GRADE 5 MATHEMATICS

Overview:

Domains	Operations and Algebraic Thinking	Number & Operations in Base Ten	Number & Operations: *Fractions*	Measurement and Data	Geometry
Clusters	• Write and interpret numerical expressions • Analyze patterns and relationships	• Understand the place value system • Perform operations with multi-digit whole numbers and with decimals to hundredths	• Use equivalent fractions as a strategy to add and subtract fractions • Apply and extend previous understandings of multiplication and division to multiply and divide fractions	• Convert like measurement units within a given measurement system • Represent and interpret data • Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	• Graph points on the coordinate plane to solve real-world and mathematical problems • Classify two-dimensional figures into categories based on their properties
Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.		5. Use appropriate tools strategically. 6. Attend to precision.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Major Interdisciplinary Grade 5 Units	**English Language Arts: across the content areas** • Reading • Writing • Speaking & Listening • Language	**Indian Education for All Titles** • *Arrow Over the Door* by Joseph Bruchac • *Navajo Long Walk* by Joseph Bruchac • *A New Look at Thanksgiving* by Catherine O'Neill Grace		**Science** • Using Variables in the Inquiry Process • Astronomy: Earth, Sun, Moon, Planets (Solar System), and Beyond • Elements and Compounds	**Social Studies** **United States History and Geography – Beginnings to 1850:** • Pre-Columbian America • Age of Exploration • American Indians • Settling Colonies • Causes of the American Revolution • War of Independence • Constitution • Life in the Young Republic and Westward Expansion

In Grade 5, instructional time should focus on three critical areas:

1. **Developing fluency with addition and subtraction of fractions, developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions)**
   Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them. Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)

2. **Extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operation**
   Students develop understanding of why division procedures work based on the meaning of

base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.

3. Developing understanding of volume

Students recognize volume as an attribute of three-dimensional space. They understand that volume can be quantified by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of shapes in order to solve real world and mathematical problems.

Domain: Operations and Algebraic Thinking

5.OA

Cluster: Write and interpret numerical expressions.

1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
    - I can evaluate expressions using parentheses, brackets, or braces.

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.*
    - I can write and interpret numerical expressions.

Cluster: Analyze patterns and relationships.

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.*
    - I can generate two different numerical patterns given two different rules.
    - I can identify and explain the relationships between the terms.
    - I can graph the ordered pairs from these terms on a coordinate plane.

Domain: Number and Operations in Base Ten

5.NBT

Cluster: Understand the place value system.

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.
   - I can explain that moving one place value to the left, that digit increases by ten times the value.
   - I can explain that moving one place value to the right, the digit has 1/10 the value.

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.
   - I can explain patterns of zeros and placement of decimal points when I multiply by powers of ten.
   - I can use exponents to demonstrate the powers of ten.

3. Read, write, and compare decimals to thousandths.
   a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$.
   - I can read, write, and compare decimals to thousandths using numerals, number names, and expanded form.

   a. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
   - I can compare two decimals to thousandths using >, =, and <.

4. Use place value understanding to round decimals to any place.
   - I can round decimals to any place.

Cluster: Perform operations with multi-digit whole numbers and with decimals to hundredths.

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

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.
   - I can find whole number quotients with four-digit dividends and two-digit divisors choosing from various strategies.

7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings within cultural contexts, including those of Montana American Indians, 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.
   - I can add, subtract, multiply, and divide decimals to hundredths choosing from various strategies.

- I can explain the reasoning behind my results.

Domain: Number and Operations—Fractions

5.NF

Cluster: Use equivalent fractions as a strategy to add and subtract fractions.

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.)*
    - I can add and subtract fractions (including mixed numbers) with unlike denominators by finding equivalent fractions.

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.*
    - I can solve real-world word problems involving addition or subtractions of fractions.
    - I can use my understanding of fractions to recognize that my answer is reasonable.

Cluster: Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

3. Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). 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?*
    - I can understand that a fraction is division of the numerator by the denominator.
    - I can solve word problems involving division of whole numbers that result in answers of fractions or mixed numbers.

4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
    a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation within cultural contexts, including those of Montana American Indians. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)*
        - I can multiply a fraction by a whole number or another fraction.
        - I can define the components and sequence of operations to multiply fractions.
    b. 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.

- I can determine the area of a rectangle with fractional side lengths by tiling or using multiplication.

1. Interpret multiplication as scaling (resizing), by:
   a. 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.
      - I can analyze the accuracy of a product based on comparison of the product with its factors.
   b. 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 $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.
      - I can explain that a number multiplied by a fraction greater than one will have a greater product than that number.
      - I can explain that a number multiplied by a fraction less than one will have a smaller product than that number.
      - I can explain that a number multiplied by a fraction equal to one will stay the same (equivalent).

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 within cultural contexts, including those of Montana American Indians.
   - I can use fraction models or equations to solve real-world word problems.

