3(2 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality), $c = 6$ by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving area and volume.
Students are expected to: **8. Look for and express regularity in repeated reasoning**.	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.

Organization of the Pre-Kindergarten to Grade 8 Content Standards in the 2011 framework

The Pre-Kindergarten through Grade 8 content standards are organized by **grade level**. Within each grade level, standards are grouped first by **domain**, and then are further subdivided into **clusters** of related standards.

- **Standards** define what students should understand and be able to do.
- **Clusters** are groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.
- **Domains** are larger groups of related standards. Standards from different domains may sometimes be closely related.

The table below shows which domains are addressed at each grade level from Prekindergarten through Grade 8. When the domain ends, it is expected that students will show mastery of that content by the end of that grade (i.e., Students should mastery in Counting and Cardinality by the end of Kindergarten).

Grade	Pre-K	K	1	2	3	4	5	6	7	8
Domains	Counting and Cardinality									
	Operations and Algebraic Thinking									
		Number and Operations in Base Ten								
					Number and Operations – Fractions					
							The Number System			
								Ratios and Proportional Relationships		
								Expressions and Equations		
										Functions
	Measurement and Data									
	Geometry									
								Statistics and Probability		

Standards Identifiers/Coding

Each standard has a unique identifier that consists of the grade level, (PK, K, 1, 2, 3, 4, 5, 6, 7, or 8), the domain code, and the standard number, as shown in the example below. The standard below is identified as **2.NBT.1**, identifying it as a Grade 2 standard in the Numbers in Base Ten domain, and as the first standard in that domain.
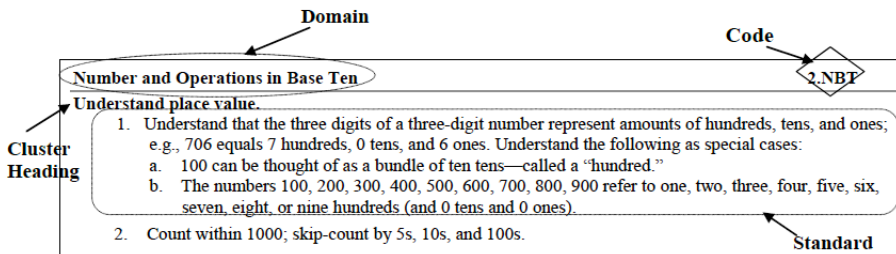
Unique Massachusetts Standards

Standards unique to Massachusetts are included in the appropriate domain and cluster and are initially coded by "MA." For example, the Massachusetts standard **MA.2.OA.2a** is identified with "MA" indicating a Massachusetts addition, "2" indicating a grade 2 standard, "OA" indicating the Operations and Algebraic Thinking domain, and "2a" indicating that it is a further specification to the second standard in that domain.

UNIT 1: *September 8 – October 2*
Chapter 1: Positive Numbers and the Number Line

Unit Notes:
- In lessons 1.4 and 1.5, cover squares and cubes and related vocabulary. Square roots and cube roots are covered in 8th grade (8.EE.2) and can be eliminated or used for enrichment.
- Students will work with number lines throughout the chapter. Keep in mind the importance of students understanding that all rational numbers are a point on the number line. (Students might present with difficulty drawing number lines with even intervals. Grid paper and rulers are suggested.)
- Students should also understand that whole numbers, fractions, and decimals can be represented in multiple ways.
- Students may struggle with vertical number lines. Try to make real world connections, such as height and temperature.

Standards:
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).*
  MA.6.NS.4a Apply number theory concepts, including prime factorization and relatively prime numbers, to the solution of problems.
Scope of standard:
- In 4th grade, students identified primes, composites and factor pairs (4.OA.4). In 6th grade students will find the greatest common factor of two whole numbers less than or equal to 100.
- Students also understand that the greatest common factor of two prime numbers is 1.
- Given various pairs of addends using whole numbers from 1-100, students should be able to identify if the two numbers have a common factor. If they do, they identify the common factor and use the distributive property to rewrite the expression. They prove that they are correct by simplifying both expressions.
Unit Consideration:
- To fully address this standard, address the Massachusetts-specific standard **MA.6.NS.4a**.

