GRADE 5

Operations and Algebraic Thinking

Write and interpret numerical expressions.	Additional

5.OA.1
Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• The mathematics symbols for operations of addition, subtraction, multiplication, and division. • There are numerous ways to write the different operations and some situations require different mathematical symbols. • Parentheses are used often when working with multiplication and can be used to illustrate the Associative Property of Multiplication and the Distributive Property of Multiplication. • The difference between an expression and an equation.	• Mathematic symbols help keep numeric expressions organized. • Parentheses group a set of numbers and operation symbols together and can also represent the operation of multiplication. • Attend to precision.	• Evaluate expressions by solving within parentheses first, within brackets second, and finally work within the braces. • Recognize that not all problems will contain all of the mathematical symbols, but when they are present, an order of importance must be followed to complete the problem. • Use mathematical symbols appropriately to organize numerical expressions. • Interpret numerical expressions and evaluate them. • Evaluate, create, and write numerical expressions.

GRADE 5

Operations and Algebraic Thinking

Write and interpret numerical expressions.	Additional

5.OA.2

Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. ***For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.***

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Parentheses are used to group expressions together. • It is possible to multiply any given expression by another quantity. • How the distributive property of multiplication can be written as an expression.	• Word problems are real-world situations and can be represented using numerical expressions. • The expression 14 x 3 is the same as (14)3, (10 + 4) x 3 , or (10 + 4) + (10 + 4) + (10 + 4). (There are many other ways to write the expression as well.) • Decontextualizing a problem and organizing the information into a numeric expression is a necessary part of mathematics. • Attend to precision.	• Represent a word problem or real-world situation as a numeric expression. • Write a problem in various equivalent expressions. • Use parentheses and other mathematical symbols appropriately. • Use these mathematical symbols appropriately to organize numerical expressions. • Interpret numerical expressions. • Evaluate, create, and write numerical expressions.

GRADE 5

Operations and Algebraic Thinking

Analyze patterns and relationships.	Additional

5.OA.3

Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to generate a number pattern that follows a given rule. *For example: given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers.*	• What an ordered pair is and the relationship between the coordinates and the coordinate plane. • Patterns and finding relationships between numbers. • Look for and express regularity in repeated reasoning. • Look for and make use of structure.	• Create real-world and mathematical problems which require graphing points in Quadrant I of a coordinate grid. • Interpret coordinate values of points in the context of the situation. • Calculate terms of an ordered pair given a rule that must be followed. • Explain the relationship between two sets of patterns. i.e., *Given the rule "Add 2" and a starting number 0, and given the rule "Add 6" and a starting number 0, explain why the terms in the second sequence are three times greater than the numbers in the first sequence.*

GRADE 5

Number and Operations in Base Ten

Understand the Place Value System	Major

5.NBT.1
Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• The names of the place value columns for whole numbers. • Ten ones compose a ten, ten different tens compose a hundred, and ten different hundreds compose a thousand. • The value of a digit located in the tenths or hundredths place. • The Base Ten System has place value because it is a positional notation system. The numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 can represent different values depending upon their position within a group of numerals. This is an efficient way to represent many quantities with few numeric symbols.	• A 9 in the ten's position has a different value than a 9 in the hundred's position. • Columns located to the left of a given column have a greater value than columns located to the right of that column. • Multiples of 10. • A fraction bar represents division. • How to find the decimal equivalents for fractions of 1/10, 1/100, 1/1000, etc. • Multiplying by the fraction 1/10 is the same as dividing by 10, multiplying by 1/100 is the same as dividing by 100, etc.	• For a multi-digit number, tell what value each digit holds. *For example, in 245, the 2 is in the hundreds place and represents 200.* • Explain the patterns of the base ten system (each position is ten times the position to its right and 1/10 of the position to its left). • Write an expression for a multi-digit number to show the quantity of each digit. For example: 345.67 is equivalent to (3 x 100) + (4 x 10) + (5 x 1) + (6 x 1/10) + (7 x 1/100). • Explain why dividing by 10 is equivalent to multiplying by 1/10.

GRADE 5

Number and Operations in Base Ten

Understand the Place Value System	Major

5.NBT.2
Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

Desired Student Performance

A student should know

- A conceptual understanding of the multiplication of whole numbers.
- A conceptual understanding of the distributive property of multiplication.
- Division is the inverse of multiplication.
- Place value has many patterns.
- In place value, each column has a value 10 times that of the column to the right of it. Each column has a value 1/10 of the column to the left of it.
- How to multiply multi-digit numbers by a single digit number as well as multi-digit numbers by a two digit number.

A student should understand

- Exponents are related to the operation of multiplication.
- The base is the number that is being multiplied and the exponent is the number of times the base is multiplied.
- Exponents can also be referred to as powers. \
- Patterns are a way of making meaning without actually evaluating.

