ACAP
Alabama Comprehensive Assessment Program
SUMMATIVE

Grade 5
Mathematics

Alabama Educator Instructional Supports

Alabama Course of Study Standards

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Introduction

The *Alabama Course of Study Instructional Supports: Math* is a companion manual to the 2016 *Revised Alabama Course of Study: Math* for Grades K–12. Instructional supports are foundational tools teachers may use to help students become independent learners as they build toward mastery of the *Alabama Course of Study* content standards.

- The purpose of the instructional supports found in this manual is to help teachers engage their students in exploring, explaining, and expanding their understanding of the content standards.

The content standards contained within the course of study may be accessed on the Alabama State Department of Education (ALSDE) website at www.alsde.edu.

Educators are reminded that content standards indicate minimum content—what all students should know and be able to do by the end of each grade level or course. Local school systems may have additional instructional or achievement expectations and may provide instructional guidelines that address content sequence, review, and remediation.

Organization

The organizational components of this manual include standards, guiding questions, connections to instructional supports, key academic terms, and examples of activities. The definition of each component is provided below:

Content Standard:	The content standard is the statement that defines what all students should know and be able to do at the conclusion of a given grade level or course. Content Standards contain minimum required content and complete the phrase "Students will."
Guiding Questions:	Each guiding question is designed to create a framework for the given standard. Therefore, each question is written to help teachers convey important concepts within the standard. By utilizing guiding questions, teachers are engaging students in investigating, analyzing, and demonstrating knowledge of the underlying concepts reflected in the standard.

Connection to Instructional Supports: The purpose of each instructional support is to engage students in exploring, explaining, and expanding their understanding of the content standards provided in the 2016 *Revised Alabama Course of Study: Math*. An emphasis is placed on the integration of the eight Standards for Mathematical Practice.

Mathematical Practices

The Standards for Mathematical Practice describe the varieties of expertise that mathematics educators at all levels should seek to develop in their students. They rest on the National Council of Teachers of Mathematics (NCTM) process standards and the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up: Helping Children Learn Mathematics.*

The Standards for Mathematical Practice are the same for all grade levels and are listed below.

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.

Key Academic Terms: The academic terms included in each instructional support. These academic terms are derived from the standards and are to be incorporated into instruction by the teacher and used by the students.

Instructional Activities: A representative set of sample activities and examples that can be used in the classroom. The set of activities and examples is not intended to include all the activities and examples defined by the standard. These will be available in Fall 2020.

Additional Resources: Additional resources include resources that are aligned to the standard and may provide additional instructional strategies to help students build toward mastery of the designated standard. These will be available in Fall 2020.

Operations and Algebraic Thinking
Write and interpret numerical expressions.
5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

Guiding Questions with Connections to Mathematical Practices:

What do parentheses, brackets, or braces mean when used in an expression?

M.P.6. Attend to precision. Describe that grouping symbols can be used to indicate order, signify multiplication, or designate any expression inside the grouping symbols as a single quantity. For example, the parentheses in the expression $3 \times (6 + 2 + 12)$ mean multiply 3 by the quantity of $6 + 2 + 12$; therefore, $6 + 2 + 12$ needs to be added before multiplying the sum by 3.

How can parentheses, brackets, or braces be used to write and evaluate expressions?

M.P.2. Reason abstractly and quantitatively. Write and solve expressions containing grouping symbols, keeping in mind the meaning of those symbols, the properties of operations, and the convention of the order of operations. For example, $6 \times (4 + 5) \div 2$ can be rewritten as the expression $6 \times 9 \div 2$, which is equivalent to $54 \div 2$ or 27.

When is it necessary to use grouping symbols?

M.P.3. Construct viable arguments and critique the reasoning of others. Demonstrate when grouping symbols are necessary or unnecessary for an expression. For example, for the expression $10 + 5 \div 5$ to equal 3, parentheses need to be placed around $10 + 5$. For the same expression to equal 11, parentheses could be placed around $5 \div 5$, but they are not necessary due to the convention of order of operations.

Key Academic Terms:

parenthesis, expressions, equations, evaluate, grouping symbols, order of operations, brace, bracket

Operations and Algebraic Thinking
Write and interpret numerical expressions.
5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. Examples: Express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18,932 + 921) is three times as large as 18,932 + 921, without having to calculate the indicated sum or product.

Guiding Questions with Connections to Mathematical Practices:

How can a calculation in the form of a written or verbal description be written as a numerical expression?

M.P.6. Attend to precision. Construct an expression from a written or verbal description that uses mathematical vocabulary. For example, write "Add 6 to the product of 8 and 3" as the expression $8 \times 3 + 6$ or $6 + 8 \times 3$ or another equivalent form.

How can expressions be interpreted without calculation?

