Orange East Supervisory Union **Dec 2019**
Mathematics: Grade 7

Grade Seven Mathematics Focus: Proportional Relationships; Operations with Rational Numbers; Expressions and Linear Equations

Make connections between models for whole numbers and integer; Look for and identify multiplicative relationships in tables and diagrams; Focus on the meaning of the quantities in a situation.

Ratios and Proportional Relationships

Common Core State Standards

- 7.RP.A.1 - Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
- 7.RP.A.2 - Recognize and represent proportional relationships between quantities.
  - 7.RP.A.2.A - Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
  - 7.RP.A.2.B - Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
  - 7.RP.A.2.C - Represent proportional relationships by equations.
  - 7.RP.A.2.D - Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
- 7.RP.A.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.

Unit Name:	**Enduring Understanding** ● Unit rates are used in the real world every day ● Comparing quantities can describe the relationship between them ● Understand the use of estimation to determine reasonableness, when solving percent word problems	**Essential Questions** ● When and why do I use proportional comparisons and reasoning? ● How can we represent proportionality and rate of change? ● How do proportions relate to percentages? ● Can money grow? ● How can we measure accuracy of predictions?
Knows: ● Graphs of proportional relationships pass through the origin ● Direct variation can be modeled by y = kx , where k is the constant of proportionality ● When and why proportional	**Understands:** ● Proportions are two ratios that are equal in value ● Proportional relationships express how quantities change in relationship to each other and when graphed, form a straight line through the origin ● Realize that a specific point (x,y) on a linear graph represents a rate and the	**Does:** ● Use rates to describe real-life problems ● Find ratios, rates, and unit rates from a situation, table or graph ● Determine if two ratios form a proportion ● Determine if two variables form a proportional relationship ● Write and solve proportions using a variety of strategies ● Find and interpret the slope of a

relationships can be used to convert between units of measurement ● Proportional relationships can be used to solve applications including determining similarity ● The information needed to calculate percent error	point (1,r) represents the unit rate ● Proportional relationships are made up of equivalent ratios therefore, in proportions, unknowns can be determined by applying cross products to set up and solve an equation ● Percents are used in the real world for a variety of situations, including discounts, sales tax, tip, markup, and markdown ● Percent decreases and increases are measures of percent change, which is a relative measure based on absolute change ● Percent literally means “per 100” and can be represented as a ratio with 100 as the denominator ● When to use algebraic expressions and equations to solve multi-step percent problems ● More than 100% of a quantity will yield more than the given quantity and less than 100% of a quantity will yield less than the given quantity	line ● Determine if two variables show direct variation ● Convert percents to decimals and decimals to percents ● Use the percent proportion and equation to find parts, wholes, and percents ● Find percent increase and decrease in real world situations ● Compute unit rates for ratios and rates specified by rational numbers ● Determine if a relationship is proportional or non-proportional and represent them in multiple ways ● Use proportions to convert between units of measurement ● Solve simple interest problems
Essential Vocabulary: ratio, rate, unit rate, complex fraction, proportion, proportional, cross products, slope, direct variation, constant of proportionality, percent of change, percent of increase, percent decrease, percent error, discount, markup, interest, principal, simple interest		

Expressions & Equations

Common Core State Standards

- 7.EE.A.1 - Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.A.2 - Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.
- 7.EE.B.3 - Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
- 7.EE.B.4 - Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
    - 7.EE.B.4.A - Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
    - 7.EE.B.4.B - Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and

r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.		
Unit Name: **Expressions & Equations**	**Enduring Understanding** ● The symbolic language of algebra is used to communicate and generalize the patterns and relationships in the real world. ● The equal sign means two expressions represent the same value. ● The inequality signs means that there might be more than one number that satisfies the two expressions. ● Thinking algebraically is different from thinking arithmetically. ● Equations, tables, and graphs are related.	**Essential Questions** ● How are real world problems represented by the formation and solution of linear equations? ● What information does the equation of a line give you and what does the slope indicate about the line? ● How can we simplify equations, using the number properties, before looking for a solution? ● How should we deal with negative coefficients, when solving inequalities and how do we graph solutions to multi-step inequalities? ● What is meant by equality, inequality and what happens when two sides of an equation are not equal?
Knows: ● Like terms have the same variables and powers ● Inverse operations undo each other. ● Properties of equalities (addition, subtraction, multiplication, and division) ● Difference between equation and inequality ● Open circle is used to graph inequalities with < , >, while closed circle is used to graph inequalities with ≤, ≥ ● Which direction to shade for inequality ● Properties of	**Understands:** ● Equations and inequalities may be used as models to solve mathematical and real-world problems ● Variables represent one number and any given solution may be checked for precision. ● In solving an inequality, multiplying or dividing both expressions by a negative number reverses the sign that indicates the relationships between the two expressions ● Ratios can be used to show a relationship between changing quantities, such as vertical and horizontal change ● A line on a graph can be represented by a linear equation ● The relationship between two lines can be determined by comparing their slopes and y-intercepts ● Algebra often uses number properties to create an equivalent expression or equation in order to solve a problem	**Does:** ● Find and compare the absolute value of integers. ● Add, subtract, multiply and divide integers. ● Use the number line to order rational numbers. ● Convert decimals to fractions and fractions to decimals. ● Add, subtract, multiply, and divide rational numbers including fractions, mixed numbers, and decimals. ● Identify like terms. ● Simplify an algebraic expression using the distributive property and combining like terms. ● Add and subtract linear expressions. ● Solve one-step linear equations using addition, subtraction, multiplication or division (equations may have fractions or decimals). ● Solve two-step linear equations. ● Write an inequality to describe a situation. ● Determine if a given value is a solution to an inequality. ● Represent the solution to an equality graphically. ● Solve one- and two-step linear inequalities. ● Show relationships between