For example:

10^2 *= 10 x 10 = 100*
10^3 *= 10 x 10 x 10 = 1,000*
10^4 *= 10 x 10 x 10 x 10 = 10,000*

A student should be able to do

- Explain how the patterns of the powers of ten relate to numbers being multiplied by them.
- Explain 10^2 is the same as multiplying by 10 x 10 and the product of this is 100
- Explain why the problem 6.2 x 10^2 is the same as 6.2 x 100.
- Use patterns and reasoning to place a decimal in a product or quotient. *For example: The product of 3.1 x* 10^2 *must be close to 300 because 3.1 is close to 3 and 3 x 100 = 300, therefore the logical placement of the decimal is between the one's place and the tenth's place.*

GRADE 5

Number and Operations in Base Ten

Understand the Place Value System	Major

5.NBT.3a **Read, write, and compare decimals to thousandths** **Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• How to read and write whole numbers using base-ten numerals, number names, and expanded form. • The relationship between fractions and their base ten decimal equivalents. • Equivalent decimal values. *For example: 0.6 is equivalent to 0.60* • Compare decimals to the hundredths. • How to represent tenths and hundredths using modeling.	• The patterns in the place value system can be extended beyond hundredths**.** • Thousandths are 1/10 the value of a hundredth, 1/100 the value of a tenth, and 1/1000 the value of one whole. • There are multiple ways to represent any given amount. • There is no comma to separate hundredths and thousandths.	• Read, write, and compare decimals to thousandths using base-ten numerals, number names, and expanded form. • Convert numbers to word form and expanded form. • Compare the decimal amount in the various forms and with varying decimal place values.

GRADE 5

Number and Operations in Base Ten

Understand the Place Value System	Major

5.NBT.3b
Read, write, and compare decimals to thousandths
Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to read and write whole numbers using base-ten numerals, number names, and expanded form. • Compare whole numbers based on the meanings of the digits in each place. • The relationship between fractions and their base ten decimal equivalents. • Equivalent decimal values. *For example: 0.6 is equivalent to 0.60* • Compare decimals to the hundredths place. • How to represent tenths and hundredths using modeling. • The meanings of the symbols >, =, and <.	• The patterns in the place value system can be extended beyond hundredths**.** • Thousandths are 1/10 the value of a hundredth, 1/100 the value of a tenth, and 1/1000 the value of one whole. • There are multiple ways to represent any given amount. • There is no comma to separate hundredths and thousandths. • The number of digits in a base-ten decimal number does not determine its value. *For example: 0.7 > 0.299 because 0.7 is closer to one whole than 0.299.*	• Compare decimals to the thousandths place by using the symbols >, =, and <**.** • Use visual models to show the value of each digit in a base-ten decimal number. • Explain decimal equivalence by using visual models and or fractional equivalence**.** • Place decimals on a number line to demonstrate an understanding of value. Use number lines that show tenths, hundredths, and thousandths. • Explain that tenths are placed on a number line between whole numbers, hundredths are placed between tenths, and thousandths are placed between hundredths.

GRADE 5

Number and Operations in Base Ten

Understand the Place Value System	Major

5.NBT.4
Use place value understanding to round decimals to any place.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to use a number line to round whole numbers**.** • Decimal numbers can be placed on a number line**.** • How to round whole numbers. *For example: If rounding 48 to the nearest tens place, it rounds to 50.*	• Tenths are placed on a number line between whole numbers, hundredths are placed between tenths, and thousandths are placed between hundredths**.** • Rounding decimal values is very similar to rounding whole number values.	• Place decimals on a number line**.** • Use the number line to determine what benchmark number the original number is closest to on the line. • Given a base-ten decimal number students should be able to explain what benchmark two numbers the given decimal is located between. • Round a decimal number to any given place using place value understanding.

GRADE 5

Number and Operations in Base Ten

Perform operations with multi-digit whole numbers and decimals to the hundredths	Major

5.NBT.5
Fluently multiply multi-digit whole numbers using the standard algorithm.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Fluently recall basic multiplication facts. • Multiplication using strategies based on place value. These strategies could include partial products algorithms, distributive property, rectangular arrays, and area models.	• The standard algorithm of multiplication is a "short cut" for other visual and written models. • The standard algorithm applies the same concepts of the distributive property of multiplication. Every digit of the multiplicand must be multiplied by every digit in the multiplier. • The partial products in the standard algorithm are the result of multiplying by each digit in the multiplier. A two digit multiplier results in two partial products. A three digit multiplier results in three partial products, and so on.	• Explain each of the steps in the standard multiplication algorithm and how place value plays an important role in each step. • Explain how the partial products in the standard algorithm relate to the place value of the digits being multiplied. • Complete all of the steps in the standard algorithm with the corresponding place values lined up appropriately. • Adhere to precision and determine the reasonableness of the final product based on the numbers multiplied. • Complete the standard algorithm fluently to multiply multi-digit numbers.