M.P.2. Reason abstractly and quantitatively. Interpret, compare, and reason about the meaning of an expression. For example, explain that $(\frac{1}{3} + \frac{5}{6}) - 1$ is 1 less than the sum of $\frac{1}{3}$ and $\frac{5}{6}$.

Key Academic Terms:

expression, calculate, interpret, evaluate, compare, reason

Operations and Algebraic Thinking
Analyze patterns and relationships.
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. 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.

Guiding Questions with Connections to Mathematical Practices:

How can rules be used to generate patterns?

M.P.7. Look for and make use of structure. Generate and describe number patterns when given a rule. For example, given the rule “Add $\frac{1}{2}$” and the starting number 3, generate the list 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$ . . . and describe the pattern.

How are two lists generated by patterns used to create ordered pairs?

M.P.4. Model with mathematics. Given two lists of terms generated by following rules to establish number patterns, create a list of ordered pairs. For example, the list “0, 2, 4, 6, 8, 10” as *x*-values, and the list “0, 3, 6, 9, 12, 15” as *y*-values would form the ordered pairs (0, 0), (2, 3), (4, 6), (6, 9), (8, 12), and (10, 15).

What are the relationships between corresponding terms in coordinate pairs generated by different patterns?

M.P.1. Make sense of problems and persevere in solving them. Identify the additive and multiplicative relationships between corresponding terms. For example, given the ordered pairs (0, 0), (3, 6), (6, 12), and (9, 18), identify that the multiplicative relationship between the corresponding *y*-coordinate and *x*-coordinate is the same for every (*x*, *y*) coordinate pair. The *y*-coordinate is 2 times as great as the *x*-coordinate for every pair. However, the difference between the corresponding *x*- and *y*-coordinate pairs changes, following the pattern 0, 3, 6, 9, etc. A graph of the coordinate pairs is a straight line with the *y*-coordinate always 2 times as great as the *x*-coordinate. Notice that with ordered pairs where one pattern starts with 0 and the other does not, such as (0, 2), (1, 7), (2, 12), multiplicative relationships are not as apparent.

Key Academic Terms:

number pattern, graph, coordinate plane, *x*-axis, *y*-axis, origin, *y*-coordinate, *x*-coordinate, ordered pairs, generate, sequence

Number and Operations in Base Ten
Understand the place value system.
5.NBT.4 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.

Guiding Question with Connections to Mathematical Practices:

How does the value of a digit change in relation to its position within a number?

M.P.8. Look for and express regularity in repeated reasoning. In a multi-digit number, the place value to the left of a given place value is ten times as much as the given place value. The place value to the right of a given place value is one-tenth as much as the given place value. For example, the value of 3 in the number 3.0 is 10 times as much as the value of 3 in 0.3 (i.e., $3.0 = 10 \times 0.3$). The value of 4 in 4.0 is $\frac{1}{10}$ times as much as the value of 4 in 40 (i.e., $4.0 = \frac{1}{10} \times 40$).

Key Academic Terms:

digit, place value

Number and Operations in Base Ten
Understand the place value system.
5.NBT.5 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.

Guiding Questions with Connections to Mathematical Practices:

What patterns become evident when multiplying by powers of 10?

M.P.8. Look for and express regularity in repeated reasoning. Observe that each time a number is multiplied by 10, each digit becomes ten times greater and therefore shifts one place to the left, with zeros used as placeholders if necessary. For example, in the multiplication equation $34 \times 10 \times 10 = 3{,}400$, the digit 3 becomes 10 times greater and then 10 times greater again, so the value changes from the tens place to the thousands place.

How can place value understanding be used to determine the location of a decimal point?

M.P.2. Reason abstractly and quantitatively. Determine the value of a product or quotient of an expression involving a power of 10 by observing that each power of 10 multiplies or divides the value of each of the digits by 10. Zeros are used as placeholders between the digits and the decimal point to show when there is no value for that location. For example, $0.7 \times \frac{1}{10}$ will cause the digit 7 to change in value from the tenths to the hundredths place, and there will be no tenths. Therefore, it results in the answer 0.07.

How is the exponent for a power of 10 related to the placement of a decimal point?

M.P.8. Look for and express regularity in repeated reasoning. Interpret the exponent of a power of 10 as an indication of how many times 10 is being multiplied or divided, change the value of each of the digits accordingly to determine the decimal placement, and use zeros to show locations of place values when there is no value given. For example, $10^3 = 10 \times 10 \times 10$, so the exponent of 3 indicates that all the digits being multiplied by 10^3 will change in value by 1,000.

