Mathematics

Fairfield Public Schools

Transition to Pre-Algebra

TRANSITION TO PRE-ALGEBRA

Critical Areas of Focus

In the Transition to Pre-Algebra course, the instructional time should focus on six critical areas: (1) completing the understanding of division of fractions; (2) connecting ratio and rate to whole number multiplication and division, and using concepts of ratio and rate to solve problems, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; (4) developing understanding of statistical thinking, (5) extending the concept of area to surface area and volume, and (6) and extending the notion of number to the system of rational numbers for all operations.

1. 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.

2. Students use reasoning for multiplication and division to solve ratio and rate problems involving 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. 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.

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 numbers, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that there are 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.

5. Students in Transition to Pre-Algebra 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.

6. Students develop a unified understanding of numbers, 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.

Pacing Guide								
1st Marking Period			2nd Marking Period		3rd Marking Period			4th Marking Period
September	October	November	December	January	February	March	April	May	June
Unit 1 **Operating with Positive Rational Numbers** 5 weeks	Unit 2 **Using Expressions and Equations** 2 weeks	Unit 3 **Applications of Geometry** 3 weeks	Unit 4 **Ratios and Rates** 3 weeks	Unit 5 **Understanding Positive and Negative Numbers** 4 weeks	Unit 6 **Algebraic Reasoning** 5 weeks	Unit 7 **Statistics and Distribution** 5 weeks	Unit 8 **Operating with Rational Numbers** 6 weeks	Unit 9 **Proportional Relationships** 4 weeks	

Course Overview		
Central Understandings Insights learned from exploring generalizations through the essential questions. (Students will understand that…) • Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technologies. • Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies. • Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technologies. • Data can be analyzed to make informed decisions using a variety of strategies, tools, and technologies.	**Essential Questions** • How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? • How are quantitative relationships represented by numbers? • How do geometric relationships and measurements help us to solve problems and make sense of our world? • How can collecting, organizing and displaying data help us analyze information and make reasonable and informed decisions?	**Assessments** • Formative Assessments • Summative Assessments

Content Outline	**Standards**
I. Unit 1 – Operating with Positive Rational Numbers II. Unit 2 – Understanding Positive and Negative Numbers III. Unit 3 – Applications of Geometry IV. Unit 4 – Ratios and Rates V. Unit 5 – Using Expressions and Equations VI. Unit 6 – Algebraic Reasoning VII. Unit 7 – Statistics and Distributions VIII. Unit 8 – Operating with Rational Numbers IX. Unit 9 – Two and Three Dimensional Geometry	Connecticut Common Core State Standards are met in the following areas: • ***Ratios and Proportional Relationships*** • ***The Number System*** • ***Expressions and Equations*** • ***Geometry*** • ***Statistics and Probability***

Grade Six Standards for Mathematical Practice

The K-12 Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. This page gives examples of what the practice standards look like at the specified grade level. Students are expected to:

Standards	*Explanations and Examples*
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?"
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.
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.
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.
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.
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.
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.
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.

Unit 1 – Operating with Positive Rational Numbers, 6 weeks top

The overall goal of this unit is to develop meaning for and skill with rational numbers, i.e., fractions and decimal operations. By the completion of this unit, students should know multiplication and division with fractions and the standard algorithm for the division of decimals. This does not mean to teach a specific or preferred algorithm for fraction and decimal operations. Problem contexts and concrete materials can support students in generating strategies for working with fractions that make sense to them. It is not enough for students to simply memorize an algorithm; they must also understand and be able to explain where it comes from. When students develop their own strategies, they understand them better and are able to apply them to other situations. As students develop ideas about a particular operation, the teacher can pull together their strategies to support them in developing an efficient algorithm, both for the division of decimals and for the multiplication and division of fractions.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Rational numbers allow us to make sense of situations that involve numbers that are not whole. • A general algorithm exits for dividing decimals. This algorithm is broadly applicable and reasonably efficient.	• How do you use exponents to represent numbers? • How do you divide multi-digit numbers? • How do you divide fractions? • How do you add and subtract decimals? • How do you multiply decimals? • How do you divide decimals? • How do you find and use the greatest common factor of two whole numbers? • How do you find the least common multiple of two numbers?

Common Core State Standards

THE NUMBER SYSTEM

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

6.NS.1

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

Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.2

Fluently divide multi-digit numbers using the standard algorithm.