GRADE 5

Number and Operations in Base Ten

Perform operations with multi-digit whole numbers and decimals to the hundredths	Major

5.NBT.6
Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• A conceptual knowledge of division and division models. • Find whole-number quotients and remainders of up to four-digit dividends and one-digit divors. • Division is the inverse of multiplication. • How to use visual models to divide whole numbers. • Make sense of problems and persevere in solving them.	• Dividing with two digit divisors is conceptually the same as dividing with a single digit divisor. • One visual model may be more appropriate than another depending on the problem context. • The relationship between multiplication and division.	• Divide a whole number dividend with up to 4 digits by a 2-digit divisor using any appropriate strategy. • Use multiple strategies for multi-digit division. Area models illustrate a connection to multiplication, partial quotients make a connection to place value, and concrete models (base ten blocks) demonstrate the decomposition needed in the standard algorithm. • Illustrate and explain the solution strategy using equations, rectangular arrays, and/or area models. • Reason with the value of the dividend and the value of the divisor to determine if a quotient is reasonable.

GRADE 5

Number and Operations in Base Ten

Perform operations with multi-digit whole numbers and decimals to the hundredths	Major

5.NBT.7
Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to add, subtract, multiply, and divide whole numbers using strategies based on place value and the properties of operations**.** • Addition and subtraction are inverse operations. • Multiplication and division are inverse operations. • Place value is extremely important when performing operations**.**	• The concept of adding and subtracting decimals is conceptually the same as it is for whole numbers. • Number lines, concrete models, and algorithms can all be used to solve addition, subtraction, multiplication, and division problems with decimal numbers as well as with whole numbers. • The relationship between performing operations with fractions and with decimal numbers.	• Use number lines, concrete models (base ten blocks or decimal grids) or visual models to illustrate addition, subtraction, multiplication, or division of decimal numbers**.** • Apply knowledge of fraction multiplication and division to perform decimal operations**.** • Use reasoning to place the decimal in a sum, difference, product, or quotient**.** • Explain how the placement of the decimal in an answer is related to the value of the numbers calculated. • Determine which method or strategy is appropriate the given problem.

GRADE 5

Number and Operations - Fractions

Use equivalent fractions as a strategy to add and subtract fractions	Major

5.NF.1

Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Adding fractions is joining separate parts referring to the same whole. • How to create an equivalent fraction for a given fraction using visual fraction models. • How to find common denominators and create equivalent fractions to compare fractions. • A unit fraction has a numerator of 1 and can be combined with other unit fractions with the same denominator. • How to + or - mixed numbers with like denominators. • Solve word problems involving + and - of fractions with like denominators by using visual fraction models, equations, and a number line.	• Equivalent fractions represent the same part of a whole. They make it easier to perform operations with fractions. • Multiples and factors are important and help in finding equivalent fractions. • Fractions can be estimated to the nearest benchmark 0 , ½, or 1 whole. • Mixed numbers can also be estimated to benchmarks. • Fractions with different size denominators can be placed on the same number line. • Improper fractions are fractions that represent an amount greater than one whole.	• Find a common denominator and create equivalent fractions for given fractions or mixed numbers. • Place a fraction or mixed number on a number line and then increase or decrease it in value (move on the number line) from this position to perform an operation (adding or subtracting). • Use bar models or visual models to represent the adding or subtracting of fractions or mixed numbers with unlike denominators.

GRADE 5

Number and Operations – Fractions

Use equivalent fractions as a strategy to add and subtract fractions	Major

5.NF.2
Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Adding fractions is joining separate parts referring to the same whole. • Use bar models, visual models, a number line, and equations to solve addition and subtraction problems involving fractions with like denominators and fractions with unlike denominators. • How to compare fractions with like and unlike denominators. • Estimate a fraction to the nearest benchmark 0, ½ , and 1 .	• Equivalent fractions represent the same part of a whole. They make it easier to perform operations with fractions. • Multiples and factors are important and help in finding equivalent fractions. • Fractions can be estimated to the nearest benchmark 0 , ½, or 1 whole. • Mixed numbers can also be estimated to benchmarks. • Fractions with different size denominators can be placed on the same number line. • Improper fractions are fractions that represent an amount greater than one whole.	• Create equivalent fractions for given fractions or mixed numbers. • Find a common denominator for given fractions or mixed numbers. • Solve word problems involving addition and subtraction of fractions with like or unlike denominators • Use bar models, equations, or a number line to represent adding or subtracting of fractions with unlike denominators. • .Relate fractions to benchmark fractions (0, ½, 1) to determine if a solution is reasonable.