inequalities (addition, subtraction, multiplication, and division)		quantities using ratios. ● Use commutative, associative, and distributive properties to solve equations.
Essential Vocabulary: like terms, simplest form, linear expressions, factoring an expression, equivalent equations, inequality, solution of an inequality, solution set, graph of an inequality		

The Number System		
Common Core State Standards ● 7.NS.A.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.A.1.A - Describe situations in which opposite quantities combine to make 0. ○ 7.NS.A.1.B - Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. ○ 7.NS.A.1.C - Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. ○ 7.NS.A.1.D - Apply properties of operations as strategies to add and subtract rational numbers. ● 7.NS.A.2 - Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. ○ 7.NS.A.2.A - Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. ○ 7.NS.A.2.B - Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts. ○ 7.NS.A.2.C - Apply properties of operations as strategies to multiply and divide rational numbers. ○ 7.NS.A.2.D - Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. ● 7.NS.A.3 - Solve real-world and mathematical problems involving the four operations with rational numbers.		
Unit Name:	**Enduring Understanding** ● A relationship exists between positive and negative numbers ● Numerical representations can be used to describe and compare the value of real-world quantities ● Absolute value of a number is the number's distance from zero on a number line.	**Essential Questions** ● How can we predict whether the answer of two integers within the four operations will be positive or negative? ● What is the difference between the opposite and the absolute value of a number? ● How can concrete and pictorial models represent operations with integers? ● How can any difference a – b of two rational numbers be restated as an equivalent addition statement?

		● What is the difference between repeating and terminating decimal?
Knows: ● Difference between rational and irrational numbers ● To calculate the sum of two numbers with the same signs, add the absolute value of the numbers and keep the sign ● To calculate the sum of two numbers with different signs, subtract the absolute value of the numbers and keep the sign on the greater number ● Products and quotients of rational numbers with the same signs are positive ● Products and quotients of rational numbers with different signs are negative ● Every point on a line corresponds to a Real Number ● Rational number is the quotient of two integers	**Understands:** ● Rational numbers can be negative and are used in everyday life such as sports, temperature, money, elevation, etc... ● Relationships exist between positive and negative integers ● A number line is a tool that enables visualization of the distance between any two numbers on the line ● Additive inverse is when opposite quantities combine to make zero ● Subtraction problems can be solved by adding the numbers opposite [ex: $p - q = p + (-q)$] ● Operations can be used to solve problems and equations with both positive and negative numbers ● Solving real-world problems involves using all properties of operations and all integer rules ● Numerical representations can be used to describe and compare the value of real-world quantities. ● Every fraction has a decimal equivalent but the inverse may not always be true. ● An inequality is another way to describe a relationship between expressions; instead of showing that the values of two expressions are equal, inequalities indicate that the value of one expression is greater than (or greater than or equal to) the value of the other expression.	**Does:** ● Find, calculate and compare the absolute value of integers ● Add, subtract, multiply and divide integers ● Use the number line to order rational numbers ● Convert decimals to fractions and fractions to decimals ● Add, subtract, multiply, and divide rational numbers including fractions, mixed numbers, and decimals ● Compare, order, and graph rational numbers ● Represent addition and subtraction using number lines and integer chips ● Add rational numbers without the use of a visual or concrete model ● Compute subtraction problems using the idea that it can be rewritten as an addition problem ● Find products and quotients of rational numbers with the same sign and different signs ● Write, solve, and interpret real life situations involving rational numbers
Essential Vocabulary: Integer, absolute value, opposites, additive inverse, rational number, terminating decimal, repeating decimal		

Statistics and Probability

Common Core State Standards

- 7.SP.A.1 - Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- 7.SP.A.2 - Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
- 7.SP.B.3 - Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
- 7.SP.B.4 - Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
- 7.SP.C.5 - Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
- 7.SP.C.6 - Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
- 7.SP.C.7 - Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
    - 7.SP.C.7.A - Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
    - 7.SP.C.7.B - Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
- 7.SP.C.8 - Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
    - 7.SP.C.8.A - Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
    - 7.SP.C.8.B - Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
    - 7.SP.C.8.C - Design and use a simulation to generate frequencies for compound events.