Key Academic Terms:

product, multiply, divide, power of 10, decimal, decimal point, exponent, append, factor, base, expression, place value

Number and Operations in Base Ten
Understand the place value system.
5.NBT.6 Read, write, and compare decimals to thousandths. **5.NBT.6a** 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 × $(\frac{1}{10})$ + 9 × $(\frac{1}{100})$ + 2 × $(\frac{1}{1000})$.

Guiding Questions with Connections to Mathematical Practices:

How can place value understanding help to read decimal numbers?

M.P.6. Attend to precision. Observe the placement of digits in a decimal number to determine how to read the number. For example, 3.042 is read as "three and forty-two thousandths" because there is a 3 in the ones place, a 0 in the tenths place, a 4 in the hundredths place, and a 2 in the thousandths place.

How can place value understanding help to write decimals in expanded form?

M.P.6. Attend to precision. Represent decimal numbers in expanded form with single digits multiplied by the power of 10 appropriate to place value. For example, the expanded form of 13.94 equals $1 \times 10 + 3 \times 1 + 9 \times \frac{1}{10} + 4 \times \frac{1}{100}$ because the 1 is in the tens place, the 3 is in the ones place, the 9 is in the tenths place, and the 4 is in the hundredths place.

Key Academic Terms:

decimal, thousandths, hundredths, tenths, base-ten, expanded form, place value, power of 10, product

Number and Operations in Base Ten
Understand the place value system.
5.NBT.6 Read, write, and compare decimals to thousandths. **5.NBT.6b** Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Guiding Questions with Connections to Mathematical Practices:

Which place value strategies can be used to compare values of decimal numbers?

M.P.5. Use appropriate tools strategically. Extend place value understanding from whole numbers to decimals that are in the tenths, hundredths, or thousandths place by using visual models or other place value strategies. For example, know that 7.80 is greater than 7.799 by comparing the tenths place in both numbers and recognizing that $\frac{8}{10}$ is greater than $\frac{7}{10}$. The digits after the tenths place in the number 7.799 can be disregarded for the comparison because all the digits to the right of the tenths place have values that are less than $\frac{8}{10}$ even though the digits are greater than 8.

How can decimal numbers be compared using mathematical symbols?

M.P.4. Model with mathematics. Record the results of the comparison of two decimals through thousandths by using the mathematical symbols $>$, $<$, or $=$. For example, $0.65 > 0.645$.

Key Academic Terms:

compare, decimal, thousandths, hundredths, tenths, symbol, greater than, less than, equal, place value strategies

Number and Operations in Base Ten
Understand the place value system.
5.NBT.7 Use place value understanding to round decimals to any place.

Guiding Questions with Connections to Mathematical Practices:

How is rounding to the nearest decimal place similar to rounding whole numbers?

M.P.8. Look for and express regularity in repeated reasoning. Extend learning regarding rounding to the nearest ten, hundred, thousand, etc., to rounding to the nearest tenth, hundredth, thousandth, etc., by using similar strategies. For example, use a number line from 0.4 to 0.5 to determine whether 0.42 is closer to 0.4 or 0.5, in the same way a number line from 40 to 50 can show how to round 42 to the nearest ten.

What makes “5” significant when rounding?

M.P.7. Look for and make use of structure. Identify that 5 is significant because it represents the halfway point between two values on a number line. For example, on a number line from 1.7 to 1.8, the interval between 1.7 and 1.8 is divided into ten equal-sized sections that are marked with the numbers 1.71, 1.72, 1.73, 1.74, 1.75, 1.76, 1.77, 1.78, and 1.79. The number 1.75 is the same distance from 1.7 as it is from 1.8 on the number line, so it represents the halfway point between 1.7 and 1.8. To the left of 1.75, all the values are closer to 1.7, and to the right of 1.75, all of the values are closer to 1.8. The value of 1.75 will round up to 1.8 because half of the values round to 1.7 and half of the values round to 1.8. The value 1.75 is the halfway point, so the digit 5 in the hundredths place is significant when rounding to the tenths. The same is true when rounding to any place value; the digit 5 is significant when rounding to a place value that is 10 times as much as the place value of the 5.

Key Academic Terms:

round, place value, tenths, hundredths, thousandths, decimal, number line

Number and Operations in Base Ten
Perform operations with multi-digit whole numbers and with decimals to hundredths.
5.NBT.8 Fluently multiply multi-digit whole numbers using the standard algorithm.

Guiding Question with Connections to Mathematical Practices:

How are multiplication algorithms related to each other?

M.P.8. Look for and express regularity in repeated reasoning. Demonstrate the standard algorithm for multi-digit multiplication, and explain how it relates to previously used multiplication methods such as the distributive property, partial products, and area models. For example, show that multiplying 43×17 using the standard algorithm is connected to multiplying and adding $(40 \times 10) + (40 \times 7) + (3 \times 10) + (3 \times 7)$.