GRADE 5

Number and Operations - Fractions

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

5.NF.3

Interpret a fraction as division of the numerator by the denominator (*a*/*b* = *a* ÷ *b*). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to divide whole numbers and what it means to divide using the partitioning and repeated subtraction models. • Division is the inverse of multiplication. • How to use visual models to divide whole numbers with and without remainders. • Equivalencies such as: 2 tens = 20 ones, 1 = 3/3, 2 =8/4, 1 = 10/10, etc. • Make sense of problems and persevere in solving them.	• Quotients can be represented with fractions. • It is possible to share an amount such as 3 with a larger number like 4. The process will require that the 3 be decomposed into smaller parts. • Contexts in word problems help to determine what operation to perform and what strategies might be useful. • Remainders can be interpreted in multiple ways and may be written as a fraction or a mixed number.	• Contextualize and decontextualize word problems involving division. • Produce visual models (bar/ circle) to justify a division such as 7/8. *i.e., Draw 7 wholes and 8 groups. Partition each whole into 8 pieces and then share the parts with the 8 groups. Each group will have seven pieces and each piece will have a size of 1/8, thus each group will receive 7/8.* • Write an equation to represent the division shown in a visual model. • Estimate the size of the quotient (part) before dividing. *i.e., ¾ is less than 1 whole.*

GRADE 5

Number and Operations - Fractions

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

5.NF.4a **Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.** **Interpret the product (*a*/*b*) × *q* as *a* parts of a partition of *q* into *b* equal parts; equivalently, as the result of a sequence of operations *a* × *q* ÷ *b*. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)***	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• A strong conceptual understanding of multiplication as an operation. • Multiplication can be viewed as repeated addition, equal-sized groups, or using an area model. • Multiplication by a number greater than 1 yields a product greater than the factors. • Multiplication by 1 yields a product that is equal to one of the factors. • Multiplication is a commutative operation.	• There are many different multiplication models that can be used. The model you use depends on the context of the problem. • Multiplying by a number that is less than one whole will yield a smaller product that is smaller than one of the factors.	• Multiply a fraction or whole number by a fraction and interpret the product. • Use visual fraction models and number lines to show the steps used in solving a problem involving multiplication by a fraction. • Using benchmarks to estimate the product and determine if the solution is reasonable. • Contextualize and decontextualize problems by creating word problems and/or equations that represent different multiplication situations and models.

GRADE 5

Number and Operations - Fractions

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

5.NF.4b

Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to find the area of a given rectangle with whole-number side lengths using square units (tiling square units and finding the total number of square units). • How to find the area of a given rectangle with whole-number side lengths using multiplication and addition.	• Rectangles can have fractional side lengths. • Finding the area of a rectangle with fractional side lengths is similar to finding the area of a rectangle with whole number side lengths (the same process is used for both). • The total number of square units used to tile a rectangle represents the area of that rectangle. • Multiplication is a more efficient process for finding the area of a rectangle.	• Find the area of a rectangle with fractional side lengths using unit squares of the appropriate unit fraction side lengths. • Find and explain the relationship between the fractional side lengths of the square unit and the fractional side lengths of the rectangle. • Show that counting the square units used to tile the rectangle and multiplying the side lengths of the rectangle produce the same answer (similar to finding the area of a rectangle with whole number side lengths).

GRADE 5

Number and Operations - Fractions

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

5.NF.5a

Interpret multiplication as scaling (resizing), by: Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• The identity property of multiplication means that any number multiplied by 1 equals the original number. *For example: 6 x 1 = 6 or 126 x 1 = 126.* • How to compare fractions to benchmarks 0, ½, and 1. • Multiplication is used for resizing (scaling). • Multiplication can produce an answer smaller than one or both of the factors.	• Multiplying by a fraction less than 1 will yield a product smaller than one of the factors. • When multiplying by $\frac{1}{2}$, the product is half the value of that factor times 1. For example, $6 \times \frac{1}{2} = 3$. Multiplying by a fraction smaller than 1 will result in an answer less than 6. • When multiplying two proper fractions, the product is a part of a part of a whole. This yields a product that is less than both factors.	• Compare the size of a product of two fractions to the size of one of the factors, without performing the indicated multiplication, • Make use of the structure of multiplication with whole numbers, and apply this knowledge to predict an outcome for multiplication of fractions. (For example, 4x2=8 and 4x1=4; therefore, multiplying 4 by a fraction less than 1 will produce an answer less than 4) • Use benchmark fractions to determine if a solution is reasonable.

GRADE 5

Number and Operations - Fractions

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

5.NF.5b

Interpret multiplication as scaling (resizing), by: Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence *a/b* = (*n* × *a*)/(*n* × *b*) to the effect of multiplying *a/b* by 1.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Multiplication can be shown using repeated addition, equal-sized groups, or using an area model. • Multiplication is commutative. • Multiplying a number by a second number larger than 1 equals a product larger than the original number. • The identity property of multiplication means that any number multiplied by 1 equals the original number. *i.e., 6 x 1 = 6 or b x 1 = b.* • The zero property of multiplication. a x 0 = 0 • Look for and make use of structure. • Look for and express regularity in repeated reasoning.	• There is pattern in multiplying whole numbers. For example: 6 x 3 = 18 6 x 2 = 12 6 x 1 = 6 (Identity Prop.) 6 x 0 = 0 (Zero Prop.) • A whole number multiplied by 1 will always result in a product equal to the original whole number. • A whole number multiplied by zero will always result in a product of zero. • A whole number can be multiplied by a fraction.	• Predict the relative size of the product for a given multiplication problem based on the two factors in the problem. • Use patterns to reason/ justify about the size of the product when multiplying a whole number by a fraction. *For example: 6 x a/b = must be less than 6 but greater than 0, because a/b < 1 and a/b > 0.* • Use patterns to reason/ justify about the size of the product when multiplying a fraction times a fraction. *For example:* *3/4 x 3 = 9/4 = 2 1/4* *3/4 x 2 = 6/4 = 1 1/2* *3/4 x 1 = 3/4*