6.NS.3

Fluently add, subtract, multiply and divide multi-digit decimals using the standard algorithm for each operation.

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*).

EXPRESSIONS AND EQUATIONS

Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE.1

Write and evaluate numerical expressions involving whole-number exponents.

Unit 2 – Using Expressions and Equations, 5 weeks top

This unit is the foundational building block for students as they will be introduced to Algebraic concepts in the next unit, and also in grade seven and eight, when the students learn how to solve equations. In this unit, students build on their understanding of numerical operations from elementary school. Students will be introduced to the concept of exponents and the order of operations. Understanding these concepts allow the student to transition to Algebraic thinking. The concept of a variable is introduced as students begin to understand how solving problems can become more efficient with the representation of an unknown value.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Expressions are foundational for Algebra; they serve as building blocks for work with equations and functions. • Variables are tools for expressing mathematical ideas clearly and concisely. They have many different meanings, depending on the context and purpose.	• How can you use variables and constants to write algebraic expressions? • How do you identify and describe parts of an expression? • How do you evaluate expressions? • How can you identify and write equivalent expressions?

Common Core State Standards

EXPRESSIONS AND EQUATIONS

Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE.2

Write, read, 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 of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of lengths = 1/2.*

6.EE.3

Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*

6.EE.4

Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*

Reason about and solve one-variable equations and inequalities.

6.EE.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.

Unit 3 – Applications of Geometry, 3 weeks top

In this unit, the overarching goal is to help students understand what it means to measure. Students should study two kinds of measurements in depth: perimeter and area, and begin their study of a third kind of measurement, volume, with right rectangular prisms.

The unit should build on students' prior experiences in studying perimeter and area of rectangles (grade 4) and extend that foundation to finding the perimeter and area of non-rectangular shapes. The distinction between area and perimeter needs to be part of the on-going conversation throughout the unit, with students investigating the possible perimeters a rectangle can have if the area is fixed, and the possible areas of a rectangle if the perimeter is fixed. Too strong an emphasis on formulas for finding measures, prior to building students' understanding of the meaning of the measurement procedures can cause confusion. While students can become adept at plugging numbers into formulas, they often have a hard time remembering which formula does what. This is often because they have an incomplete fundamental understanding of what the measurement is about and how the formula captures their more informal, intuitive computations.

As students move through the unit, they should be asked to investigate the area of polygon shapes by covering them with grid paper and counting the number of squares needed to cover a shape. Through a carefully selected and organized set of experiences, students should come to see patterns and develop their own rules/formulas for finding area and perimeter of triangles, parallelograms, and other shapes that can be decomposed into rectangles and triangles. Finding the volume of rectangular prisms is first developed in 5th grade. The extension in grade 6 is to have students find the volume when the lengths of the sides of a rectangular prism have fractional side lengths. In addition, the unit should introduce the study of surface area of prisms made from triangles and rectangles, through experiences that ask students to design nets to wrap containers.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Representation of geometric ideas and relationships allows multiple approaches to geometric problems and connects geometric interpretations to other contexts. • Area represents the space enclosed by a 2-dimentional figure. • Volume represents the space enclosed by a 3-dimentional object.	• How do you find the area of a triangle? • How can you find the areas of parallelograms, rhombi, and trapezoid? • How can you find the area of a polygon by breaking it into simpler shapes? • How can you solve problems by drawing polygons in the coordinate plane? • How do you find the volume of a rectangular prism? • How can you use nets to find surface areas?

Common Core State Standards

GEOMETRY

Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.1

Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G2
Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

6.G.3
Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

6.G.4
Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Unit 4 – Ratios and Rates, 4 weeks top

Relationships between fractions, decimals, and percents are developed in this unit. Students learn how these forms are related to one another and make decisions about when to use each form. Various models such as fraction strips, percent bars, and number lines are used to develop conceptual understanding. There is an emphasis on understanding and applying these relationships to solve real-world problems such as unit rate, measurement conversions, constant rate, and comparison of quantities. Fractions are viewed as rates, ratios, or parts of a proportion to provide underpinnings needed in seventh grade for work with proportional reasoning.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Reasoning with ratios involves attending to and coordinating two quantities. • A ratio is a multiplicative comparison of two quantities, or is it a joining of two quantities in a composed unit. • A number of mathematical connections link ratios and fractions. • Ratios can be meaningfully reinterpreted as quotients. • A proportion is a relationship of equality between two ratios. In a proportion, the ratio of two quantities remains constant as the corresponding values of the quantities change.	• How do you write ratios and equivalent ratios? • How can you use tables and graphs to understand ratios? • How can you use unit rates to solve problems and make comparisons? • How are percents related to fractions and decimals? • How do you use percents to solve problems? • How can you use ratios to convert measurements?