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.
Scope of standard:
- In this standard, students should apply their knowledge of integers in a real-world context. This standard gives students the opportunity to see the connection between the difference of two numbers and the distance between them on the number line.

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.

   6.NS.6a 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.

   6.NS.6b 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.

   6.NS.6c 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.

Scope of standard:
- In 6th grade, students extend the number line to represent all rational numbers and recognize that number lines may be either horizontal or vertical (i.e. thermometer) which facilitates the movement from number lines to coordinate grids.
- Students worked with Quadrant I in elementary school. As the *x*-axis and *y*-axis are extending to include negatives, students begin to work with the Cartesian Coordinate system.
- Students understand the relationship between two ordered pairs differing only by signs as reflections across one or both axes.

6.NS.7 Understand ordering and absolute value of rational numbers.

   6.NS.7a 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.*

Scope of standard:
- Comparing integers creates an informal experience with operations and lays the foundation for formal work with operations on integers in grade 7.
- The 2011 framework interprets inequality through relative position on the number line: larger numbers on the right (horizontal) or top (vertical) of the number line and smaller numbers to the left (horizontal) or bottom (vertical) of the number line

6.EE.1 Write and evaluate numerical expressions involving whole-number exponents.

   6.EE.2c 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 $A = 6s^2$ to find the volume and surface area of a cube with sides of length s = ½ .*

UNIT 2: *October 5 – October 16*
Chapter 2: Negative Numbers and the Number Line

Unit Notes:
- A big idea for students is that negative numbers are the opposite of positive numbers. Students should use this to idea to understand the meaning of integers and compare integers.
- Pay special attention to the – (negative) sign, which indicates directionality on the number line as well as an operation.
- Students will also develop a secure understanding of absolute value and apply it to real world problem solving.

Standards:
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.

   6.NS.6a   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.

6.NS.7   Understand ordering and absolute value of rational numbers.

   6.NS.7a   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.*

   6.NS.7b   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 $-7 °C$.*

   6.NS.7c   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.*

   6.NS.7d   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.*

Scope of standard:
- Although 6.NS.7a is limited to two numbers, 6.NS.7d expands the ordering of rational numbers to more than two numbers in context.

Unit 3: *October 19 – November 13*
Chapter 3: Multiplying and Dividing Fractions and Decimals

Unit Notes:
- Teach the standard algorithm for division. (This is a 6th grade standard, but is found in MiF 5th grade materials.) Students have divided using a place value method.
- Chapter 3 is a very important chapter as students are completing their understanding of fractions and decimals.
- Students will be expected to use fractions and decimals throughout the grade 6 curriculum. Use visual models and hands on activities to help build conceptual understanding. The progression moves students from considering whole numbers divided by proper fractions to larger fractions divided by fractions, and finally smaller fractions divided by larger fractions. Students look for a pattern as they find the solution to $1 \div a/b$.

Standards:
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 $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because 3/4 of 8/9 is 2/3. (In general, $(a/b) \div (c/d) = ad/bc$.) 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?*
Scope of the standard:
- The 2011 framework includes mixed numbers when referring to fractions in grade 6.
- Contexts and visual models can help students to understand quotients of fractions and begin to develop the relationship between multiplication and division.
- Building from familiar scenarios with whole or friendly number dividends or divisors can facilitate model development.
- Computing quotients of fractions builds upon and extends student understandings developed in Grade 5.

6.NS.2 Fluently divide multi-digit numbers using the standard algorithm.
Scope of standard:
- The Common Core defines *procedural fluency* as "skill in carrying out procedures flexibly, accurately, efficiently and appropriately."
  - In 4th grade, students were expected to fluently add and subtract multi-digit whole numbers using the standard algorithm.
  - In 5th grade, students were expected to fluently multiply multi-digit whole numbers using the standard algorithm.
  - In 6th grade, students are expected to fluently divide multi-digit numbers using the standard algorithm. This is the culminating standard for several years' worth of work with division of whole numbers.
- To fully master this standard, students should efficiently use the standard algorithm to use any number of digits for the divisor and dividend, and not limit them to just 4-digit dividends and 2-digit divisors.