			3/4 x 3/3 = 9/12 = 3/4 *3/4 x 2/3 = 6/12 = 1/2* *3/4 x 0 = 0* *Therefore 3/4 multiplied by a number greater than 1 will result in a product greater than 3/4. If 3/4 is multiplied by any number less than one but greater than 0 the product will be less than ¾.*

GRADE 5

Number and Operations - Fractions

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

5.NF.6
Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Multiplication can be shown using repeated addition, equal-sized groups, or using an area model. • Multiplying a number by a second number larger than 1 equals a product larger than the original number. • The identity property of multiplication means that any number multiplied by 1 equals the original number. *i.e., 6 x 1 = 6 or b x 1 = b.* • Look for and make use of structure. • Look for and express regularity in repeated reasoning.	• Mixed numbers can be written as improper fractions. • The concepts learned for multiplying whole numbers and fractions can be applied when multiplying by mixed numbers. • Mixed numbers represent a value greater than 1; therefore, multiplying a number by a mixed number will yield an answer that is larger than the given number.	• Solve real world multiplication problems involving fractions and mixed numbers by creating a visual model or equation to solve. • Make use of patterns to solve problems. Use prior knowledge of multiplying by fractions (proper or improper) to solve problems such as the following:. 4 x 4 ½ = 4 ½ = 9/2 So, 6x 9/2 = 54/2 = 27 • Apply an understanding of the Distributive Property to solve problems. 6 x 4 = 24 6 x ½ = 3 So, (6 x 4) + (6 X ½) = 27

GRADE 5

Number and Operations - Fractions

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

5.NF.7a	Desired Student Performance		
Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. **Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3*.**	**A student should know** • How to divide whole numbers and what it means to divide using the partitioning and repeated subtraction models. • Division is the inverse of multiplication. • How to use visual models to divide whole numbers with and without remainders. • Contextualize division problems using whole numbers. • Division is not a commutative operation. • Unit fractions have a numerator of one and can be combined to create non-unit fractions.	**A student should understand** • Creating a visual model to represent problems helps to give meaning to the problem and what is happening in the problem. • The division model used to solve a problem depends on the context of the problem. • The role of the dividend, divisor, and quotient. • A fraction can be divided by a whole number and the result will be less than the original fraction because it was partitioned into pieces.	**A student should be able to do** • Create visual models and divide unit fractions by whole numbers. • Reason through a division problem. *i.e., For ¼ ÷ 3, ask, "Can ¼ be shared with three groups?" Explain that if ¼ is shared with 3 groups the quotient will be smaller in size than ¼.* • Interpret division of a unit fraction by a non-zero whole number and compute quotients. Create a word problem to represent division of a unit fraction by a non-zero whole number.

GRADE 5

Number and Operations - Fractions

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

5.NF.7b	**Desired Student Performance**		
Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. **Interpret division of a whole number by a unit fraction, and compute such quotients**. ***For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.***	**A student should know** • How to divide whole numbers and what it means to divide using the partitioning and repeated subtraction models. • Division is the inverse of multiplication. • How to use visual models to divide whole numbers with and without remainders. • Unit fractions have a numerator of one. • Division is not a commutative operation.	**A student should understand** • Creating a visual model to represent problems helps to give meaning to the problem and what is happening in the problem. • The division model used to solve a problem depends on the context of the problem. • The role of the dividend, divisor, and quotient. • A whole number can be divided by a fraction and the result will be larger than the original whole number.	**A student should be able to do** • Create visual models to divide a whole number by a unit fraction. Make meaning of a problem such as 6 ÷ ½ by asking, "How many ½ are in 6?" (The quotient will be > 6 because each whole is composed of two halves.) • Create word problems to represent division problems. • Draw visual fraction models (bar/circles) using the appropriate number of wholes to find out how many of the given unit fraction are found in the wholes.

GRADE 5

Number and Operations - Fractions

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

5.NF.7c **Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.** **Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem.** ***For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?***	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• How to divide whole numbers and what it means to divide using the partitioning and repeated subtraction models. • Division is the inverse of multiplication. • How to use visual models to divide whole numbers with and without remainders. • Contextualize division problems using whole numbers. • Division is not a commutative operation. • Unit fractions have a numerator of one. • Make sense of problems and persevere in solving them.	• Creating a visual model to represent problems helps to give meaning to the problem and what is happening in the problem. • The division model used to solve a problem depends on the context of the problem. • The role of the dividend, divisor, and quotient. • Various models can be used to illustrate given problems.	• Solve real-world world problems involving division of unit fractions by non-zero whole numbers. • Solve real-world problems involving division of whole numbers by unit fractions. • Use visual fraction models and equations to represent word problems and solve them. • Use prior knowledge of patterns in dividing fractions and whole numbers to reason through problems. • Use benchmark fractions to estimate quotients and determine the reasonableness of solutions.

