5th Grade Mathematics

UNIT 1: Whole Number Operations and Applications

Volume, Multiplication, and Division

ESSENTIAL QUESTION	BIG IDEAS
How do we measure volume?	Students understand the meaning of volume and how it is measured. Students find the volume of three-dimensional figures using various strategies.

GUIDING QUESTIONS

Content and Process

- What is volume? **5.MD.3**
- What measurement is used when solving for the volume of a three dimensional figure? **5.MD.3a, 5.MD.3b**
- How can volume be determined using cubes? **5.MD.4**
- What are the various ways volume can be measured? **5.MD.5a, 5.MD.5b**
- How is the volume of a figure determined when it can be decomposed into rectangular prisms? **5.MD.5c**
- How can place value concepts and properties of operations be used to multiply multi-digit whole numbers fluently? **5.NBT.5**
- How can you find whole-number quotients of whole numbers and explain your strategy or illustrate your solution? **5.NBT.6**

Reflective

- Why is a unit cube used to measure volume?
- How do I find the volume of any rectangular solid?
- How does thinking about volume help me design a packing box?
- How do I decide which strategies are most helpful when solving complex problems?
- What patterns have I found that help me solve other problems?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.1 Make sense of problems and persevere in solving them.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.5 Use appropriate tools strategically.

Standards

5.MD.3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

- **5.MD.3a.** 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.
- **5.MD.3b.** 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.

5.MD.4. Measure volumes by counting unit cubes such as cubic cm, cubic in, cubic ft. or non-standard cubic units.

5.MD.5. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

- **5.MD.5a.** 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 three-dimensional whole-number products as volumes, *(e.g. to represent the associative property of multiplication.)*
- **5.MD.5b.** Apply the formulas $V = l \cdot w \cdot h$ and $V = B \cdot h$ (*B represents the area of the base)* 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.
- **5.MD.5c.** 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.

5.NBT.5. Fluently (efficiently, accurately, and flexibly) multiply multi-digit whole numbers using an efficient algorithm *(ex., traditional, partial products, etc.)* based on place value understanding and the properties of operations.

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.

5th Grade Mathematics

UNIT 2: Decimals and Fractions

Place Value, Addition, and Subtraction

ESSENTIAL QUESTION	BIG IDEAS
How can we use equivalence, models, and estimation to make sense of problems involving fractions?	Students reason and use equivalent fractions to solve problems involving fractions with unlike denominators. Students reason with benchmark fractions to make reasonable estimations. Students explore patterns of very small and very large numbers using powers of 10. Students use place value understanding to read, write, estimate, and compare decimals.

GUIDING QUESTIONS

Content and Process

- How does place value help you reason about the size of numbers? **5.NBT.1**
- How can you apply place value patterns when multiplying decimals or whole numbers by powers of ten? **5.NBT.2**
- How are whole number exponents used to denote powers of ten? **5.NBT.2**
- How can you read and write decimals to the thousandths using base-ten numerals, number names, expanded form, and unit form? **5.NBT.3a**
- How is place value used when comparing decimals? What symbols can be used to communicate the comparisons? **5.NBT.3b**
- How is place value used when rounding decimals to any place? **5.NBT.4**
- How can models and strategies be used to solve problems involving decimals to the hundredths? **5.NBT.7**
- How can equivalent fractions with like denominators be created for fractions with unlike denominators? **5.NF.1**
- How can fraction number sense be used to check the reasonableness of a solution? **5.NF.2**

Reflective

- If I had two fractions with unlike denominators, what would I have to think about in order to find the sum or difference?
- What makes an estimation strategy effective and/or interesting?
- What makes a fraction easier or harder to estimate?
- How does my understanding of place value help to improve my number flexibility?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

MP.7 Look for and make use of structure.

Standards

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

$\frac{1}{10}$ of what it represents in the place to its left.

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.

5.NBT.3. Read, write, and compare decimals to thousandths.