6.NS.3 Fluently add, subtract, multiply and divide multi-digit decimals using the standard algorithm for each operation.
Scope of standard:
- The Common Core defines *procedural fluency* as "skill in carrying out procedures flexibly, accurately, efficiently and appropriately." Multiplication and division of decimals were introduced in 5th grade (decimals to the hundredth place).
- The use of estimation strategies supports student understanding of decimal operations.

UNIT 4: *November 16 – December 23*
Chapter 4 - Ratios

Unit Notes:
- Ratios are a key concept for grade 6.
- The use of visual models (bar models in particular) is essential for the development of conceptual understanding.
- Students should be able to describe ratio relationships and their meaning. It is important to focus on part-to-part and part to whole ratio relationships.
- To support struggling students, use resources from Grade 5 Chapter 7. You can also use paper strips or cubes along with bar models to help students visualize ratio relationships.

Standards:
6.RP.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."*

Scope of standard:
- Incorporate ratio language into instruction of fractions. Students should be able to describe fractions using the language of ratios: "For every _____, there are _____"

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.
    6.RP.3a 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.
    6.RP.3d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Scope of standard:
- Ratios and rates can be used in ratio tables and graphs to solve problems. Previously, students have used additive reasoning in tables to solve problems. To begin the shift to proportional reasoning, students need to begin using multiplicative reasoning. To aid in the development of proportional reasoning the cross-product algorithm is not expected at this level. When working with ratio tables and graphs, whole number measurements are the expectation for this standard.
- Previously, students have used additive reasoning in tables to solve problems. To begin the shift to proportional reasoning, students need to begin using multiplicative reasoning. To aid in the development of proportional reasoning, the cross-product algorithm is not expected at this level. When working with ratio tables and graphs, whole number measurements are the expectation for this standard.
- Students recognize the use of ratios, unit rate and multiplication in solving problems, which could allow for the use of fractions and decimals.
- A ratio can be used to compare measures of two different types, such as inches per foot, milliliters per liter and centimeters per inch. Students recognize that a conversion factor is a fraction equal to 1 since the numerator and denominator describe the same quantity.

UNIT 5: *January 4 – January 15*
Chapter 5: Rates

Unit Notes:
- Students should build on what they learned in Chapter 4 to make connections between Ratio and Rate.
- Students should understand that for a ratio *a*:*b*, the unit rate is a/b.

Standards:
6.RP.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0 (b not equal to zero), 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."* (*Expectations for unit rates in this grade are limited to non-complex fractions.)*

Scope of standard:
- A unit rate expresses a ratio as part-to-one, comparing a quantity in terms of one unit of another quantity. Common unit rates are cost per item or distance per time.
- At this level, students should use reasoning to find these unit rates instead of an algorithm or rule.

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.
    6.RP.3b 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?*

Scope of standard:
- Students recognize the use of ratios, unit rate and multiplication in solving problems, which could allow for the use of fractions and decimals.

UNIT 6: *January 19 – January 29*
Chapter 6: Percent

Unit Notes:
- Lesson 6.5 includes content from 7th grade (7.RP.3) and can be used as an extension.
- Lesson 6.4 - focus on sales tax and interest problems only
- This chapter continues to add depth of understanding of ratio and rate/unit rate. Students will explore percent of a number using multiple methods and visuals to support their understanding.
- Students need know how to convert between fractions and decimals, e.g. 8% = 8/100 and 0.08

Standards:
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.
    6.RP.3c   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.
Scope of standard:
- o Percentages are a rate per 100. Models, such as percent bars or 10×10 grids should be used to model percents. Students use ratios to identify percents.
- o Students will study solving multi-step problems involving percents in 7th grade.

UNIT 7: *February 1 – February 12*
Chapter 7: Algebraic Expressions

Unit Notes:
- Students will begin to build understanding that algebraic expressions can be used to describe situations. Use bar models and variables to represent unknown numbers and write algebraic expressions. Visuals can also be used to develop understanding of algebraic properties and how they can be used to produce equivalent algebraic expressions.
- Properties are introduced throughout elementary grades (3.OA.5); however, there has not been an emphasis on recognizing and naming the property. In 6th grade students, should be able to apply the properties and identify them by name.