Key Academic Terms:

multiply, multi-digit, standard algorithm, distributive property, partial products, area model

Number and Operations in Base Ten
Perform operations with multi-digit whole numbers and with decimals to hundredths.
5.NBT.9 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.

Guiding Questions with Connections to Mathematical Practices:

How does knowledge of place value and properties of operations help solve division problems?

M.P.2. Reason abstractly and quantitatively. Decompose and compose numbers in a variety of ways using place value and the properties of operations to demonstrate different strategies for division, such as partial quotients. This prepares students to learn the standard division algorithm, which is introduced in grade 6. For example, when solving $345 \div 15$, use knowledge of the number of 15s in 300 and the number of 15s in 45 to get $20 + 3 = 23$.

How do area models and arrays connect with equations and division strategies?

M.P.4. Model with mathematics. Connect area models to equations and division strategies to explain and illustrate a calculation. For example, when solving $1{,}056 \div 22$, use an area model of a rectangle with one side length of 22 and an area of 1,056 to show that the unknown length has 4 tens and 8 ones, and the quotient of the division problem will be 48.

Key Academic Terms:

quotient, dividend, divisor, divide, multiply, multiple, equation, remainder, area model, decompose, partial quotients

Number and Operations in Base Ten
Perform operations with multi-digit whole numbers and with decimals to hundredths.
5.NBT.10 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.

Guiding Questions with Connections to Mathematical Practices:

How does using the four operations with decimal numbers relate to using the four operations with whole numbers?

M.P.8. Look for and express regularity in repeated reasoning. Describe the similarities when adding, subtracting, multiplying, and dividing decimal numbers compared to the same operations with whole numbers. For example, if using base-ten blocks to multiply 54×3 with the hundred-grid representing 100, compare to multiplying 0.54×3 with the hundred-grid representing one whole.

How can problems involving the four operations with decimal numbers be solved in a variety of ways?

M.P.1. Make sense of problems and persevere in solving them. Use a variety of strategies, such as modeling, connecting to fractions, using patterns, and reasoning about the size of a number to solve problems involving the four operations with decimal numbers. For example, when solving $4 \div 0.1$, use the meaning of division and place value to think of the problem as "How many one tenths are in forty tenths?" to find a solution of 40.

How can a strategy for solving a problem with decimal numbers be written and explained?

M.P.1. Make sense of problems and persevere in solving them. Use properties of operations and place value thinking to simplify a decimal multiplication problem. For example, to multiply 23×0.8, properties of operations can be used to decompose 23 into $(20 + 3)$ and 0.8 into 8×0.1. The resulting expression, $(20 + 3) \times 8 \times 0.1$, can be simplified, using the distributive property, to get $(20 \times 8 + 3 \times 8) \times 0.1$, which is equivalent to $(160 + 24) \times 0.1$ or 184×0.1, which is equal to 18.4. This is a reasonable result since multiplying 23 by a decimal less than 1 will yield a result less than 23.

Key Academic Terms:

add, subtract, multiply, divide, decimal, tenths, hundredths, operation, hundred-grid

Number and Operations – Fractions
Use equivalent fractions as a strategy to add and subtract fractions.
5.NF.11 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. Example: $\frac{2}{3}$ + $\frac{5}{4}$ = $\frac{8}{12}$ + $\frac{15}{12}$ = $\frac{23}{12}$. (In general, $\frac{a}{b}$ + $\frac{c}{d}$ = $\frac{(ad+bc)}{bd}$.)

Guiding Questions with Connections to Mathematical Practices:

How does adding or subtracting fractions with unlike denominators connect to adding or subtracting fractions with like denominators?

M.P.7. Look for and make use of structure. Connect that fractions need to be expressed in the same unit fraction to be added, and once equivalent fractions are created with like denominators, the process is the same as traditional addition. For example, adding $\frac{4}{5}+\frac{2}{5}$ is the same as adding the unit fraction $\frac{1}{5}$ six times for a sum of $\frac{6}{5}$. However, $\frac{3}{4}$ and $\frac{3}{5}$ are not expressed in the same unit fraction, so to be added together they must be rewritten so that they are. Writing the sum in the unit fraction of $\frac{1}{20}$ using the equivalent fractions of $\frac{15}{20}+\frac{12}{20}$ makes the solution $\frac{27}{20}$ or $1\frac{7}{20}$.

How can the common denominator between fractions with unlike denominators be determined in order to add or subtract?