GRADE 5

Measurement and Data

Convert like measurement units within a given measurement system	Supporting

5.MD.1 **Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• There are two systems of measurement (metric and customary). • Relative sizes of the different units in each of the two different systems**.** • There are multiple ways to represent measurements and equivalent measurements can be expressed by using different units**.** • There are different units for different types of measuring**.** *For example: There are different units for mass, height, capacity, length and so on.*	• Units of measurement can be expressed in terms of a larger unit or a smaller unit**.** *(For example: 6 in. = 0.5 ft.)* • Conversions of measurement units are sometimes necessary when applying measurement to the real world. • The metric system is a base ten system and the customary system works in various bases. • Basic concepts of whole numbers, fractions, and decimals.	• Solve multiple-step real world problems using various units of measurement (within the same system). • Explain equivalents within a given measurement system. • Use knowledge of whole numbers, fractions, and decimals to compare/convert units of measurement within a system. • Use visual models for conversions and solve measurement problems**.** • Apply knowledge of base ten place value to conceptually understand the conversion of metric units. • Use measurement tools appropriately.

GRADE 5

Measurement and Data

Represent and interpret data	Supporting

	Desired Student Performance		
5.MD.2 **Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.***	**A student should know** • How to partition a line into halves, fourths, and eighths. • How to use a line or line segment to make a line plot. • How to interpret and solve problems with a line plot using whole numbers and the unit fractions of (1/2, 1/4, 1/8). • Make sense of problems and persevere in solving them. • How to add and subtract unit fractions. • How to multiply unit fractions by whole numbers.	**A student should understand** • A line plot is used to organize data**.** • Every piece of data in a data set is displayed on the line plot with a symbol. Intervals on the line plot that do not have a symbol do not contain data. • Real world problems can be represented using a line plot.	**A student should be able to do** • Collect real world data using fractions (1/2, 1,4, 1/8) and create a line plot to display the results visually. • Use the results of the line plot to make observations and/or inferences about the data. • Answer questions using a line plot that has already been created • Use fraction operations of addition, subtraction, multiplication, and division to solve real world problems using line plots. • Find the mean (average) of a set of data by leveling off the line plot and redistributing the data equally.

GRADE 5

Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	Major

5.MD.3a **Recognize volume as an attribute of solid figures and understand concepts of volume measurement.** **A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• The names and attributes of two-dimensional shapes, in particular, squares and rectangles. • The names and attributes of three-dimensional shapes, in particular, rectangular prisms and cubes. • Two dimensional figures can be measured using area**.** • How to find the area of a figure using square units or the standard algorithm. • How the formula for the area of rectangles and squares is derived.	• Volume is the space that can be filled in a 3-dimensional figure similar to the way that area is the space that can be filled in a 2-dimensional figure. • A cubic unit is similar to a square unit. The difference is that it has a third dimension, height. • Exponents can be used to describe square units ($units^2$) and cubic units ($units^3$). • Volume can be "packed" or "filled." These two different ideas both represent volume. *For example: packing with unit cubes vs. filling with liquid/gas*.	• Explain the concept of volume. Provide examples in the real world that represent a measure of volume. • Describe the difference between square units and cubic units**.** • Make connections between exponents and the relationship they have with square units and cubic units**.** • Explain how the unit cube is used to find the volume of an object. • Use differing units such as inches, centimeters, feet, etc. to construct a unit cube. • Select the appropriate unit cube to use to measure a 3-dimensional space.

GRADE 5

Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	Major

5.MD.3b
Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• The names and attributes of two-dimensional shapes especially squares and rectangles. • The names and attributes of three-dimensional shapes especially rectangular prisms and cubes. • Two-dimensional figures can be measured using area**.** • How to find the area of a figure using square units or the standard algorithm. • How the formula for the area of rectangles and squares is derived.	• Volume is the space in a three-dimensional figure. • What it means to find the area of a two-dimensional figure. • A cubic unit is similar to a square unit. The difference is that it has a third dimension, height. • Exponents are used to describe square units ($units^2$) and cubic units ($units^3$). • Volume can be "packed" or "filled." These two different ideas both represent volume. Packing with unit cubes vs. filling with liquid/gas.	• Explain that when finding volume, unit cubes must be packed without gaps or overlays inside a three-dimensional space. • The total number of unit cubes (*n*) packed into a three-dimensional figure equals the volume of the figure. • Look at examples of different sized prisms packed with unit cubes, some packed with no gaps or overlays and others packed in an unorganized manner, and explain which examples accurately represent the volume of the prism.