Standards:
6.EE.2 Read, write, and evaluate expressions in which letters stand for numbers.
    6.EE.2a Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as $5 - y$.*
    6.EE.2b 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.*
    6.EE.2c Evaluate expressions at specific values for their variables. Include expressions that arise from formulas 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 $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = ½$*

Scope of the standard:
- Students use appropriate mathematical language to write verbal expressions from algebraic expressions. Students should read algebraic expressions in a manner that reinforces that variables represent numbers.
- Students can describe expressions such as $3(2 + 6)$ as the product of two factors: 3 and $(2 + 6)$. The quantity $(2 + 6)$ is viewed as one factor consisting of two terms.
- Terms are the parts of a sum. When the term is an explicit number, it is called a constant. When the term is a product of a number and a variable, the number is called the coefficient of the variable.
- Students should identify the parts of an algebraic expression including variables, coefficients, constants, and the names of operations (sum, difference, product, and quotient). Variables are letters that represent numbers. There are various possibilities for the number they can represent.
- Students write expressions from verbal descriptions using letters and numbers, understanding order is important in writing subtraction and division problems. Students understand that the expression "5 times any number, *n*" could be represented with $5n$ and that a number and letter written together means to multiply.
- All rational numbers may be used in writing expressions when operations are not expected.

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 $3y$.*
Unit Considerations:
Students should distinguish between and expression as a quantity, such as $8n$, versus an equation, such as
    $8n + 3 = 19$.

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.*

Scope of standard:
- Students demonstrate an understanding of like terms as quantities being added or subtracted with the same variables and exponents. For example, $3x + 4x$ are like terms and can be combined as $7x$; however, $3x + 4x^2$ are not like terms since the exponents with the x are not the same.

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.

Scope of standard:
- Students write expressions to represent various real-world situations. Given a contextual situation, students define variables and write an expression to represent the situation.
- No solving is expected with this standard; however, 6.EE.2c does address the evaluating of the expressions.
- Connecting writing expressions with story problems and/or drawing pictures will give students a context for this work. It is important for students to read algebraic expressions in a manner that reinforces that the variable represents a number.

UNIT 8: *February 22 – March 11*
Chapter 8: Equations and Inequalities

Unit Notes:
- Students should develop a very solid understanding of one-step equations and have the ability to write an equation to represent a real world situation.
- Use models to help students make connections and form a visual representation. Spend time on inequalities after students have a solid understanding of algebraic expressions and equations.

Standards:
6.EE.2   Read, write, and evaluate expressions in which letters stand for numbers.

> **6.EE.2c** 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 $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = ½$.*

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.

Scope of standard:
- In elementary grades, students explored the concept of equality. In 6th grade, students explore equations as expressions being set equal to a specific value. The solution is the value of the variable that will make the equation or inequality true. Students use various processes to identify the value(s) that when substituted for the variable will make the equation 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.

Scope of standard:
- Students have used algebraic expressions to generate answers given values for the variable. This understanding is now expanded to equations where the value of the variable is unknown but the outcome is known. For example, in the expression, $x + 4$, any value can be substituted for the x to generate a numerical answer; however, in the equation $x + 4 = 6$, there is only one value that can be used to get a 6.
- Problems should be in context when possible and use only one variable.
- Students write equations from real-world problems and then use inverse operations to solve one-step equations based on real world situations.
- Equations may include fractions and decimals with non-negative solutions.
- Beginning experiences in solving equations require students to understand the meaning of the equation and the solution in the context of the problem.

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 solution of such inequalities on number line diagrams.

Scope of standard:
- Many real-world situations are represented by inequalities. Students write inequalities to represent real world and mathematical situations. Students use the number line to represent inequalities from various contextual and mathematical situations.
- Students recognize that possible solutions can include fractions and decimals, which are represented on the number line by shading.