M.P.8. Look for and express regularity in repeated reasoning. Solve a variety of problems to find the general method that $\frac{a}{b}+\frac{c}{d}=\frac{(ad+bc)}{bd}$ or $\frac{a}{b}-\frac{c}{d}=\frac{(ad-bc)}{bd}$. For example, after solving a variety of fraction subtraction problems with many different denominators, explore the similarities when solving to find that a like denominator can always be found by multiplying the denominators. Multiplying the numerator by the other fraction’s denominator will give an equivalent fraction, making it possible to subtract the fractions.

How can equivalent fractions be created to add and subtract fractions with unlike denominators?

M.P.5. Use appropriate tools strategically. Use a variety of strategies, including visual models and equations, to add fractions with unlike denominators by finding equivalent fractions. For example, add $1\frac{2}{3}+\frac{7}{8}$ by multiplying the denominators 3 and 8 to find a common denominator of 24, then solving $1+\frac{2}{3}\times\frac{8}{8}+\frac{7}{8}\times\frac{3}{3}=1+\frac{16}{24}+\frac{21}{24}=1+\frac{37}{24}=2\frac{13}{24}$.

Key Academic Terms:

fraction, denominator, numerator, addition, subtraction, visual model, equivalent fractions, equation, mixed number

Number and Operations – Fractions
Use equivalent fractions as a strategy to add and subtract fractions.
5.NF.12 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. Example: Recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$ by observing that $\frac{3}{7} < \frac{1}{2}$.

Guiding Questions with Connections to Mathematical Practices:

How can word problems involving the addition and subtraction of fractions be represented and solved?

M.P.4. Model with mathematics. Represent word problems that use fractions with visual fraction models, and then use those models to add or subtract. For example, if Mari and Nina ate $\frac{1}{3}$ and $\frac{2}{5}$ of a pan of brownies, respectively, a 3×5 rectangular grid can be used to determine the total amount of the brownies eaten. The portion of the brownies Mari ate can be represented by shading 5 pieces in the grid, and the portion of the brownies Nina ate can be represented by shading 6 pieces in the grid. A total of 11 shaded pieces, from a whole of 15 pieces, models that $\frac{1}{3} + \frac{2}{5} = \frac{11}{15}$.

How can benchmark fractions and number sense be used to estimate and determine whether an answer is reasonable as the sum or difference of two fractions?

M.P.4. Model with mathematics. Compare the relative sizes of fractions by using benchmark fractions. For example, $\frac{4}{7} + \frac{3}{8}$ cannot be equal to $\frac{7}{15}$ because $\frac{7}{15}$ has a value less than $\frac{1}{2}$, and the sum should have a value greater than $\frac{1}{2}$ since $\frac{4}{7}$ is greater than $\frac{1}{2}$.

Key Academic Terms:

fraction, benchmark fraction, denominator, addition, subtraction, model, sum

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.13 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.   Examples: 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 which two whole numbers does your answer lie?

Guiding Questions with Connections to Mathematical Practices:

How can a fraction be interpreted as a division problem?

M.P.8. Look for and express regularity in repeated reasoning. Recognize that a fraction represents the quotient of two quantities; namely, the numerator and the denominator. For example, the quotient of 2 and 5 can be represented with either the expression $2 \div 5$ or the fraction $\frac{2}{5}$.

M.P.7. Look for and make use of structure. Use multiplicative thinking to decompose and understand fractions as division. For example, interpret $\frac{7}{6}$ as 7 divided by 6 and also as the product of $\frac{1}{6}$ and 7.

How can word problems involving the division of whole numbers be represented visually?

M.P.4. Model with mathematics. Model the quotient of two whole numbers by starting with a whole number of objects equal to the dividend (numerator), and then partitioning those objects equally into a number of pieces or sections that is equivalent to the divisor (denominator). For example, if 2 pies are divided equally between 10 people, then an image of 2 whole pies that are segmented into 10 equal sections illustrates that each person receives $\frac{2}{10}$ of a pie.

M.P.2. Reason abstractly and quantitatively. Represent quotients as fractions greater than 1 or whole numbers with fractional remainders depending on the context. For example, given that a bakery divides 170 cups of flour equally between 20 bowls, find how many cups of flour are in each bowl by writing the expression $\frac{170}{20}$ and solving to find a solution of $\frac{17}{2}$ or $8\frac{1}{2}$ cups, and use $8\frac{1}{2}$ cups to represent the solution given the context.

Key Academic Terms:

fraction, numerator, denominator, division, remainder, dividend, divisor

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.14 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. **5.NF.14a** Interpret the product $\left(\frac{a}{b}\right) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. Example: Use a visual fraction model to show $\left(\frac{2}{3}\right) \times 4 = \frac{8}{3}$, and create a story context for this equation. Do the same with $\left(\frac{2}{3}\right) \times \left(\frac{4}{5}\right) = \frac{8}{15}$. (In general, $\left(\frac{a}{b}\right) \times \left(\frac{c}{d}\right) = \frac{ac}{bd}$.)