Common Core State Standards

RATIOS AND PROPORTIONAL RELATIONSHIPS

Understand ratio concepts and use ratio reasoning to solve problems.

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."*

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. *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.)*

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.RP.3c Find a percent of a quantity as a rate per 100 (e.g., 30 percent of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. **6.RP.3d** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Unit 5 – Understanding Positive and Negative Numbers, 3 weeks top

Students have studied operations with whole numbers, fractions, and decimals in previous grades and also in previous units in grade six. In this unit, students should extend this understanding to negative numbers. Exploring ideas about negative numbers is also building and connecting to what students already know. It will not only help develop understandings of negative numbers, but also deepen understanding of meaning of positive numbers. Doing this will require students making meaning of what kinds of situations call for using negative numbers.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Integers are useful for noting relative changes or values.	• How are positive and negative numbers represented on a number line? • How do you compare and order positive and negative numbers? • How do you find and use absolute value? • How do you locate and name points in the coordinate plane? • How do you find the distance between two points in the coordinate plane?

Common Core State Standards

THE NUMBER SYSTEM

Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.5

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

6.NS.6

Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

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.

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.*

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.

Unit 6 – Algebraic Reasoning, 6 weeks top

In this unit, students should be engaged in experiences and activities that explore a variety of situations in which change occurs; situations in which change is predictable and others in which it is not. Learning to observe, describe, and record changes is the focus of this unit. The unit should provide the basis for future middle grades study of algebra (such as linear relationships in 7th grade and exponential growth in 8th).

The relationship between two variables, in particular the way in which one variable changes in relation to another, is an important idea in mathematics. "Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation", as stated in CCSS, is not only a central goal of this unit of study but lays the groundwork for students' understanding of function, and much later, concepts in calculus. The goal of this unit is to help students develop methods for representing relationships and patterns of change. Verbal descriptions, tables, and graphs are central representations that students should become comfortable with during this unit. Towards the end of the unit, written and symbolic expressions and equations and inequalities should be introduced.

The unit should start with students exploring three ways to represent changing situations: describing an event narratively, using a data table to record the changes in two variables, and using a graph that also shows the changes in two variables. Students should begin to recognize that each representation has its advantages and disadvantages in promoting understanding of a situation and patterns of change. In the second half of the unit, the focus should be on searching for and verbalizing patterns of change that relate one variable to another. The last part of the unit should introduce symbolic expression and equations as a shorter quicker way to give a written summary and the relationship between two variables.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• The equal sign indicates that two expressions are equivalent. It can also be used in defining or naming a single expression or function rule. • A general algorithm exits for solving linear equations. This algorithm is broadly applicable and reasonably efficient. • Linear equations can be solved by symbolic, graphical, and numerical methods; on some occasions and in some contexts, one solution method may be more elegant, efficient, or informative than others.	• How do you determine whether a number is a solution of an equation? • How do you solve equations that contain addition or subtraction? • How do you solve equations that contain multiplication or division? • How can you use equations, tables, and graphs to represent relationships between two variables?

Common Core State Standards

EXPRESSIONS AND EQUATIONS

Reason about and solve one-variable equations and inequalities.

6.EE.5

Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if an, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.6

Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7

Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

6.EE.8

Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

Represent and analyze quantitative relationships between dependent and independent variables.

6.EE.9

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

Unit 7 – Statistics and Distribution, 6 weeks top

Students in prior grades spent time gathering data in terms of learning the various concepts of measurement. In grade 6, the student expands on the ideas from prior grades and shifts the focus to statistical thinking. Students will gather data to learn the basic concepts of the measures of central tendency, i.e., mean, median, mode, range, interquartile range, etc. Students should understand the appropriate use of each concept and how to apply them to various data sets. Students will use various displays of data to help understand the meaning of data (Number line, Dot plot, Histogram, and Box plot). This unit will build the foundation for further investigations of statistics and probability in grades seven and eight.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Statistics are a useful way to find the meaning behind the data.	• How can you summarize and display numerical data? • How can you use measures of center to describe a data set? • How can you use measures of variability to describe a data set?