- **5.NBT.3a.** Read and write decimals to thousandths using base-ten numerals, number names, expanded form, and unit form *(e.g.*

  expanded form 47.392 = $4 \cdot 10 + 7 \cdot 1 + 3 \cdot \frac{1}{10} + 9 \cdot \frac{1}{100} + 2 \cdot \frac{1}{1000}$

  unit form 47.392 = 4 tens + 7 ones + 3 tenths + 9 hundredths + 2 thousandths).
- **5.NBT.3b.** Compare two decimals to thousandths based on meanings of the digits in each place, using >, <, =, and ≠relational symbols to record the results of comparisons.

5.NBT.4. Use place value understanding to round decimals to any place (Note: In fifth grade, decimals include whole numbers and decimal fractions to the hundredths place.)

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.

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,*

$\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$ *In general,* $\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$

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*

$\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$ *by observing that* $\frac{3}{7} < \frac{1}{2}$.

5th Grade Mathematics

UNIT 3: More Decimals and Fractions

Multiplication and Division

ESSENTIAL QUESTION	BIG IDEAS
How are models used to understand fraction multiplication and division?	Students use the meaning of fractions and multiplication to understand and explain why the procedures for multiplying fractions make sense. Students multiply fractions to find the area of rectangles and solve real world problems. Students use visual models and computation to solve real world problems involving division of fractions and whole numbers.

GUIDING QUESTIONS

Content and Process

- How can models and strategies be used to solve problems involving decimals to the hundredths? **5.NBT.7**
- How are benchmark fractions used when estimating? **5.NF.2**
- How does a fraction represent the division of two quantities? **5.NF.3**
- How can a visual model represent multiplying a fraction by a whole number or fraction? **5.NF.4a**
- How can a model be used to find and prove the area of a rectangle with fractional lengths? **5.NF.4b**
- How can number sense help you estimate a solution when multiplying a fraction by a whole number? **5.NF.5a**
- What happens to the product when multiplying a fraction by a whole number greater than 1? **5.NF.5b**
- How can multiplication problems, involving fractions (including mixed numbers) and whole numbers, be solved using diagrams? **5.NF.6**
- How does understanding the relationship between multiplication and division help when dividing a whole number by a fraction or a fraction by a whole number? **5.NF.7**
- How is the division of fractions connected to multiplication? **5.NF.7a, 5.NF.7b, 5.NF.7c**

Reflective

- When might I need to find a fraction of a whole number?
- How can multiplication help me find a fraction of a number?
- What patterns did I find when multiplying fractions?
- How does division help me multiply a whole number by a fraction?
- When dividing a unit fraction by a whole number, what patterns might I see? Why?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.5 Use appropriate tools and strategies.

MP.6 Attend to precision.

Standards

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.

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

5.NF.3. Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$). 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* $\frac{3}{4}$ *as the result of dividing 3 by 4, noting that* $\frac{3}{4}$ *multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size* $\frac{3}{4}$*. 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?*

For example, recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$ *by observing that* $\frac{3}{7} < \frac{1}{2}$.

5.NF.4. Apply and extend previous understandings of multiplication (refer to 2.OA.3, 2.OA.4, 3.OA.1, 3.NF.1, 3.NF.2, 4.NF.4) to multiply a fraction or whole number by a fraction.

- **5.NF.4a.** Interpret the product $\frac{a}{b} \cdot q$ as *a* parts of a partition of *q* into *b* equal parts; equivalently, as the result of a sequence of operations $a \cdot q \div b$. *For example, use a visual fraction model to show* $\frac{2}{3} \cdot 4 = \frac{8}{3}$ *and create a story context for this equation. Do the same with* $\frac{2}{3} \cdot \frac{4}{5} = \frac{8}{15}$*. (In general,* $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$*).*
- **5.NF.4b.** 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.

5.NF.5. Interpret multiplication as scaling (resizing), by:

- **5.NF.5a.** Comparing the size of a product to the size of one factor based on the size of the other factor, without performing the indicated multiplication *(e.g. They see* $(\frac{1}{2} \cdot 3)$ *as half the size of 3.).*

- **5.NF.5b.** Explain 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); explain 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 $\frac{a}{b} = \frac{na}{nb}$ to the effect of multiplying $\frac{a}{b}$ by 1. *(e.g. Students may have the misconception that multiplication always produces a larger result. They need to have the conceptual understanding with examples like;* $\frac{3}{4} \times$ *one dozen eggs will have a product that is less than 12.)*

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).*

5.NF.7. Apply and extend previous understandings of division (3.OA.2, 3.OA.5), to divide unit fractions by whole numbers and whole numbers by unit fractions. Division of a fraction by a fraction is not a requirement at this grade.

