GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

6.RP.1	Desired Student Performance		
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."*	**A student should know** • A ratio is a pair of nonnegative numbers, A:B, where both are not zero, and that are used to indicate a relationship between 2 quantities. • For the ratio, A:B, the value is the quotient of A/B. • The order of the numbers is important to the meaning of the ratio. Switching the numbers changes the relationship. • Descriptions of a ratio relationship include words such as: to, for each, for every. • Reason abstractly and quantitatively.	**A student should understand** • Solving problems involving multiplicative comparisons. • Interpret a fraction as division of the numerator by the denominator. (a/b = a ÷ b) • How to find and use the Greatest Common Factor to simplify fractions. • Changing the order of the numbers represents a different relationship.	**A student should be able to do** • Write a ratio that describes a relationship between two quantities. • Use ratio reasoning to solve real-world and mathematical problems. • Compare data from bar diagrams and frequency tables using ratios. • Use ratios to describe a simple set of data in different ways: girls to boys, boys to girls, boys to total, total to girls. • Cannot use a four-function calculator for computations.

GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

6.RP.2

Understand the concept of a unit rate a/b associated with a ratio a:b with b≠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 ¾ cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• A rate indicates, for a proportional relationship between two quantities, how many units of one quantity there are for every 1 unit of the second quantity. • A unit rate is a ratio, a:b, where b = 1. • The unit price is the cost per unit. • Dividing the numerator by the denominator will find the unit rate.	• Equivalent fractions as equivalent ratios. • Interpret a fraction as division of the numerator by the denominator. (a/b = a ÷ b) • Descriptions of a unit rate include words such as: per, in, and for every.	• Convert a given ratio to a unit rate. • Use ratio and rate reasoning to solve real-world and mathematical problems. • Compare unit rates. • Find and justify the best buy using unit price. • Cannot use a four-function calculator for computations.

GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

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.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Rate tables show a collection of equivalent ratios. • An equivalent ratio can be found my multiplying both quantities by the same amount. (a:b = 2a:2b) • In an equation, the constant value represents the rate. (y = 3x; 3 is the unit rate) • A double number line has one set of number running along the top representing one quantity and a second set of numbers running along the bottom representing the second quantity.	• Ratios and proportional relationships are used to express how quantities are related and how quantities change in relation to each other. • Equivalent fractions.	• Use ratio and rate reasoning to solve real-world and mathematical problems. • Use a variety of tools: tape diagrams, double number lines, or equations to demonstrate equivalent ratios. • A four -function calculator may be used for computing.

GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

6.RP.3a **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.** **a. Make tables of equivalent ratios relating quantities with whole-number measurements, finding missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Equivalent fractions are equivalent ratios. • The 'rule' for a rate table is the unit rate. • The equation y = mx, relates independent variables, dependent variables, and rates. • How to plot points in all 4 quadrants of the coordinate plane.	• The relationship between dependent and independent variables. • The unit rate for y is the point located at (1,y). • Pairs of numbers that have the same ratio can be organized into a ratio table. • Scaled ratios (equivalent fractions) can be created by multiplying or dividing the two related quantities by the same number. • Ratios can be scaled up or down.	• Make a table of equivalent ratios. • Use tables to compare ratios. • Find missing values in tables. • Plot values on the coordinate plane. • Determine the steeper line represents the greater ratio. • Use ratio and rate reasoning to solve real-world and mathematical problems such as increasing a recipe to serve more people. • Use a four-function calculator for computing.

GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

6.RP.3b

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.

b. 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?*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• A unit rate is a ratio, a:b, where b = 1. • Unit price is the cost per unit. • Dividing the numerator by the denominator will find the unit rate. • The distance formula is d = rt, where d is distance, r is the unit rate, and t is time. • Dependent variables can be found by multiplying the independent variable by the unit rate. • Descriptions of a unit rate include words such as: per, in, and for every.	• Knowing two values in an equation leads to calculation of the third. • The inverse relationship between multiplication and division. • Division of whole numbers with decimals quotients.	• Calculate speed, if distance and time are known. • Calculate unit price, if total cost and quantity are known. • Find and justify the 'best buy'. • Use ratio and rate reasoning to solve real-world and mathematical problems. • Use a four-function calculator for computing.

GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

6.RP.3c

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.

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.