Guiding Questions with Connections to Mathematical Practices:

How can knowledge of multiplication and division be used to represent fraction multiplication in a variety of ways?

M.P.7. Look for and make use of structure. Use the meanings of multiplication and division, the relationship between multiplication and division, and visual models to solve products of fractions. For example, use a visual fraction model to show that since $\frac{1}{5} \times 2$ is 1 part of a partition of 2 into 5 equal parts and is equal to $\frac{2}{5}$, then $\frac{3}{5} \times 2$ is 3 parts of a partition of 2 into 5 equal parts, which is equal to $\frac{6}{5}$.

How is multiplying a whole number by a fraction similar to multiplying a fraction by a fraction?

M.P.1. Make sense of problems and persevere in solving them. Recognize that any whole number can be written as a fraction with a denominator of 1, and therefore the product of a whole number and a fraction can be written as the product of two fractions. For example, the expression $2 \times \frac{2}{3}$ can be written as $\frac{2}{1} \times \frac{2}{3}$.

What is the general rule for multiplying fractions and how is it shown using a visual model?

M.P.8. Look for and express regularity in repeated reasoning. After solving fraction multiplication problems in a variety of ways, generalize that when two fractions are multiplied together, the numerator of the product is equal to the product of the two numerators in the fractions and the denominator of the product is equal to the product of the two denominators in the fractions. For example, connect a visual model of the product of $\frac{3}{5}$ and $\frac{4}{7}$ to the expression $\frac{3 \times 4}{5 \times 7}$.

M.P.4. Model with mathematics. Use fraction models to visually represent products that include fractions. For example, if a family had 2 pies and ate $\frac{2}{3}$ of each pie, then the total amount of pie eaten can be represented with 2 circles divided into thirds with 2 segments shaded in each circle. The total of 4 shaded segments shows that the family ate a total of $\frac{4}{3}$ pies (i.e., $2 \times \frac{2}{3} = \frac{4}{3}$).

How does context help interpret products of fractions?

M.P.2. Reason abstractly and quantitatively. Write a story problem for an equation to make sense of the product and attend to the whole. For example, for the expression $\frac{5}{8} \times \frac{1}{4}$, write the story problem "There was $\frac{5}{8}$ of a cake left over from a party. Rayshawn ate $\frac{1}{4}$ of the left over cake. How much of the whole cake did Rayshawn eat?" and solve to get $\frac{5}{32}$ of the whole cake.

Key Academic Terms:

fraction, fraction model, whole number, multiplication, division, numerator, denominator, product, equation, expression

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.14 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. **5.NF.14b** 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.

Guiding Questions with Connections to Mathematical Practices:

How can tiling with unit squares that have unit fraction side lengths be used to find the area of rectangles with fractional side lengths?

M.P.4. Model with mathematics. Model the area of a rectangle with fractional side lengths by creating a rectangular grid that uses unit fraction side lengths for each dimension. For example, the area of a rectangular rug with a length of $\frac{3}{4}$ of a meter and a width of $\frac{2}{3}$ of a meter can be represented by a rectangular grid with 4 columns and 3 rows. When 3 of the 4 columns are shaded with one color to represent $\frac{3}{4}$ and 2 of the 3 rows are shaded with another color to represent $\frac{2}{3}$, then 6 squares from a total of 12 squares are shaded with both colors. The total area of the rug is $\frac{6}{12}$ of a square meter.

How is the process for determining the area of a rectangle with fractional edge lengths similar to the process for determining the area of a rectangle with whole-number edge lengths?

M.P.4. Model with mathematics. Extend previous knowledge of the formula for the area of a rectangle to rectangles with fractional edge lengths. For example, just as the area for a rectangle with a length of 13 units and width of 22 units is determined by decomposing 13×22 as $(10 + 3) \times (20 + 2)$, the area for a rectangle with a length of $2\frac{1}{3}$ units and width of $1\frac{1}{2}$ unit is determined by decomposing $2\frac{1}{3} \times 1\frac{1}{2}$ as $(2 + \frac{1}{3}) \times (1 + \frac{1}{2})$.

Key Academic Terms:

rectangle, area, length, width, fraction, decomposing

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.15 Interpret multiplication as scaling (resizing), by: **5.NF.15a** 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.

Guiding Question with Connections to Mathematical Practices:

How does a product reflect the sizes of its factors?

M.P.2. Reason abstractly and quantitatively. Recognize that a product indicates how many times larger or smaller one factor is compared to the other as a multiplicative comparison. For example, the product of $\frac{1}{3}$ and 12 is 4, which indicates that 4 is $\frac{1}{3}$ the size of 12.

