

Grade Six Mathematics Focus: Ratios, Rate, Fractions, Expressions and Equations

Use models to compare ratios, and solve problems including those involving unit rates; division with fractions; extend notion of number to the system of rational numbers, which includes negative number; write, interpret and use expressions and equations; statistical thinking

Ratios and Proportional Relationships

Common Core State Standards

- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
- 6.RP.A.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.
- 6.RP.A.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.A.3.A Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
 - 6.RP.A.3.B Solve unit rate problems including those involving unit pricing and constant speed.
 - 6.RP.A.3.C Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
 - 6.RP.A.3.D Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

<p>Unit Name: Ratios and Proportional Relationships</p>	<p>Enduring Understanding</p> <ul style="list-style-type: none"> ● Ratios are comparisons of two numbers ● The relationships and rules that govern whole numbers, govern all rational numbers ● Both part-to-whole and part-to-part ratios compare two measures of the same type of thing 	<p>Essential Questions</p> <ul style="list-style-type: none"> ● How can you represent a relationship between two quantities? ● How can you write a ratio to represent a situation, and what does that ratio mean? ● Can more than one ratio describe a situation? ● How is a ratio that is part to whole like a fraction? ● How are fractions, decimals, and percents related?
<p>Knows:</p> <ul style="list-style-type: none"> ● Ratios can express comparisons of a part to whole ● The ratio of the length to the width of a rectangle is a part-to-part 	<p>Understands:</p> <ul style="list-style-type: none"> ● Fractions are part-whole ratios therefore fractions are also ratios ● Percentages are ratios and are sometimes used to 	<p>Does:</p> <ul style="list-style-type: none"> ● 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 ● Solve unit rate problems including those

<p>relationship</p> <ul style="list-style-type: none"> • A ratio can also be a • The difference between a rate and a unit rate 	<p>express ratios</p> <ul style="list-style-type: none"> • Switching the numbers in the ratio change the description of the ratio relationship 	<p>involving unit pricing and constant speed</p> <ul style="list-style-type: none"> • 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 • Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities • Use patterns to help generate equivalent ratios/proportions and/or other ratio concepts to solve ratio problems
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Vocabulary: Ratio, expression, rate, unit rate, equivalent ratios, unit price, percent

Expressions and Equations

Common Core State Standards

- 6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents.
- 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers.
 - 6.EE.A.2.A Write expressions that record operations with numbers and with letters standing for numbers.
 - 6.EE.A.2.B Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
 - 6.EE.A.2.C Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
- 6.EE.A.3 Apply the properties of operations to generate equivalent expressions.
- 6.EE.A.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).
- 6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
- 6.EE.B.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.B.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.B.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.
- 6.EE.C.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 Name:

Enduring Understanding

- There are multiple ways to write expressions
- Expressions are powerful tools for exploring, reasoning about, and representing

Essential Questions

- How do you use patterns to understand mathematics and model situations?
- How are the horizontal and vertical axes related?

	<p>situations</p> <ul style="list-style-type: none"> Real-world situations can be represented using an inequality 	<ul style="list-style-type: none"> How do algebraic representations relate and compare to one another? How can we communicate and generalize algebraic relationships? How do variables allow us to model real world situations using mathematics?
<p>Knows:</p> <ul style="list-style-type: none"> How to evaluate expressions How to write an expression and then evaluate for any number, given a context and the formula arising from the context How to generate equivalent expressions 	<p>Understands:</p> <ul style="list-style-type: none"> Variables represent numbers and unknowns Numerical expressions can be written and evaluated using whole number exponents Expressions can be written from verbal descriptions using letters and numbers The value of the exponent tells you how many times to write the base as a factor 	<p>Does:</p> <ul style="list-style-type: none"> Evaluate a variable expression by substituting a number for each variable Solve one step equations Use the order of operations to evaluate expressions Write phrases and sentences as variable expressions or equations Evaluate functions and write function rules Make predictions and write a function by using a graph of a linear function in the coordinate plane.
<p>Essential Vocabulary: Base, exponent, exponential expression, simplify, coefficient, constant, variable, term, variable term, substitute, associative property of addition, commutative property of addition, distributive property, like terms, equation, balance the equation, inverse operations, isolate the variable, inequality, dependent variable</p>		

The Number System

Common Core State Standards

- 6.NS.A.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions.
- 6.NS.B.2 Fluently divide multi-digit numbers using the standard algorithm.
- 6.NS.B.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
- 6.NS.B.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.
- 6.NS.C.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.C.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 rational numbers.
 - 0 represent points on the line and in the plane with negative number coordinates.
 - 6.NS.C.6.A Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite.
 - 6.NS.C.6.B Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
 - 6.NS.C.6.C Find and position integers and other rational numbers on a horizontal or vertical number line

diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

- 6.NS.C.7 Understand ordering and absolute value of rational numbers.
 - 6.NS.C.7.A Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
 - 6.NS.C.7.B Write, interpret, and explain statements of order for rational numbers in real-world contexts.
 - 6.NS.C.7.C Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
 - 6.NS.C.7.D Distinguish comparisons of absolute value from statements about order.
- 6.NS.C.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.