Desired Student Performance

A student should know

- Percents are rates per 100.
- The percent of a number is the product of the percent in fraction or decimal form and the original number.
  50% of 10 = 50/100 times 10
- Fluently write decimals as fractions and percents.
- Fluently write fractions as decimals and percents.
- Fluently write percents as decimals and fractions.
- How to represent percents greater than 100% and less than 1%.
- Equivalent fractions.
- Solve for the unknown in an equation.
- Reason abstractly and quantitatively.

A student should understand

- Fraction and percent equivalents.
- Fractions demonstrate the relationships between parts and wholes.
- How to compare and order decimals, fractions, and percents.
- How to use the percent proportion:
  part/whole = % /100
- Proportional reasoning.

A student should be able to do

- Write percents as a rate per one hundred.
- Find a percent of a quantity.
- Solve problems involving finding the whole when given a part and the percent.
- Use ratio and rate reasoning to solve real-world and mathematical problems.
- Use a visual representation to model percents.

GRADE 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems	Major

6.RP.3d **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.** **d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying and dividing quantities.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Converting among different-sized standard measurement units. • Common conversion factors in the customary system: *inches, feet, miles, ounces, pounds, tons, fluid ounces, cups, quarts, and gallons.* • Common conversion factors in the metric system: *kilo-, centi-, milli-, meters, liters, and grams.* • Reason abstractly and quantitatively.	• Dividing by the conversion factor when transforming from smaller units to larger units (inches to feet). • Multiplying by the conversion factor when transforming from larger units to smaller units (gallons to cups). • Equivalent ratios are used as conversion factors: 12 in. / 1 ft = 1 ft / 12 in. 1 lb / 16 oz = 16 oz / 1 lb	• Use a ratio as a conversion factor when working with measurements of different units. • Use ratio and rate reasoning to solve real-world and mathematical problems. • Use a four-function calculator for computing.

GRADE 6

The Number System

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

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?*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• This standard completes the extension of operations to fractions. • Fractions should be seen and treated as regular numbers. • The meaning of multiplication. • The co-dependent relationship between multiplication and division. • Solve for the unknown in an equation. • Reason abstractly and quantitatively. • Interpretation means to communicate symbolically, numerically, abstractly, and/or with a model. • How to create a story context from a set of given information.	• A fraction *1/b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts (unit fraction). • A fraction *a/b* as the quantity formed by *a* parts of size *1/b*. • All fractions are rational. • Fractions allow us to solve word problems that may not be possible to solve with whole numbers or integers. • Three uses of division: equal sharing; measurement; and unknown factors. • Fractions have multiple interpretations, and making sense of them depends on identifying the unit. • Equivalent fractions can be used as a strategy for solving various word problems. • The close relationship between fractions and ratios.	• Plot, label, and identify fractions on a number line. • Evaluate the reasonableness of a solution based on the benchmark fractions of 0, ½, and 1. • Perform +, -, and · with fractions, and with whole numbers and fractions (with like and unlike denominators). • Make comparisons between fractions given in multiple representations. • Perform operations with mixed numbers. • Use a variety of visual fractions models (tape diagram, number line diagram, or area model). • Cannot use a calculator, but must know the standard algorithm to convert between fractions and decimals.

GRADE 6

The Number System

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

6.NS.2
Fluently divide multi-digit numbers using the standard algorithm.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Multiplication facts (0-12) • The difference between dividend, divisor, and quotient. • This is the culminating standard for several years' worth of work with division of whole numbers. • Attend to precision.	• Divisibility rules for numbers 2 through 10. • Division is repeated subtraction. • Rational numbers can be represented in multiple ways and are useful when examining situations involving numbers that are not whole. • Estimation as a tool for checking reasonableness of a quotient.	• Divide multi-digit numbers using the standard algorithm. • Check quotients for reasonableness.

GRADE 6

The Number System

Compute fluently with multi-digit numbers and find common factors and multiples — **Additional**

6.NS.3
Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Place value to the left and right of the decimal point. • Vocabulary for adding, subtracting, multiplying, and dividing: addends, sum, subtrahend, minuend, difference, factors, products, dividend, divisor, and quotient. • When adding and/or subtracting decimals, decimal points must be lined up. • Commutative Properties of addition and multiplication. • Attend to precision.	• Addition and subtraction are inverse operations. • Multiplication and division are inverse operations. • Subtraction problems may be interpreted as missing addend problems. • Division problems may be interpreted as missing factor problems. • The difference between a terminating and repeating decimal. • Multiplying a whole number by a decimal less than 1 results in a product less than the original factor.	• Add and subtract multi-digit decimals using the standard algorithm. • Multiply and divide multi-digit decimals using the standard algorithm. • Use estimation to check answers for reasonableness.