Key Academic Terms:

factor, product, resizing, scaling

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.15 Interpret multiplication as scaling (resizing), by: **5.NF.15b** 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 $\frac{a}{b} = \frac{(n \times a)}{(n \times b)}$ to the effect of multiplying $\frac{a}{b}$ by 1.

Guiding Question with Connections to Mathematical Practices:

How does the number you multiply another number by impact the value of the product?

M.P.2. Reason abstractly and quantitatively. Extend previous knowledge of multiplying two whole numbers to multiplying a whole number and a fraction greater than 1. For example, just as the equation $2 \times 3 = 6$ indicates that 6 is 3 times as great as 2, the equation $2 \times \frac{3}{2} = 3$ indicates that 3 is $\frac{3}{2}$ (i.e., 1.5) times as great as 2.

M.P.2. Reason abstractly and quantitatively. Extend previous knowledge of multiplying two whole numbers to multiplying a whole number and a fraction less than 1. For example, just as the equation $8 \times 4 = 32$ indicates that 32 is 4 times as great as 8, the equation $8 \times \frac{3}{4} = 6$ indicates that 6 is $\frac{3}{4}$ the size of 8.

M.P.2. Reason abstractly and quantitatively. Extend previous knowledge of multiplying fractions and equivalence to show that multiplying any fraction by $\frac{n}{n}$ is the same as multiplying by 1. For example, $\frac{3}{4} \times \frac{2}{2} = \frac{6}{8} = \frac{3}{4}$, so multiplying by a fraction with the same numerator and denominator is the same as multiplying by 1.

Key Academic Terms:

factor, product, equivalent, resizing, equation, scaling

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.16 Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

Guiding Questions with Connections to Mathematical Practices:

How can the product of two fractions in context be visualized?

M.P.4. Model with mathematics. Use fraction models to visually represent the product of two fractions in context. For example, if $\frac{1}{2}$ of the snacks in a box are granola bars, and $\frac{1}{4}$ of the granola bars have chocolate chips, then a 2×4 rectangular grid can be constructed with $\frac{1}{2}$ of the pieces (i.e., 4) shaded to represent granola bar snacks and $\frac{1}{4}$ of those shaded pieces (i.e., 1) marked with a c to represent which ones have chocolate chips. This demonstrates that $\frac{1}{8}$ of the snacks in the box are chocolate chip granola bars.

Why is it important to attend to the meaning of the underlying quantities in a fraction multiplication word problem?

M.P.2. Reason abstractly and quantitatively. Analyze the problem to determine the meaning of the solution. For example, given the solution of $\frac{1}{8}$ for the problem above, recognize that because the initial number of snacks is not given, we only know the fraction of the snacks that are chocolate chip granola bars, not the number of chocolate chip granola bars.

Key Academic Terms:

fraction, mixed number, multiplication

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.17 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general by reasoning about the relationship between multiplication and division. However, division of a fraction by a fraction is not a requirement at this grade.) **5.NF.17a** Interpret division of a unit fraction by a nonzero whole number, and compute such quotients. Example: Create a story context for $\left(\frac{1}{3}\right) \div 4$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $\left(\frac{1}{3}\right) \div 4 = \frac{1}{12}$ because $\left(\frac{1}{12}\right) \times 4 = \frac{1}{3}$.

Guiding Questions with Connections to Mathematical Practices:

How can multiplication and the meaning of division be used to solve division problems with fractions?

M.P.2. Reason abstractly and quantitatively. Recognize that a division problem can be expressed as a multiplication problem with a missing factor. For example, the equation $10 \div \frac{1}{2} = \square$ can be rewritten as $\square \times \frac{1}{2} = 10$ and expressed as "How many $\frac{1}{2}$s are in 10?"

M.P.8. Look for and express regularity in repeated reasoning. Connect previous knowledge of fractions as division to the idea of multiplying a number by a unit fraction to solve division problems. For example, since $5 \div 4 = 5 \times \frac{1}{4}$, then $\frac{1}{5} \div 4 = \frac{1}{5} \times \frac{1}{4} = \frac{1\times1}{5\times4} = \frac{1}{20}$.

How can the quotient of a unit fraction and a whole number be represented visually?

M.P.4. Model with mathematics. Create fraction models to represent quotients of unit fractions and whole numbers, using context to make meaning of the whole. For example, to represent $\frac{1}{2} \div 4$, write the story problem "Mike has $\frac{1}{2}$ of a foot of ribbon. He cuts the ribbon into 4 equal pieces. How many feet of ribbon is each portion of the ribbon after he cuts it?" Then represent $\frac{1}{2}$ on a number line that begins at 0 and ends at 1. To represent division by 4, both halves of the number line are split into 4 equal sections to show the fraction of the $\frac{1}{2}$ of a foot of ribbon that Mike cut. The quotient $\frac{1}{2} \div 4$ is represented by 1 of the sections of the whole foot, which is located at $\frac{1}{8}$ on the number line.