Common Core State Standards

STATISTICS AND PROBABILITY

Develop understanding of statistical variability.

6.SP.1
Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*

6.SP.2
Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.3
Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Summarize and describe distributions.

6.SP.4
Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.5
Summarize numerical data sets in relation to their context, such as by:

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.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 were 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 were gathered.

Unit 8 – Operating with Rational Numbers, 6 weeks top

Students have studied operations with whole numbers, fractions, and decimals in previous grades. In this unit, students should extend this understanding to operations with negative numbers for addition and subtraction. Exploring ideas about negative numbers by building and connecting to what students already know will not only help develop understandings of negative numbers, but also deepen understanding of meaning and operations of positive numbers, Doing this will require students making meaning of the operations and analyzing what kinds of situations call for which operation.

Students come to this unit having already informally experienced positive and negative numbers in their everyday lives—temperatures in winter dropping below zero, TV game shows in which participants lose points if they answer incorrectly, and sports teams being ahead or behind by some amount. This unit recommends exploring situations that require students to reason and represent with integers. Number lines offer a wonderful model for developing understanding of order, for comparing integers, as well as for developing the concept of opposites, distances, and absolute value. The number line can also be used to model addition and subtraction.

The inverse relationship between addition and subtraction need to be addressed to help students generalize algorithms for the operations as well as looking at number patterns. Asking questions about meaning and about what makes sense will help focus students' attention on the situation, the operation and connections.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Solving a system equation can be done with tables, graphs and equations. • The different methods to solve a system of equations can be more efficient than others, based on the situation and context.	• How can situations be modeled as a system of linear equations and how to find solutions using all constraints? • What does it mean when the graphs of two functions intersect? • What method is most appropriate solve a system of equations (table, graph, or equation)?

Common Core State Standards

THE NUMBER SYSTEM

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

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.

7.NS.1a

Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*

7.NS.1b

Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

7.NS.1c
Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

7.NS.1d
Apply properties of operations as strategies to add and subtract rational numbers.

7.NS.2
Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a
Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

7.NS.2b
Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then –(p/q) = (–p)/q = p/(–q). Interpret quotients of rational numbers by describing real world contexts.

7.NS.2c
Apply properties of operations as strategies to multiply and divide rational numbers.

7.NS.2d
Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

7.NS.3
Solve real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)

Unit 9 – Proportional Relationships, 5 weeks top

Students studied rates and ratios in earlier in sixth grade. In this unit, students reason proportionally. They use ratios as a basis of comparison between two sets of data. They observe related data in the form of a table and look for patterns connecting these data values. Plotting the paired data points to see a graphical representation, and writing an equation that shows the relationship of the data in the table further strengthens this understanding. When the change observed in the table is constant, students connect to a linear graph. This demonstrates a proportional relationship across multiple representations and deepens the understanding of these characteristics. The unit rate studied in grade six is now a focus of rate of change used in writing linear equations in grade seven.

Other concepts in this unit include solving problems to find an unknown part of a proportion and applying proportional reasoning to real-world contexts. Students think proportionally in such situations as calculating sales tax, interest, and commissions; scale drawings; and unit pricing.

Big Ideas The central organizing ideas and underlying structures of mathematics	**Essential Questions**
• Reasoning with ratios involves attending to and coordinating two quantities. • Ratios are often expressed in fraction notation, although ratios and fractions do not have identical meaning. • Ratios are often used to make "part-to-part" comparisons, but fractions are not. • Equivalent ratios can be created by iterating and/or partitioning a composed unit. • A rate is a set of infinitely many equivalent ratios. • Several ways of reasoning, all grounded in sense making, can be generalized into algorithms for solving proportion problems. • A proportion is a relationship of equality between two ratios.	• How do you find and compare unit rates? • How can you use tables and equations to identify and describe proportional relationships? • How can you use graphs to represent and analyze proportional relationships? • How do you use percents to solve problems?

Common Core State Standards

RATIOS AND PROPORTIONAL RELATIONSHIPS

Analyze proportional relationships and use them to solve real-world and mathematical problems.

7.RP.1

Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks ½ mile in each ¼ hour, compute the unit rate as the complex fraction ½ to ¼ miles per hour, equivalently 2 miles per hour.*

7.RP.2

Recognize and represent proportional relationships between quantities.

7.RP.2a

Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

7.RP.2b

Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c

Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as* $t = pn$.

7.RP.2d

Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.

7.RP.3

Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*