<p>Unit Name: The Number System</p>	<p>Enduring Understanding</p> <ul style="list-style-type: none"> ● Extending from whole numbers to rational numbers creates a more powerful and complicated number system ● The rational numbers allow us to solve real world problems that are not possible to solve with just whole numbers or integers ● Any rational number can be represented in infinitely many equivalent symbolic forms 	<p>Essential Questions</p> <ul style="list-style-type: none"> ● How can we use rational numbers (including integers and whole numbers) to solve real world problems? ● How do rational numbers extend the number system? ● How can we represent and identify rational numbers in various forms (including numerical representations, number line, tape diagram pictorial representation, etc.) and how can we apply these representations to real-world scenarios? ● How can we show equivalency among rational numbers, and decide which representation would be the most efficient for application?
<p>Knows:</p> <ul style="list-style-type: none"> ● Opposite signs of numbers as indicating locations on opposite sides of 0 on the number line ● Opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$ ● 0 is its own opposite ● Rational numbers have multiple interpretations 	<p>Understands:</p> <ul style="list-style-type: none"> ● 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 ● Computation with rational numbers is an extension of computation with whole numbers but introduces some new ideas, processes, and algorithms 	<p>Does:</p> <ul style="list-style-type: none"> ● 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 ● Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation ● Use absolute value to find horizontal and vertical distances on the number line, coordinate plane ● 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

Essential Vocabulary: Common denominator, reasonable, reciprocal, multiplicative inverse, greatest common factor, least common multiple, positive numbers, negative numbers, signed numbers, opposite numbers, integers, absolute value, quadrants, rational numbers

Geometry

Common Core State Standards

- 6.G.A.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
- 6.G.A.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l w h$ and $V = b h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
- 6.G.A.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.A.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 Name: Geometry	Enduring Understanding <ul style="list-style-type: none"> ● Geometry and spatial sense offer ways to interpret and reflect on our physical environment ● Analyzing geometric relationships develops reasoning and justification skills 	Essential Questions <ul style="list-style-type: none"> ● How do geometric models describe spatial relationships? ● How are geometric shapes and objects classified?
Knows: <ul style="list-style-type: none"> ● Formulas for surface area and volume ● How to represent three-dimensional figures using nets ● How to use nets to find surface area ● How to find the area of triangles and other two-dimensional shapes 	Understands: <ul style="list-style-type: none"> ● That the purpose of using nets is to determine surface area ● When finding the area of polygons, understands when to compose or decompose those polygons into other shapes 	Does: <ul style="list-style-type: none"> ● Solve real world problems involving surface area and volume ● Apply and expand knowledge of coordinate planes to solve problems ● Use the formula for volume ● Use nets to find the surface area of three-dimensional shapes

Essential Vocabulary: Polygon, base, net, surface area, triangular prism, pyramid

Statistics and Probability

Common Core State Standards

- 6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
- 6.SP.A.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.A.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.
- 6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- 6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:
 - 6.SP.B.5.A Reporting the number of observations.
 - 6.SP.B.5.B Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
 - 6.SP.B.5.C Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
 - 6.SP.B.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Unit Name:	Enduring Understanding <ul style="list-style-type: none"> ● Data can be collected, measured, and analyzed and used to describe real life situations ● Statistics can be used to gain information about a population by examining a sample of the population. ● There are differences between a sample and its population ● Data sets can be used to predict future events ● Random sampling tends to produce representative samples and support valid inferences 	Essential Questions <ul style="list-style-type: none"> ● What is the best way to organize a set of data? ● How can I decide which measure of center best describes the data? ● How can I use data to compare different groups? ● How can I recognize when a question is statistical and when it is not?
Knows: <ul style="list-style-type: none"> ● Ways to summarize numerical data sets in relation to their context ● Numerical data can be displayed in plots on a number line, including dot 	Understands: <ul style="list-style-type: none"> ● Statistical questions and the answers account for variability in the data ● A set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape ● A measure of center for a numerical data set 	Does: <ul style="list-style-type: none"> ● Summarize numerical data-set in relation to context by <ul style="list-style-type: none"> ○ Reporting the number of observations ○ Describing the nature of the attribute under investigation, including how it was measured and its units of measurement ○ Giving quantitative measures of center (median and/or mean) and variability (interquartile range

<p>plots, histograms, and box plots</p> <ul style="list-style-type: none"> • The difference between a measure of center and a measure of variation 	<p>summarizes all of its values with a single number, while a measure of variation describes how</p> <ul style="list-style-type: none"> • Its values vary with a single number • Generalizations about a population from a sample are valid only if the sample is representative of that population 	<p>and/or mean absolute deviation)</p> <ul style="list-style-type: none"> ○ Describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. ○ 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 <ul style="list-style-type: none"> • Collect random sampling to generate data sets and draw inferences
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Vocabulary: Statistical questions, cluster, skewed left, skewed right, symmetrical graphs, peak, outlier, median, mode, range, mean absolute deviation (MAD), lower quartile, upper quartile, box plot, interquartile range (IQR), bins, interval, analyze numerical data, variation