7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. [1] (*Note: Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.*)
   a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context within cultural contexts, including those of Montana American Indians, 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.*
      - I can understand and divide a unit fraction by a whole number.
   b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context within cultural contexts, including those of Montana American Indians, 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.*
      - I can understand and divide a whole number by a unit fraction.
   c. 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?

- I can apply my knowledge of dividing unit fractions by whole numbers and whole numbers by unit fractions to solve real-world problems.

Domain: Measurement and Data

5.MD

Cluster: Convert like measurement units within a given measurement system.

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 within a cultural context, including those of Montana American Indians.
   - I can convert units of different sizes within the same system.
   - I can apply a given measurement system to solve real-world problems.

Cluster: Represent and interpret data.

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.*
   - I can represent fractional units on a line plot.
   - I can use the data on a line plot to solve problems.

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

3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
   a. 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.
   - I can define and measure volume based on a cubic unit.

   a. 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.
   - I can use cubic units to measure volume.

4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
   - I can measure volume by counting various cubic units.

5. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
   a. Within cultural contexts, including those of Montana American Indians, 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.
   - I can find the volume of a rectangular prism using unit cubes or multiplication.

b. 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.

- I can apply the formula $V = l \times w \times h$ to find the volume of a rectangular prism.
- I can apply the formula $V = b \times h$ to find the volume of a rectangular prism.

c. 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.

- I can determine the volumes of two separate rectangular prisms and add them to find the total volume of the combined prisms.
- I can apply this technique to solve real-world problems.

Domain: Geometry

5.G

Cluster: Graph points on the coordinate plane to solve real-world and mathematical problems.

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).
    - I can create a coordinate graph using two perpendicular lines called axes.
    - I can identify the origin as where the lines intersect and coincide with zero on each line.
    - I can plot an ordered pair in the coordinate plane.

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 including those found in Montana American Indian designs.
    - I can represent and evaluate real-world problems by graphing in the first quadrant of the coordinate plane.

Cluster: Classify two-dimensional figures into categories based on their properties.

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.*
    - I can identify the attributes of all two-dimensional figures within their subcategory.

4. Classify two-dimensional figures in a hierarchy based on properties.
    - I can classify two-dimensional figures based on their properties.

Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.

Standards	Explanations and Examples
Students are expected to:	**The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.**
5.MP.1. Make sense of problems and persevere in solving them.	Students solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related to volume and measurement conversions. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".
5.MP.2. Reason abstractly and quantitatively.	Fifth graders should recognize that a number represents a specific quantity. They connect quantities to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.
5.MP.3. Construct viable arguments and critique the reasoning of others.	In fifth grade, students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain calculations based upon models and properties of operations and rules that generate patterns. They demonstrate and explain the relationship between volume and multiplication. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking.
5.MP.4. Model with mathematics.	Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fifth graders should evaluate their results in the context of the situation and whether the results make sense. They also evaluate the utility of models to determine which models are most useful and efficient to solve problems.
5.MP.5. Use appropriate tools strategically.	Fifth graders consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. They use graph paper to accurately create graphs and solve problems or make predictions from real world data.
5.MP.6. Attend to precision.	Students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to expressions, fractions, geometric figures, and coordinate grids. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the volume of a rectangular prism they record their answers in cubic units.
5.MP.7. Look for and make use of structure.	In fifth grade, students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. They examine numerical patterns and relate them to a rule or a graphical representation.
5.MP.8. Look for and express regularity in repeated reasoning.	Fifth graders use repeated reasoning to understand algorithms and make generalizations about patterns. Students connect place value and their prior work with operations to understand algorithms to fluently multiply multi-digit numbers and perform all operations with decimals to hundredths. Students explore operations with fractions with visual models and begin to formulate generalizations.

Grade 5 Montana Common Core Standards Vocabulary				
Operations and Algebraic Thinking	**Numbers and Operations in Base Ten**	**Number and Operations: Fractions**	**Measurement & Data**	**Geometry**
	exponents	numerator	convert	axes/axis
braces	base	denominator	conversion	intersect
brackets	powers of 10	equivalent	line plot	Origin
parentheses	digit	mixed number	unit fraction	coincide
numerical expression	number	unlike denominator	volume	coordinates
evaluate	whole number	like denominator	unit cube	coordinate system
expression	base 10 numerals	benchmark fraction	cubic unit	coordinate plane
equation	expanded form	fraction model	solid figure	ordered pair
numerical pattern	standard form	estimate	additive	x-axis
corresponding terms	number name	fraction	right rectangular prism	y-axis
ordered pairs	< less than	partition	edge	x-coordinate
coordinate plane	> greater than	unit fraction	face	y-coordinate
graph	= equal	unit cube	base	quadrant
	thousandths	scaling	vertices	point
	tenths	rectangular areas		two-dimensional figure
	hundredths	non-zero whole number		subcategory
	product	compute		category
	round			properties
	decimal			
	decimal place			
	standard algorithm			
	quotient			
	operations			
	multiplication			
	division			
	area model			
	rectangular array			