GRADE 6

The Number System

Compute fluently with multi-digit numbers and find common factors and multiples — **Additional**

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).*

Desired Student Performance

A student should know

- The greatest common factor of any two numbers is the largest number that will divide evenly into both numbers.
- The least common multiple of any two numbers is the first consecutive number divisible by the two numbers.
- Prime numbers are numbers with exactly two factors: 1 and itself.
- Composite numbers are numbers with more than 2 factors.
- Look for and make use of structure.

A student should understand

- 1 is neither prime nor composite.
- Prime factorization of a number is a multiplication expression composed of only prime numbers.
- Distributive property of multiplication over addition means you can multiply a sum by a number and get the same result as multiplying each addend separately.
  a(b + c) = ab + ac

A student should be able to do

- Find the greatest common factor of two whole numbers less than or equal to 100.
- Find 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.

GRADE 6

The Number System

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

6.NS.5	Desired Student Performance		
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 the real-world contexts, explaining the meaning of 0 in each situation.	**A student should know** • Numbers greater than 0, located to the right of 0 on the number line, are called positive numbers. • Numbers less than 0, located to the left of 0 on the number line, are called negative numbers. • Any negative number is less than any positive number. • 0 is neither positive nor negative. • Reason abstractly and quantitatively. • Use appropriate tools strategically.	**A student should understand** • Two numbers with opposite signs, such as 5, and -5, are equidistant from 0 on the number line. • Number lines may be displayed horizontally or vertically. This does not affect a number's value. • 0 is the point at which direction or value change.	**A student should be able to do** • Explain the relationship between positive and negative numbers in real-world context: temperature, money, sea level, electric charge. • Explain the meaning of zero is any real-world context.

GRADE 6

The Number System

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

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.**	**Desired Student Performance**		
	A student should know • A rational number is a number that may be displayed as a fraction as long as the denominator is not zero. • The number line extends infinitely in both positive and negative directions. • An integer is any positive or negative whole number. • Points on the number line may be integers, fractions, or decimals. • Attend to precision. • Look for and make use of structure.	**A student should understand** • Why every rational number can be represented by a point on a number line. • The coordinate plane is 2 number lines intersecting at 0, effectively called the x and y axes. • As such, the coordinate plane extends infinitely.	**A student should be able to do** • Plot a rational number as a point on the number line. • Extend number lines as needed to display data. • Extend coordinate axes learned in previous grades. • Plot ordered pairs that may include negative coordinates.

GRADE 6

The Number System

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

6.NS.6.a	Desired Student Performance		
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. **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.**	**A student should know** • The opposite of a positive number is a negative number and the reverse is true. • Two numbers with opposite signs, such as 5 and -5, represent numbers equidistant from 0 on the number line. • Zero is its own opposite. • Look for and express regularity in repeated reasoning.	**A student should understand** • The opposite of an opposite of a number is the original number.	**A student should be able to do** • Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line. • Find the opposite of any number. • Read numbers accurately plotted on the number line. • Plot numbers accurately on the number line.

GRADE 6

The Number System

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

6.NS.6.b

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.
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.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• The coordinate plane is made up 4 quadrants that extend infinitely. • Numbers with opposite signs represent locations opposite to one another. • A reflection refers to exact opposite position as to create a mirror image. • Attend to precision. • Look for and make use of structure.	• The signs of numbers in an ordered pair relate to its location on the coordinate plane. • (5, 5) and (-5,-5) would be points reflected about the origin. You move in exact opposite directions when plotting.	• Use the signs of the coordinates to determine the location of an ordered pair in the coordinate plane. • Plot a point on a coordinate plane. • Read a point plotted on the coordinate plane.

GRADE 6

The Number System

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

6.NS.6.c **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.** **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.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Integers are positive and negative whole numbers. • Number lines may run horizontally or vertically. • Ordered pairs are coordinates that are positive, negative, or one of each. • Coordinates are not limited to integers.	• The coordinate plane is 2 number lines intersecting at 0, effectively called the x and y axes. • As such, the coordinate plane extends infinitely.	• Find and position integers and other rational numbers on a horizontal or vertical number line. • Find and position pairs of integers and other rational numbers on a coordinate plane.