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.*

Scope of standard:
• Relationships should be proportional with the line passing through the origin.
• The purpose of this standard is for students to understand the relationship between two variables, which begins with the distinction between dependent and independent variables.
• Students recognize that not all data should be graphed with a line. Data that is discrete would be graphed with coordinates only. Discrete data is data that would not be represented with fractional parts such as people, tents, records, etc. A line is drawn when both variables could be represented with fractional parts.
• Students are expected to recognize and explain the impact on the dependent variable when the independent variable changes (As the *x* variable increases, how does the *y* variable change?)
• Additionally, students should be able to write an equation from a word problem and understand how the coefficient of the dependent variable is related to the graph and /or a table of values.
• Students can use many forms to represent relationships between quantities. Multiple representations include describing the relationship using language, a table, an equation, or a graph. Translating between multiple representations helps students understand that each form represents the same relationship and provides a different perspective.

UNIT 9: *March 14 – March 21*
Chapter 9: The Coordinate Plane

Unit Notes:
- Students will graph points in all four quadrants. Students to will use this information to solve problems involving the distance between two points on the coordinate plane.
- Review how to use symbolic notation to label points, line segments, and vertices.

Standards:
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.

   6.NS.6c   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.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.

Scope of standard:
- Students find the distance between points when ordered pairs have the same x-coordinate (vertical) or same y-coordinate (horizontal). Coordinates could also be in two quadrants and include rational numbers.

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.

   6.RP.3a   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.

   6.RP.3b   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?*

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.EE.2c   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 $A = 6s^2$ to find the volume and surface area of a cube with sides of length s = ½ .*

UNIT 10: *March 22 – April 6*
Chapter 10: Area of Polygons and Chapter 11.1 & 11.2 Circumference and Area of a Circle

Unit Notes:
- Students will build a strong understanding of area of triangles and how to find the base and height of all types of triangles.
- Students will use their understanding of the area of rectangles and triangles to calculate the area of other figures. Encourage students to make connections while exploring the formulas. It is important that students recognize how to decompose a shape and find the area of composite figures.
- Circles: Use Lessons 11.1 & 11.2 only. Use 11.3 for extension.

Standards:
6.EE.2 Read, write, and evaluate expressions in which letters stand for numbers.
> **6.EE.2c** 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 $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$.*

6.G.1 Find 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.
> **MA.6.G.1a** Use the relationship between radius, diameter, and center of a circle to find the circumference and area.
> **MA.6.G.1b** Solve real-world and mathematical problems involving the measurements of circles.

Scope of standard:
- Students continue to understand that area is the number of squares needed to cover a plane figure. Students should have an understanding of why the area formula works and how the formula relates to the measure (area) and the figure. This understanding should be for all students.
- Finding the area of triangles is introduced in relationship to the area of rectangles – a rectangle can be decomposed into two congruent triangles.
- Students decompose shapes into rectangles and triangles to determine the area.
- Special quadrilaterals include rectangles, squares, parallelograms, trapezoids, rhombi, and kites.

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.

UNIT 11: *April 7 – April 15*
Chapter 12: Surface Area and Volume of Solids

Unit Notes:
- Use nets made up of rectangles and triangles to help visualize surface area.
- Focus understanding of volume using right rectangular prisms.
- Students will calculate volume using unit cubes and using the formula $V = Bh$. Give students time to explore some of the more complex problems. Provide scaffolding (graph paper, cubes, formulas, visuals) to help all students to access the problem solving.
- Use Lesson 12.3 as extension.

Standards:
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 $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

Scope of standard:
- Previously students calculated the volume of right rectangular prisms (boxes) using whole number edges. The use of models was emphasized as students worked to derive the formula $V = Bh$ (5.MD.3, 5.MD.4, 5.MD.5)
- Students need multiple opportunities to measure volume by filling rectangular prisms with blocks and looking at the relationship between the total volume and the area of the base. Through these experiences, students derive the volume formula ($V = Bh$).
- In addition to filling boxes, students can draw diagrams to represent fractional side lengths, connecting with multiplication of fractions. This process is similar to composing and decomposing two-dimensional shapes.

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.