GRADE 5

Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	Major

5.MD.4 **Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• The names and attributes of two-dimensional shapes, especially squares and rectangles. • The names and attributes of three-dimensional shapes, especially rectangular prisms and cubes. • Two-dimensional figures can be measured using area**.** • How to find the area of a figure using square units or the standard algorithm. • How the formulas for the area of rectangles and squares are derived.	• Volume is the space in a three-dimensional figure. • Finding the area for a two-dimensional figure is similar to finding the volume of a three-dimensional figure. • A cubic unit is similar to a square unit. The difference is that it has a third dimension, height. • Exponents are used to describe square units ($unit^2$) and cubic units ($unit^3$). • A cubic unit has a length, width, and height of 1 unit. • Volume can be "packed" or "filled." These two different ideas both represent volume. Packing with unit cubes vs. filling with liquid/gas.	• Determine the volume of a rectangular prism using a concrete or pictorial example, by counting unit cubes. The unit cubes may be cubic inches, cubic feet, or other improvised units. (These examples should already have visible unit cubes associated with them. F*or example: a cube or rectangular prism built from snap cubes or inch cubes or a drawing or picture of a cube/rectangular prism with individual unit cubes visible*.)

GRADE 5

Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	Major

5.MD.5a **Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.** **Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Volume is the space in a 3-dimensional figure. • Volume can be "packed" or "filled." These two different ideas can be problematic for students. Packing with unit cubes vs. filling with liquid/gas. • A cubic unit is similar to a square unit. The difference is that it has a third dimension, height. • Exponents are used to describe square units ($unit^2$) and cubic units ($unit^3$).	• Unit cubes must be packed into a prism or cube with no gaps or overlays to accurately measure volume. • Volume can be measured with cubic units that are improvised or standardized. The improvised unit will be referred to solely as a cubic unit and has a length, width, and height of 1 unit. • A unit cube with 1 in. side lengths is referred to as a cubic inch, a unit cube with 1 cm side lengths is referred to as a cubic centimeter, and a unit cube with 1 ft. side lengths is referred to as a cubic foot. • It is possible to calculate the volume of prisms and cubes that have no unit cubes visible.	• Pack real world prisms/cubes with unit cubes such as inch cubes, centimeter cubes, and improvised cubes. State the volume of a given prism/cube based on how many unit cubes it holds. • Calculate the volume of real world rectangular prisms by counting the unit cubes used for the length, width, and height and multiplying them to get the total number of unit cubes in the volume. • Use addition to determine the number of unit cubes or volume in a 3-dimensional shape. • Solve real world problems using the concepts related to volume.

GRADE 5

Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	**Major**

5.MD.5b **Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.** **Apply the formulas *V = l × w × h* and *V = b × h* for rectangular prisms to find volumes of right rectangular prisms with whole-number 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 space inside a 3-dimensional figure. • Volume can be "packed" or "filled." These two different ideas can be problematic for students. Packing with unit cubes vs. filling with liquid/gas. • A cubic unit is similar to a square unit. The difference is that it has a third dimension, height. • Exponents are used to describe cubic units ($unit^3$).	• Unit cubes must be packed into a prism or cube with no gaps or overlays to accurately measure volume. • It is possible to calculate the volume of rectangular prisms/cubes without counting every unit cube. • Volume of rectangular prisms can be found by multiplying the total number of unit cubes needed to form the length of the prism by the total number of unit cubes needed to form the width of the prism by the number of unit cubes needed for the height. • The total number of unit cubes in each layer is equivalent to the area of the base.	• Discover the formulas for volume (l x w x h and b x h) based on their knowledge of packing unit cubes into 3-dimensional figures and counting the cubes. • Explain the different formulas V=l x w x h and V = b x h**.** (*l* represents length, *w* represents width, *h* represents height, and *b* represents the area of the base). • Find the volume for real world problems using rectangular prisms with whole number side lengths.

GRADE 5

Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	Major

5.MD.5c **Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.** **Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.**	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Volume is the space that can be filled in a 3-dimensional figure. • Volume can be "packed" or "filled." These two different ideas can be problematic for students. Packing with unit cubes vs. filling with liquid/gas. • A cubic unit is similar to a square unit. The difference is that it has a third dimension, height. • Exponents are used to describe cubic units ($unit^3$).	• Unit cubes must be packed into a prism or cube with no gaps or overlays to accurately measure volume. • It is possible to calculate the volume of rectangular prisms/cubes without counting every unit cube by applying the formulas V= l x w x h or V = b x h. • The total number of unit cubes in each layer of a rectangular prism is equivalent to the area of the base.	• Find the volume of different rectangular prism/cubes by counting unit cubes and applying the formulas for volume. • Combine two different rectangular prisms/cubes and determine the total volume of the combined prisms. Explain that if two prisms are combined, the total volume of one prism is added to the volume of the second prism. • Find the volume of combined rectangular prisms by decomposing them into separate figures, finding the volume of each, and then compose the figures back together.