Unit Name:	**Enduring Understanding**	**Essential Questions**
	• Interpreting and communicating data are critical in modeling and understanding real-world situations • Probability quantifies the likelihood that something will happen and enables us to make predictions and informed decisions • The chance of an event happening may be represented by the use of decimals, fractions, and percentages • The more trials being conducted will lead to a more accurate experimental probability	• How can you determine the likelihood that an event will occur? • How can you represent an event? • What determines if an event is independent or dependent? • What is the difference between experimental and theoretical probability?
Knows: • When to use probability • An event	**Understands:** • The concept of probability and the relationship between probability and likelihood	**Does:** • Identify and count the outcomes of experiments. • Find the probability of an event

closer to 1 is more likely to occur, whereas, an event closer to 0 is less likely to occur ● Convert fluently between fractions, decimals and percents	● Reading, understanding, interpreting, and communicating data are critical in modeling a variety of real-world situations, drawing appropriate inferences, making informed decisions, and justifying those decisions ● The more trials being conducted will lead to a more accurate experimental probability ● The likelihood of event x occurring is $0 \leq x \leq 1$ ● Statistics and probability are used in everyday life ie: sports, weather and making predictions	using experimental or theoretical probability ● Find the probability of compound independent and dependent events ● Make inferences about bias to determine if conclusions are valid and use samples to make predictions ● Compare populations using measures of center and variation
Essential Vocabulary: Probability, Theoretical Probability, Experimental Probability, compound event, independent event, dependent event, measures of central variation, outcomes		

Geometry		
Common Core State Standards ● 7.G.A.1 - Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. ● 7.G.A.2 - Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. ● 7.G.A.3 - Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. ● 7.G.B.4 - Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. ● 7.G.B.5 - Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. ● 7.G.B.6 - Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.		
Unit Name: Geometry	**Enduring Understanding** ● Volume as a measure of filling an object and surface area as a measure of wrapping or covering an object. ● Three-dimensional figures may have the same volume but quite different surface areas or they may have the same surface areas	**Essential Questions** ● How do geometric models describe spatial relationships? ● How does what we measure influence how we measure? ● How can one part of a circle help determine the measure of another part? ● How are area and circumference connected and how can we determine area, given a circumference?

	but different shapes and volumes. ● The effect on surface area and volume of applying a scale factor to a rectangular prism. expressions are equal, inequalities indicate that the value of one expression is greater than (or greater than or equal to) the value of the other expression.	
Knows: ● Diameter is twice the radius of a given circle using $d = 2r$ or $r = {}^{d}/_{2}$ ● Circumference can be found using $C = 2\pi r$ or $C = \pi d$ ● Perimeter of a composite figure can be found by adding all the sides and arcs together ● Area of a circle can be found using the formula $A = \pi r^2$ ● Area of composite figures can be found by finding areas of separate figures and adding them all together ● Surface area of prisms, pyramids and cylinders can be found by adding all the individual faces ● Volume of prisms can be found using $V = Bh$, where B is the area of the base and h is height ● Volume of pyramids can be found using $V = Bh$, where B is the area of the base and h is height	**Understands:** ● Recognize that all other dimensions of a circle may be determined given any other dimension ● Changing the diameter or radius will affect the area and/or circumference. ● Understand how a semi-circle relates to a circle. ● Changes in one or more dimensions of a rectangular prism or cylinder will affect the prism's volume. ● Diameter or radius can be found using a known area or circumference of a circle	**Does:** ● Identify and find angle measures of adjacent and vertical angles ● Classify angles as complementary, supplementary, or neither and find measures of complementary and supplementary angles ● Classify quadrilaterals and triangles by angles and sides ● Construct triangles and quadrilaterals freehand, with a protractor and ruler, or technology ● Find missing measures of angles in triangles and quadrilaterals ● Use scale drawings to find distances, perimeters, and areas ● Find scale factors and recreate scale drawings with a different scale ● Understand the relationship between radius and diameter ● Find circumference and area of a circle ● Find the perimeter and area of composite figures ● Find surface areas and areas of triangular and rectangular prisms, regular pyramids and cylinders
Essential Vocabulary: lateral surface area, regular pyramid, slant height, cross section, adjacent angle, vertical angle, supplementary angle, complementary angle, composite figure		