GRADE 6

The Number System

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

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

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Rational numbers may include whole numbers, integers, fractions, and decimals. • Ordering refers to putting numbers greatest to least or least to greatest. • Absolute value is the distance a number is from 0 on the number line. • The symbol for absolute value is | |.	• Since absolute value refers to distance from zero, it is always represented by a positive number.	• Order rational numbers least to greatest or greatest to least. • Find the absolute value of a rational number.

GRADE 6

The Number System

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

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

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Numbers to the right of zero are positive on a number line diagram. • Numbers to the left of zero are negative on a number line diagram. • Relation symbols: <, >, ≤, ≥, and ≠. • Reason abstractly and quantitatively. • Use appropriate tools strategically.	• The further left a number is from zero, the more negative (smaller) it is. • The further right a number is from zero, the more positive (larger) it is. • When comparing any two numbers on a number line diagram, the number to the left is always smaller if the number line is oriented from left to right.	• Describe the relative position of two numbers on a number line when given an inequality. • Interpret statements of inequality as statements about relative position of two numbers on a number line diagram.

GRADE 6

The Number System

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

6.NS.7.b **Understand ordering and absolute value of rational numbers.** **b. 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.	**Desired Student Performance**		
	A student should know • Relation symbols: <, >, ≤, ≥, and ≠. • The position of positive and negative numbers in relation to zero on a number line diagram. • Reason abstractly and quantitatively. • Use appropriate tools strategically.	**A student should understand** • The further a negative number is from zero, the smaller the value. • The further a positive number is from zero, the greater the value.	**A student should be able to do** • Write and interpret statements of inequality in terms of a real world situation. • Explain what the numbers in an inequality represent.

GRADE 6

The Number System

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

6.NS.7.c **Understand ordering and absolute value of rational numbers.** **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.** *For example, for an account balance of -30 dollars, write* $\|-30\| = 30$ *to describe the size of the debt in dollars.*	**Desired Student Performance**		
	A student should know • Absolute value is the distance a number is from 0 on the number line. • The symbol for absolute value is | |. • Magnitude refers to the amount or size relative to the context. • Reason abstractly and quantitatively. • Use appropriate tools strategically.	**A student should understand** • The absolute value of any numbers, positive or negative, is positive. • Absolute value is positive because it represents distance from zero. • The difference between a signed number, such as -5, and the absolute value of a signed number, $\|-5\|$, in real world context.	**A student should be able to do** • Explain absolute value. • Relate absolute value to real world situations such as sea level, temperature, and debt.

GRADE 6

The Number System

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

6.NS.7.d **Understand ordering and absolute value of rational numbers.** **d. 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.*	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Comparing rational numbers • Absolute value is the distance from zero. • Reason abstractly and quantitatively. • Use appropriate tools strategically.	• Using a number line diagram as a tool for comparison. • Absolute value is may not be limited to integers.	• Distinguish comparisons of absolute value from statements about order.

GRADE 6

The Number System

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

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 distance between points with the same first coordinate or the same second coordinate.**	**Desired Student Performance**		
	A student should know • Plotting points in all four quadrants. • One can use coordinates or absolute value to find distance between plotted points. • Reason abstractly and quantitatively. • Use appropriate tools strategically.	**A student should understand** • Distance between two plotted points with the same x-coordinate is found by subtracting the y-coordinates using standard rules for subtraction. • Distance between two plotted points with the same y-coordinate is found by subtracting the x-coordinates using standard rules for subtraction. • One may also consider the absolute value of the difference between coordinates. *For example, (2,4) and (2,7): 7 – 4 = 3 and 4 – 7 = -3. Either solution as an absolute value of 3. As such, the points are 3 units apart.*	**A student should be able to do** • Solve real world and mathematical problems by graphing points in all four quadrants of the coordinate plane. • Use coordinates and absolute value to find distance between points.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

6.EE.1 **Write and evaluate numerical expressions involving whole-number exponents.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• A base is the number being raised to an exponent, or power. • A number raised to a power represents repeated multiplication of the base. • Evaluate means to solve for the product of the base. • How to read and identify the parts of a numerical and algebraic expression using mathematical terms.	• A number raised to a power represents an algebraic expression. • Using exponents to make sense of quantitative relationships. • Any number, whole or fractional, may be raised to an exponent. • The function of each part of a numerical expression.	• Write an expression using exponents to illustrate repeated multiplication. • Multiply fluently whole numbers and fractions. • Evaluate expressions that consist of whole-numbers, exponents, fractions and decimals. • Use a four-function calculator to evaluate expressions.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