- **5.NF.7a.** Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for* $\frac{1}{3} \div 4$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $\frac{1}{3} \div 4 = \frac{1}{12}$ *because* $\frac{1}{12} \cdot 4 = \frac{1}{3}$.
- **5.NF.7b.** Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for* $4 \div \frac{1}{5}$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $4 \div \frac{1}{5} = 20$ *because* $20 \cdot \frac{1}{5} = 4$.
- **5.NF.7c.** 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* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{1}{3}$ *cup servings are in 2 cups of raisins?*

5th Grade Mathematics

UNIT 4: Measurement, Data, and Geometry

Converting Units, Using Data, and Classifying Figures

ESSENTIAL QUESTION	BIG IDEAS
How are graphs used to represent data and understand plane figures?	Students apply powers of ten when multiplying and dividing decimals. Students classify two-dimensional figures based on their attributes. Students display fractional measurement data in a variety of ways and solve problems about the data set.

GUIDING QUESTIONS

Content and Process

- How are units of measures within the same system converted? **5.MD.1**
- How can a data display be used to represent fractional measurements ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$)? **5.MD.2**
- How can the information from a data display be used to solve problems with addition, subtraction, and multiplication of fractions based on the data? **5.MD.2**
- How are attributes (sides, angles and properties of symmetry) used to describe and classify shapes in more than one way? **5.G.3**
- How are two-dimensional figures classified in a hierarchy based on properties? **5.G.4**

Reflective

- Where and how do I see data displays in my world being used?
- How can I always prove a square is always a rectangle?
- When would you find it useful in your everyday life to be able to convert units of measure?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.3 Construct viable arguments and critique the reasoning of others.

MP.6 Attend to precision.

Standards

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.

5.MD2. Make a data display (line plot, bar graph, pictograph) to show a data set of measurements in fractions

of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$). Use operations (add, subtract, multiply) on fractions for this grade to solve problems involving information presented in the data display. *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. After lunch everyone measured how much milk they had left in their containers. Make a line plot showing data to the nearest* $\frac{1}{4}$ *cup. Which value has the greatest amount? What is the total?*

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.*

5.G.4. Classify two-dimensional figures in a hierarchy based on properties.

5th Grade Mathematics

UNIT 5: Algebraic Thinking and the Coordinate Plane

Expressions, Graphing Points, Patterns and Relationships

ESSENTIAL QUESTION	BIG IDEAS
How can evaluating an expression be useful?	Students explore the coordinate plane and represent situations by graphing in the first quadrant. Students write, interpet, and evaluate numerical expressions

GUoIDING QUESTIONS

Content and Process

- How does understanding the relationship between the x- and y-axis help you decide how to plot data points on the coordinate grid? **5.G.1**
- How can points on a coordinate grid represent real life situations? **5.G.2**
- How can grouping symbols change the meaning of an expression? **5.OA.1**
- How does the order in which calculations are performed impact the solution when evaluating an expression? **5.OA.1**
- How can numerical expressions be written and interpreted? **5.OA.2**

Reflective

- What patterns have I found that help me solve other problems?
- How do I decide which strategies are most helpful when solving complex problems?
- How can I imagine myself using or seeing a coordinate plane in real life?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.4 Model with mathematics.

MP.8 Look for and express regularity in repeated reasoning.

Standards

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)*.

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. *(e.g. plotting the relationship between two positive quantities such as maps, coordinate grid games (such as Battleship), time/temperature, time/distance, cost/quantity, etc.).*

5.OA.1. Use parentheses in numerical expressions and evaluate expressions with these symbols.

5.OA.2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "multiply the sum of 8 and 7 by 2" as* $2 \times (8 + 7)$ *because parenthetical information must be solved first. Recognize that* $3 \times (18932 + 921)$ *is three times as large as* $18932 + 921$*, without having to calculate the indicated sum or product.*