

5th Grade Mathematics



UNIT 1: Thinking in Cubes

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

- How are units of measures within the same system converted? **5.MD.1**
- How are conversions within the same system used to solve multi-step problems? **5.MD.1**
- What is volume? **5.MD.3**
- How can volume be determined using cubes? **5.MD.4**
- Why is volume measured in cubic units? **5.MD.4**
- What measurement is used when solving for the volume of a three dimensional figure? **5.MD.3a, 5.MD.3b**
- 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**

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?
- 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.1 Make sense of problems and persevere in solving them.

MP.6 Attend to precision.

Content Standards- Assessed

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.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.



Students find the volume of each rectangular prism that is decomposed from the original figure and add the individual volumes to find the total volume.

5th Grade Mathematics



UNIT 2: Thinking in Powers of 10

ESSENTIAL QUESTION

How are very large and very small numbers represented in our world?

BIG IDEAS

Students explore patterns of very small and very large numbers using powers of 10.

Students apply powers of ten when multiplying and dividing decimals.

Students use place value understanding to read, write, estimate, and compare decimals.

GUIDING QUESTIONS

Content and Process

- How can moving the place of a digit in a number affect its value? **5.NBT.1**
- 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**
- What is the connection between whole number exponents and 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**

Reflective

- How can I describe relationships between very large and very small numbers?
- 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.6 Attend to precision.

Content Standards- Assessed

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.

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

$$\text{unit form } 47.392 = 4 \text{ tens} + 7 \text{ ones} + 3 \text{ tenths} + 9 \text{ hundredths} + 2 \text{ thousandths}.$$

- **5.NBT.3b** Compare two decimals to thousandths based on meanings of the digits in each place, using $>$, $<$, $=$, and \neq 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.)

5th Grade Mathematics

UNIT 3: Using Numbers and Symbols Flexibly



ESSENTIAL QUESTION

BIG IDEAS

How can being flexible with numbers help you be a more creative problem solver?

Students write, interpret, and evaluate numerical expressions.

Students model and perform operations with multi-digit whole numbers and with decimals to hundredths.

GUIDING QUESTIONS

Content and Process

- 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**
- 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**
- How can models and strategies be used to solve problems involving decimals to the hundredths? **5.NBT.7**

Reflective

- What patterns have I found that help me solve other problems?
- How can I use models to divide decimals?
- How do I decide which strategies are most helpful when solving complex problems?

FOCUS STANDARDS

Standards of Mathematical Practice

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

MP.5 Use appropriate tools and strategies.

Content Standards

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.*

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.

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.

5th Grade Mathematics



UNIT 4: Estimating with Fractions

ESSENTIAL QUESTION

BIG IDEAS

Why is estimation important when working with fractions?

Students solve word problems involving addition and subtraction of fractions

Students reason with benchmark fractions to make reasonable estimations.

Students use models to understand division with fractions.

GUIDING QUESTIONS

Content and Process

- How are benchmark fractions used when estimating? **5.NF.2**
- How can fraction number sense be used to check the reasonableness of a solution? **5.NF.2**
- How does a fraction represent the division of two quantities? **5.NF.3**
- How can models be used to foster an understanding of the division of whole numbers resulting in fractional solutions? **5.NF.3**
- How can models be used to solve word problems involving the division of whole numbers resulting in fractional solutions? **5.NF.3**

Reflective

- What makes an estimation strategy effective and/or interesting?
- What makes a fraction easier or harder to estimate?
- How can I use a visual model to prove my solution to a division problem using fractions (a whole number divided by a fraction or a fraction divided by a whole number)?
- How can I prove $n \div \frac{a}{b} = c$ or $\frac{a}{b} \div n = c$ using a visual model?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.2 Reason abstractly and quantitatively.

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

Content Standards- Assessed

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 $\frac{3}{7} < \frac{1}{2}$.

* Note; the crossed out part of the standard is not assessed in this unit. It will be assessed in unit 5.

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?

5th Grade Mathematics

UNIT 5: Using Fraction Equivalence



ESSENTIAL QUESTION

How can we use fraction equivalence and models to make sense of problems?