	Desired Student Performance		
6.EE.2 **Write, read, and evaluate expressions in which letters stand for numbers.**	**A student should know** • A variable is a symbol that stands in the place of an unknown value. • An expression is a mathematical phrase containing numbers, variables, and operation symbols. • A term, such as 3x, is read 3 times x. • Evaluate means to substitute a value in for the variable and solve the expression. • Attend to precision.	**A student should understand** • Common algebraic expressions: less than, more than, times, shared equally. • The difference between an expression and an equation. • Variables may represent any whole number, fraction, decimal, exponent. • Variables may also represent positive or negative values. • Order of operations.	**A student should be able to do** • Read accurately an algebraic expression containing variables and exponents (reading). • Translate an expression from words to symbols (writing). • Substitute in a value for the given variable and complete the calculations (evaluating). • Add, subtract, multiply, and divide fluently with whole numbers, fractions, and decimals. • Apply Order of Operations • Use a four-function calculator for computations.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

6.EE.2.a
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.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Mathematical terms: sum, quotient, product, difference, coefficient • A variable is a symbol that stands in the place of an unknown value. • When a term is representing addition/subtraction vs. multiplication/division. • Look for and express regularity in repeated reasoning. • How to read an expression.	• Common algebraic expressions: less than, more than, times, shared equally. • An expression can be a final answer: 5 – y is the answer until you have a value to substitute in for y. • The difference between the expressions 5 - y and y – 5. • Order of Operations.	• Write an expression when using whole numbers, fractions and decimals.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

6.EE.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. *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.*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Parts of an expression. • Which operations apply to the mathematical terms sum, difference, product, quotients, less than, more than, less, etc…	• 2(8 + 7) is a product of two factors: 2 and the sum of 8 and 7. • An expression has a single value but may also be viewed as multiple terms that operations are performed on. • That variables in an expression represents a value.	• Identify accurately the parts of an expression.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

6.EE.2.c	Desired Student Performance		
Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of lengths $s = ½$.*	**A student should know** • A variable is a symbol that stands in the place of an unknown value. • Evaluate means to substitute a value for the variable and solve the expression.	**A student should understand** • Substituting a value for a variable. • Order of operations.	**A student should be able to do** • Evaluate an expression for a given value. • Substitute values in formulas to solve real-world problems. • Apply order of operations with or without parentheses. • Evaluate expressions that arise from formulas however students are not required to manipulate the formulas.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

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.*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Commutative Properties of Addition and Multiplication, Associative Properties of Addition and Multiplication, and Distributive Properties of Multiplication over Addition and Subtraction • Repeated addition is multiplication. • Equivalent means expressions have the same value. • Look for and make use of structure.	• 2 * 2 is the same thing as 4. As such, 3(2 + x) is the same as 6 + 3x. • Distributing is multiplying a term outside of parentheses times every term inside the parentheses. • The importance of fluently adding, subtracting, multiplying and dividing whole numbers, fractions, and decimals.	• Generate 2 or more equivalent expressions using the properties. • Composing and decomposing expressions using the properties.

GRADE 6

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions	Major

6.EE.4	**Desired Student Performance**		
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.*	**A student should know** • A variable is a symbol that stands in the place of an unknown value (number). • When two or more expressions are equivalent, that means the value of each expression same.	**A student should understand** • Variables represent a numerical value. • Expressions may have to be simplified in order to determine equivalency.	**A student should be able to do** • Determine whether two expressions are equivalent by using the same value to evaluate both expressions. • Identify equivalent expressions. • Use properties of operations to justify two expressions are equivalent.

GRADE 6

Expressions and Equations

Reason about and solve one-variable equations and inequalities	Major

6.EE.5	Desired Student Performance		
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.	**A student should know** • An expression is a mathematical phrase containing numbers, variables, and operation symbols. • An equation is a number sentence that's equal to a specific value. • An inequality is a number sentence that utilizes relation symbols other than the equal sign. (i.e., <, >, ≤, ≥, or ≠) • Reason abstractly or quantitatively.	**A student should understand** • The difference between expressions, equations and inequalities. • An inequality may contain a variable that can represent more than one value. *For example, $x < 5$; x = all real numbers less than 5.* • A solution is the number or set of numbers that makes an inequality true.	**A student should be able to do** • Utilize substitution to decide if an equation or inequality is true. • Solve an equation or inequality to find the value of the variable. • Use a four-function calculator to solve equations and inequalities.