Scope of standard:
- Students represent three-dimensional figures whose nets are composed of rectangles and triangles. Students recognize that parallel lines on a net are congruent. Using the dimensions of the individual faces, students calculate the area of each rectangle and/or triangle and add these sums together to find the surface area of the figure.
- Students construct models and nets of three-dimensional figures, describing them by the number of edges, vertices, and faces.
- Solids include rectangular and triangular prisms.
- Students are expected to use the net to calculate the surface area.
- Students also describe the types of faces needed to create a three-dimensional figure. Students make and test conjectures by determining what is needed to create a specific three-dimensional figure.

6.EE.1 Write and evaluate numerical expressions involving whole-number exponents.

   6.EE.2c   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 $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$.*

UNIT 12: *April 25 – May 2*
Chapter 13: Introduction to Statistics

Unit Notes:
- Begin to explore statistical variability. Discuss different types of statistical questions and the data produced. Summarize and collect data accurately and display data in line plots, dot plots, and histograms. Spend time interpreting graphs.

Standards:
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.*
Scope of standard:
- Statistics are numerical data relating to an aggregate of individuals; statistics is also the name for the science of collecting, analyzing and interpreting such data. A statistical question anticipates an answer that varies from one individual to the next and is written to account for the variability in the data. Data are the numbers produced in response to a statistical question. Data are frequently collected from surveys or other sources (i.e. documents).

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.
Scope of standard:
- The distribution is the arrangement of the values of a data set. Distribution can be described using center (median or mean), and spread. Data collected can be represented on graphs, which will show the shape of the distribution of the data. Students examine the distribution of a data set and discuss the center, spread and overall shape with dot plots, histograms, and box plots.

6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
    MA.6.SP.4a   Read and interpret circle graphs.
Scope of standard:
- Histograms and box plots are new at this grade level. Instruction of stem-and-leaf plots is no longer included in this unit.
- Students are expected to be able to determine the appropriate graph to use to display data as well as read data from graphs generated by others.

6.SP.5   Summarize numerical data sets in relation to their context, such as by:
    6.SP.5a   Reporting the number of observations.
    6.SP.5b   Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
    6.SP.5d   Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.

UNIT 13: *May 3 – May 17*
Chapter 14: Measures of Central Tendency

Unit Notes:
- **After completing this chapter, complete the "Online Common Core Additional Resources for Course 1"**
- As part of understanding statistical thinking, students need to explore mean, median, and mode to help summarize data. The focus in 6th grade CCSS is on understanding the meaning of summary data as it relates to variability.

Standards:
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.
Scope of standard:
- The distribution is the arrangement of the values of a data set. Distribution can be described using center (median or mean), and spread. Data collected can be represented on graphs, which will show the shape of the distribution of the data. Students examine the distribution of a data set and discuss the center, spread and overall shape with dot plots, histograms, and box plots.

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.
Scope of standard:
- Data sets contain many numerical values that can be summarized by one number such as a measure of center. The *measure of center* gives a numerical value to represent the center of the data (ie. midpoint of an ordered list or the balancing point). Another characteristic of a data set is the variability (or spread) of the values. *Measures of variability* are used to describe this characteristic.

6.SP.4   Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
    MA.6.SP.4a   Read and interpret circle graphs.
Scope of standard:
- Histograms and box plots are new at this grade level. Instruction of stem-and-leaf plots is no longer included in this unit.
- Students are expected to be able to determine the appropriate graph to use to display data as well as read data from graphs generated by others.

    6.SP.5 Summarize numerical data sets in relation to their context, such as by:
6.SP.5a   Reporting the number of observations.
6.SP.5c   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 was gathered.
6.SP.5d   Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.
Scope of standard:
- Interquartile Range (IR) and Mean Absolute Deviation (MAD) are new at this grade level.
- The use of mean absolute deviation in 6th grade is mainly exploratory. The intent is to build a deeper understanding of variability. Students should understand the mean distance between the pieces of data and the mean of the data set expresses the spread of the data set. Students should see that the larger the mean distance, the greater the variability.

Final Exam & End of Year Project
May 18 – June 21

Cumulative review projects of content convered in 6th grade. Examples of topics that students could benefit from in-depth work: percents, fractions, geometry, e.g.