BIG IDEAS

Students reason and use equivalent fractions to solve problems involving fractions with unlike denominators.

Students use equivalent fractions as a strategy to add and subtract fractions (including mixed numbers).

Students write simple expressions to represent math problems involving fractions.

GUIDING QUESTIONS

Content and Process

- How are equivalent fractions used to solve problems involving addition and subtraction of fractions with unlike denominators? **5.NF.1**
- How can equivalent fractions with like denominators be created for fractions with unlike denominators? **5.NF.1**
- Why does a denominator matter when adding or subtracting fractions? **5.NF.1**
- How are visual models used to prove solutions involving addition and subtraction of fractions with like and unlike denominators? **5.NF.2**
- How can you connect visual models and written expressions to represent the addition and subtraction of fractions? **5.NF.2**
- In what ways can word problems involving addition and subtraction of fractions, including unlike denominators, be solved? **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?
- When adding and subtracting fractions, how can I use visual models to convince a skeptic of my solution?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.5 Use appropriate tools strategically.

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

Content Standards- Assessed

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,*

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

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~~

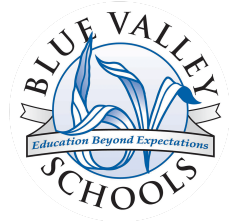
$$\frac{2}{5} + \frac{1}{2} = \frac{3}{7} \text{ by observing that } \frac{3}{7} < \frac{1}{2}.$$

* *Note: the crossed out portion of the standard was assessed in unit 4.*

5th Grade Mathematics

UNIT 6: Understanding Fraction Multiplication

Visually



ESSENTIAL QUESTION

BIG IDEAS

How are models used to understand fraction multiplication?

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.

GUIDING QUESTIONS

Content and Process

- How can a visual model represent multiplying a fraction by a whole number or fraction? **5.NF.4a**
- How can you accurately and efficiently multiply 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**
- What happens to the product when multiplying a fraction by a whole number less than 1? **5.NF.5b**
- How can multiplication problems, involving fractions (including mixed numbers) and whole numbers, be solved using diagrams? **5.NF.6**

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? Can I create a visual proof?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.4 Model with mathematics.

MP.7 Look for and make use of structure.

Content Standards- Assessed

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).

5th Grade Mathematics



UNIT 7: What Does it Mean to Divide Fractions?

ESSENTIAL QUESTION

What does it mean to divide fractions?

BIG IDEAS

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 a visual model represent dividing a fraction by a whole number? **5.NF.7a, 5.NF.7c**
- How can you accurately and efficiently divide a fraction by a whole number? **5.NF.7a, 5.NF.7c**
- How can you accurately and efficiently divide a whole number by a fraction? **5.NF.7b, 5.NF.7c**
- How can a visual model represent dividing a whole number by a fraction? **5.NF.7b, 5.NF.7c**
- How is the division of fractions connected to multiplication? **5.NF.7a, 5.NF.7b, 5.NF.7c**
- 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**

Reflective

- Why is it that division with fractions can lead to a larger answer than I started with?
- 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.8 Look for and express regularity in repeated reasoning.

Content Standards- Assessed

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

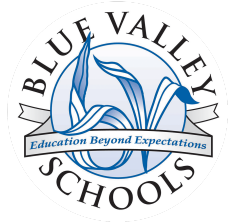
$$\frac{1}{12} \cdot 4 = \frac{1}{3}.$$

- **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 8: Exploring the Coordinate Plane

ESSENTIAL QUESTION

How are graphs used to represent data and understand plane figures?

BIG IDEAS

Students explore the coordinate plane and represent situations by graphing in the first quadrant.

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 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 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**
- 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**

Reflective

- How can I imagine myself using or seeing a coordinate plane in real life?
- Where and how do I see data displays in my world being used?
- How can I prove a square is always a rectangle?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.4 Model with mathematics.

MP.7 Look for and make use of structure.

Content Standards- Assessed

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.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.

5.MD.2 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?*