GRADE 6

Expressions and Equations

Reason about and solve one-variable equations and inequalities	Major

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.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• The difference between an equation, expression, and inequality. • Variables and their purpose.	• A variable may represent one number or more than one number. (equation vs. inequality) • A variable may represent any whole number, fraction, or decimal. • A variable may represent positive or negative numbers.	• Use variables to represent numbers to solve a real-world problem. • Determine the function of the variable in a real-world or mathematical problem. • Write expressions when solving real-world or mathematical problems. • Identify the relationship of the variable in real-world or mathematical problems.

GRADE 6

Expressions and Equations

Reason about and solve one-variable equations and inequalities	Major

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.**	Desired Student Performance		
	A student should know	**A student should understand**	**A student should be able to do**
	• Nonnegative rational numbers include positive numbers that may be written as a quotient of two integers where the denominator is not zero. • Decimals that are rational numbers either terminate or repeat. • Reason abstractly and quantitatively. • Look for and make use of structure.	• Substitution of values as they pertain to a real-world problem.	• Solve equations when the values for the variables are given. • Write and solve equations that represent real-world problems. • Fluently add, subtract, multiply and divide whole numbers, fraction, and decimals. • Evaluate reasonableness of solutions.

GRADE 6

Expressions and Equations

Reason about and solve one-variable equations and inequalities	Major

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.**	**Desired Student Performance**		
	A student should know • A simple inequality is x > 4 or x < 4. • X can represent any value that proves the inequality true. • Reason abstractly and quantitatively. • Look for and make use of structure.	**A student should understand** • C, the constraint value, is not limited to integers. • A constraint value is the value that x is greater than or less than. • X in an inequality, x < c, has an infinite number of solutions. • That there are an infinite number of solutions for an inequality.	**A student should be able to do** • Write an inequality to represent constraints or conditions in a real-world or mathematical problem. • Graph a solution set of an inequality on a number line. • Explain what the solution set of an inequality represents.

GRADE 6

Expressions and Equations

Reason about and solve one-variable equations and inequalities	Major

6.EE.9	**Desired Student Performance**		
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.*	**A student should know** • Dependent variable is a variable whose value is determined by another variable in the expression. *For example, the distance you travel is determined by how long you drive.* • Independent variable is a variable whose value decides the value of the other variable. *For example, in a fundraiser, how many items you sell determines the amount of money you make.* • Plotting points in all four quadrants of the coordinate plane. • Model with Mathematics. • Attend to precision. • Look for and express regularity in repeated reasoning.	**A student should understand** • The relationship between the dependent and independent variable in a real-world relationship. • The function of the dependent and independent variable. • The pattern y=mx, to show that the dependent variable is the product of a rate times the independent variable. • The y and x in y=mx refer to the x and y axis on the coordinate plane. • The effect x has on y corresponds to the rate in the equation. *For example, d = 65t, means for every hour (t), d will increase by 65 miles.*	**A student should be able to do** • Analyze tables and graphs to determine the dependent and independent variable. • Analyze tables and graphs to determine the relationship between dependent and independent variables. • Write an equation with variables that represents the relationship between the dependent and independent variables. • Create a table of two variables that represent a real-world situation in which one quantity will change in relation to the other. • Use data to plot points on the coordinate plane. • Interpret patterns in the table and graph and relate them back to the equation. • Use a four-function calculator to determine either variable.

GRADE 6

Statistics and Probability

Develop understanding of statistical variability	Additional

	Desired Student Performance		
	A student should know	**A student should understand**	**A student should be able to do**
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.*	• Variability means that not all the data values will have the same value. • A statistical question poses a question where data must be collected to answer the question. • Reason abstractly and quantitatively.	• What makes a good statistical question. • The difference between numerical data and categorical data. *For example, heights of basketball players vs. their favorite colors.*	• Recognize a statistical question. • Develop a question that can be used to collect statistical information. • Collect data to demonstrate the variability of the answers to the question.