GRADE 5

Geometry

Graph points on the coordinate plane to solve real-world and mathematical problems	Additional

5.G.1

Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate).

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• How to use a number line. • Basic geometric concepts of points, lines, line segments, rays, perpendicular lines, and parallel lines. • Two lines that cross at a 90 degree angle are perpendicular lines.	• When two lines cross they form an intersection. • When perpendicular lines exist a plane has been partitioned by those lines into fourths. The fourths are also referred to as quarters. In the case of coordinate planes each quarter is referred to as a quadrant. • Each line forming the perpendicular line set is labeled for identification. The horizontal line is known as the x axis and the vertical line is known as the y axis. • When two number lines form perpendicular lines a coordinate grid can be created.	• Identify the different parts of the coordinate grid. Know and understand the following: Origin X axis Y axis Ordered Pair Quadrant I Point/Coordinate • Given an ordered pair, place a point on the correct coordinate. • Given a point in quadrant I, identify the correct ordered pair. • Explain how to correctly move and locate points within quadrant I.

		• The point where the two lines cross is known as the origin and is a starting point. • A point can be located and identified by using the X axis and the Y axis.	

GRADE 5

Geometry

Graph points on the coordinate plane to solve real-world and mathematical problems	Additional

5.G.2
Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Desired Student Performance

A student should know	A student should understand	A student should be able to do
• Coordinate planes are created when two perpendicular lines cross and a mathematical grid is placed upon them. • These perpendicular lines are labeled as the x axis and the y axis. • Points within a plane can be located using an ordered pair and that an ordered pair consists of an x coordinate and a y coordinate. • Movement begins at the origin, follows the x axis first, and the y axis second.	• Coordinate grids are a mathematical concept that can be applied to the real world. • Coordinates are used in the real world to help with locating and direction. Lines of latitude and longitude are an example of how mathematical structure is applied to the real world. • Quadrant I can also be useful when representing real world data. This quadrant can allow us to look for trends in data or changes in data over time.	• Locate points (coordinates) and follow directions on a coordinate grid that has been contextualized using a real world example. • Use maps, pictures, or drawings with a coordinate grid imposed upon it to create real world math problems that involve locating and graphing points within Quadrant I. • Create Quadrant I using an x axis and y axis and graph points within Quadrant I that relate to real world data. Connect the points in order to look for structure/patterns in the data. This leads to the creation and interpretation of line graphs.

GRADE 5

Geometry

Classify two-dimensional figures into categories based on their properties	Additional

5.G.3 **Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category.** *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*	**Desired Student Performance**		
	A student should know	**A student should understand**	**A student should be able to do**
	• Basic geometric concepts such as points, lines, line segments, rays, and angles. • Special types of lines including parallel and perpendicular lines. • Angles are obtuse, acute, or right. • Polygons are closed figures with straight sides. There are many different types of polygons and each is named based on the number of sides and angles. • Polygons can be classified based on attributes. There can also be a hierarchy for certain polygons.	• Polygons may appear different in shape and size but they can still be classified together based on their attributes. • Regular polygons contain equal length sides and are a special type of polygon. Irregular polygons do not have to have the same length sides but still contain attributes that can be classified. • Polygons must be classified based on their attributes and not solely on their appearance. • Different polygons may or may not contain some of the same attributes thus creating subcategories.	• Given the attributes without a visual picture, a student should be able to classify and name the polygon. • Sort polygons, especially quadrilaterals, into different subcategories by explaining the criterion by which they used to sort the polygons. • Compare and contrast the different polygons. • Justify, explain, and debate the categorizing of different types of polygons. • *For example: Are all parallelograms squares? When is a rhombus a square? Are all squares rectangles?*

GRADE 5

Geometry

Classify two-dimensional figures into categories based on their properties	Additional

5.G.4 Classify two-dimensional figures in a hierarchy based on properties.	Desired Student Performance		
	A student should know	**A student should understand**	**A student should be able to do**
	• Basic geometric concepts such as points, lines, line segments, rays, and angles. • Special types of lines including parallel and perpendicular lines. • Angles are obtuse, acute, or right. • Polygons are closed figures with straight sides. There are many different types of polygons and each is named based on the number of sides and angles it has. • Polygons can be classified based on attributes. There can also be a hierarchy for certain polygons.	• Polygons may appear different in shape and size but they can still be classified together based on their attributes. • Regular polygons contain equal length sides and are a special type of polygon. Irregular polygons do not have to have the same length sides but still contain attributes that can be classified. • Polygons must be classified based on their attributes and not solely on their appearance. • Different polygons may or may not contain some of the same attributes thus creating subcategories.	• Given the attributes without a visual picture, a student should be able to classify, draw, and name the polygon. • Explain why squares are unique among quadrilaterals. • Create a hierarchy of polygons, such as quadrilaterals, sorted with those with the most attributes and narrowing down to those with the fewest attributes.