GRADE 6

Statistics and Probability

Develop understanding of statistical variability	Additional

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.	Desired Student Performance		
	A student should know	**A student should understand**	**A student should be able to do**
	• Distribution refers to the entire data set as a whole. • Distribution can be described in terms of center, spread, and shape. • Mean is the average of all the numerical data. • Median is the exact middle value of the data. • Mode is the most frequently occurring data value. • Model with mathematics.	• The center of a distribution can be described in terms of mean, median, and mode. • The spread of a distribution can be described in terms of clusters, gaps, and outliers. • Shape can be described as symmetric or skewed. • A box plot is a method of displaying a distribution of data values by using the median, quartiles, and extremes of the data set. • A box shows the middle 50% of the data.	• Describe a distribution of data in terms of center, spread, and overall shape. • Construct a box plot to show the distribution of a set of data. • Interpret data from a box plot. • Compare multiple distributions looking for similar centers, spreads, and overall shapes.

GRADE 6

Statistics and Probability

Develop understanding of statistical variability	Additional

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.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Measure of center refers to mean, median, and mode. • Any of these three represent the entire data set with just one number. • Measure of variation refers to range, interquartile range, or mean absolute deviation. • Range is the difference between maximum and minimum data values. • Mean absolute deviation is the average of the absolute value of the distances of the data values from the mean. • Attend to precision.	• When mean is used as the measure of center, that number may not itself be a value from the data set. • When median is used as the measure of center, it may or may not be a value from the data set. That is dependent on whether the data set is made up of an even or odd set of data. • When mode is used as the measure of center, it is an actual value from the data set.	• Calculate measures of center (mean, median, and mode) of a set of numerical data. • Calculate measures of variation by calculating range, interquartile range, or mean absolute deviation of a set of numerical data. • Cannot use a calculator but must be able to use the standard algorithm for calculating.

GRADE 6

Statistics and Probability

Summarize and describe distributions			Additional
6.SP.4 **Display numerical data in plots on a number line, including dot plots, histograms, and box plots.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Dot plots are also called line plots. Data are represented by Xs or dots on a number line. • Histograms are bar graphs where data are grouped and displayed within intervals. • Intervals must be continuous (bars must be touching). • Box plots, also called box-and-whisker plots, graph five summary measures. They show the center as well as the variability of the data. • Model with mathematics. • Attend to precision.	• The difference between how data are represented by dot plots, histograms, and box plots. • Graphical representations should be chosen based on what information needs to be communicated about the data set.	• Organize and display data as a line plot or dot plot. • Organize and display data in a histogram. • Organize and display data in a box plot. • Calculate extremes, range, median, and mean to be able to display data in a box plot. • Identify a graphical representation representative of a given data set.

GRADE 6

Statistics and Probability

Summarize and describe distributions			Additional
6.SP.5a **Summarize numerical data sets in relation to their context such as by:** **a) Reporting the number of observations.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Observations refer to the number of data values in the set. • Measures of center are mean, median, and mode. • Measures of variability are range, interquartile range, and mean absolute deviation.	• Reporting the number of observations does not by itself lend any information to measures of center or variability, only how many data values were collected.	• Use a four-function calculator for rapid calculation of measures of center or variability. • Report number of observations.

GRADE 6

Statistics and Probability

Summarize and describe distributions			Additional
6.SP.5b **Summarize numerical data sets in relation to their context such as by:** **b) Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.**	**Desired Student Performance**		
	A student should know • An attribute is a particular characteristic or feature being investigated: *typical age of 6th graders, typical numbers of pets, or how many states have most students visited in their lifetime.* • Model with mathematics.	**A student should understand** • The difference between an attribute and the units used to measure that attribute.	**A student should be able to do** • Identify the attribute being investigated. • Identify how the attribute was measured and by what units.

GRADE 6

Statistics and Probability

Summarize and describe distributions	Additional

6.SP.5c **Summarize numerical data sets in relation to their context such as by: 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 references to the context in which the data were gathered.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Measures of center are mean, median, and mode. • Mean is the average of all the data sets. • Median is the exact middle data value. • Measures of variability are range, interquartile range, and mean absolute deviation. • Range is the difference in the two extremes. • Interquartile range (IQR) is the difference between the upper and lower quartiles. • Mean absolute deviation (MAD) is the average of the absolute values of the distances of the data values from the mean.	• When the median and the mean are the same data value, or almost the same, the distribution is said to be symmetric. • If the data does not resemble a mirror image due to clusters, gaps, or outliers, the distribution is said to be skewed. • Outliers, extreme high or low data values, have a direct effect on the mean of the data set.	• Calculate measures of center: mean, median, and mode. • Calculate measures of variability: range, interquartile range, and mean absolute deviation. • Identify clusters, gaps, extremes, and outliers in the data set. • Describe overall patterns and how those patterns relate to the context of the data. • Describe any deviations from the overall pattern and how they relate to the context of the data.

GRADE 6

Statistics and Probability

Summarize and describe distributions			Additional
6.SP.5d **Summarize numerical data sets in relation to their context such as by: 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.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Measures of center: mean, median, and mode. • Measures of variability: range, interquartile range, and mean absolute deviation. • Shape is described as symmetrical or skewed. • Construct viable arguments and critique the reasoning of others.	• There is no wrong choice of measure of center – only a wrong interpretation of it. • The shape of the data should be considered before deciding on which measure of center or variability should be used to summarize the data. • The effect adding or removing data values will have on measures of center or variability.	• Calculate measures of center. • Calculate measures of variability. • Draw inferences about the shape of the distribution using measures of center and/or variability. • Justify the use of a particular measure of center or variability based on the shape of the data.

GRADE 6

Geometry

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

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.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• A quadrilateral is defined as a four-sided shape. • Recognize squares, rectangles, rhombuses and trapezoids as quadrilaterals. • Simple shapes compose to form larger shapes. • Shapes can be partitioned into parts of equal areas. • Multiplication and division are inverse operations. • Reason abstractly and quantitatively. • Look for and make use of structure. • Area as defined as the inside shape or space measured in square units. • How to identify a right triangle.	• A trapezoid is defined as a quadrilateral with at least one pair of parallel sides. • Area formulas for rectangles, parallelograms, triangles, and trapezoids are related. • The relationship between area of a rectangle and area of a triangle. • Area of a right triangle equals one-half base times height. • Shapes with more than 3 sides can be decomposed into triangles. (*1 square = 2 triangles)* • Triangles can be used to compose larger polygons.	• Calculate area of triangles and quadrilaterals when given base and height. • Calculate base or height when given area. • Compose polygons from triangles. • Decompose polygons into triangles. • Solve real-world and mathematical problems. • Use a four-function calculator to solve for area.

GRADE 6

Geometry

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

6.G.2

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

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Volume of a right rectangular prism equals the product of the length times the width times the height of the figure. • A right rectangular prism is defined as a prism whose lateral faces are rectangles. • A unit cube is a cube whose side lengths are 1 unit long. • Multiplication of fractions and mixed numbers. • What volume means and what volume represents. • Reason abstractly and quantitatively.	• The connection between computing volume and packing the solid figure with cubes of varying sizes. • The formula V = bh refers to multiplying the area of the base times the height. • Units that measure volume are cubic (cm^3, m^3, ft^3).	• Compute volume after packing a rectangular prism with unit cubes. • Apply formulas to solve problems with real world contexts. • Calculate volume with and without a four-function calculator. • Evaluate reasonableness of the volume of a prism in regards to its length, width, and height.

GRADE 6

Geometry

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

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.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Polygons are closed figures with no curved sides. • Vertices is plural for vertex; vertex being the point where two segments meet. • Coordinates (ordered pairs) are two numbers that describe the location of a point on the coordinate grid. • Plot points on the coordinate grid in all four quadrants. • How to find, name, and label coordinates. • How to identify and label a line segment. • Use appropriate tools strategically.	• Length of a segment with joining points is also distance between said points. • The distance between two points with the same first coordinate is found my subtracting the points' second coordinates. • Conversely, the distance between two points with the same second coordinate is found my subtracting the points' first coordinates.	• 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. • Subtract positive and negative numbers. • Find perimeter and area of polygons. • Solve real-world and mathematical problems.

GRADE 6

Geometry

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

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.	Desired Student Performance		
	A student should know	**A student should understand**	**A student should be able to do**
	• The difference between right rectangular prisms, right triangular prisms, right square prisms (cube), and right tetrahedron. • A right tetrahedron is also called a triangular pyramid. • Area formulas for triangles and rectangles. • Model with mathematics.	• A net is a two-dimensional pattern for a three-dimensional figure. • Nets may be rearranged to form the same three-dimensional figure. *For example, there are 11 different nets for a right square prism (cube).* • Surface area is the sum of the areas of each face of a three-dimensional figure.	• Match nets with corresponding three-dimensional figures. • Draw nets when given the name of a three-dimensional figure. • Calculate surface area with and without a four-function calculator. • Evaluate reasonableness of the surface area considering the lengths and widths of the faces of the figure. • Solve real-world and mathematical problems.