Key Academic Terms:

unit fraction, whole number, division, multiplication, factor, number line

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.17 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general by reasoning about the relationship between multiplication and division. However, division of a fraction by a fraction is not a requirement at this grade.) **5.NF.17b** Interpret division of a whole number by a unit fraction, and compute such quotients. Example: Create a story context for $4 \div \left(\frac{1}{5}\right)$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $4 \div \left(\frac{1}{5}\right) = 20$ because $20 \times \left(\frac{1}{5}\right) = 4$.

Guiding Questions with Connections to Mathematical Practices:

Why is the quotient of a whole number and a unit fraction larger than the dividend?

M.P.2. Reason abstractly and quantitatively. Use the meaning of division and the relationship between multiplication and division to recognize that the quotient of a whole number and a unit fraction is larger than the dividend because the divisor is separating the dividend into fractional pieces, and the quotient represents how many pieces the dividend has been divided into. For example, the expression $4 \div \frac{1}{3}$ is asking how many one-third pieces are in 4 wholes.

How can the quotient of a whole number and a unit fraction be represented visually?

M.P.4. Model with mathematics. Create fraction models to represent quotients of whole numbers and unit fractions. For example, the quotient of 2 and $\frac{1}{3}$ can be represented with 2 rectangles that are each divided into thirds, and then observing that there is a total of 6 thirds within the two original rectangles. As such, $2 \div \frac{1}{3} = 6$.

How can context be used to interpret division problems involving fractions?

M.P.2. Reason abstractly and quantitatively. Write a story problem to make sense of a division problem involving fractions. For example, given the equation $6 \div \frac{1}{4} = 24$, write the story problem "6 cups of cat food will provide 24 servings of $\frac{1}{4}$ of a cup per serving."

Key Academic Terms:

unit fraction, whole number, division, dividend, divisor, quotient, equation, rectangle, fractional pieces

Number and Operations – Fractions
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.NF.17 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general by reasoning about the relationship between multiplication and division. However, division of a fraction by a fraction is not a requirement at this grade.) **5.NF.17c** Solve real-world problems involving division of unit fractions by nonzero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. Examples: 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?

Guiding Question with Connections to Mathematical Practices:

How can real-world problems involving the quotients of unit fractions and whole numbers be solved?

M.P.4. Model with mathematics. Utilize fraction models and equations to solve real-world problems that involve division with unit fractions. For example, if 1 pizza contains 3 servings, then a fraction model can be used to determine the total number of servings in 4 pizzas. More specifically, 4 circles that are each divided into thirds can be used to show that $4 \div \frac{1}{3} = 12$ because there are 12 segments, each containing $\frac{1}{3}$ of a pizza, in the 4 circles.

Key Academic Terms:

unit fraction, whole number, division, fraction model

Measurement and Data
Convert like measurement units within a given measurement system.
5.MD.18 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 multistep, real-world problems.

Guiding Questions with Connections to Mathematical Practices:

What is the general process for converting from a larger unit of measurement to a smaller unit of measurement within the same system?

M.P.8. Look for and express regularity in repeated reasoning. Recognize that multiplication can be used to convert a larger unit of measurement to a smaller unit of measurement by scaling up. For example, when converting a number of feet into inches, the number of feet is multiplied by 12 because there are 12 inches in every foot. So to convert 3.5 feet into inches, 3.5 is multiplied by 12. As such, there are 42 inches in 3.5 feet because $3.5 \times 12 = 42$.

What is the general process for converting from a smaller unit of measurement to a larger unit of measurement within the same system?

M.P.8. Look for and express regularity in repeated reasoning. Recognize that division can be used to convert a smaller unit of measurement to a larger unit of measurement by scaling down. For example, when converting 72 ounces into cups, 72 should be divided by 8 because there are 8 ounces for every 1 cup. As such, there are 9 cups in 72 ounces because $72 \div 8 = 9$.

How can models be used to represent and solve multistep, real-world problems?

M.P.4. Model with mathematics. Solve multistep, real-world problems using a variety of strategies, including models. For example, create a table of equivalent measurements to solve a multistep problem such as “Tanya is in a race that is 5 kilometers long. So far she has run 1,500 meters. How many kilometers does she have left in the race?”

Key Academic Terms:

measurement system, unit, conversion, multiplication, division, equivalent measurements

Measurement and Data
Represent and interpret data.
5.MD.19 Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots. 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.

Guiding Questions with Connections to Mathematical Practices:

How is a line plot constructed when data measurements include fractions of a unit?

M.P.5. Use appropriate tools strategically. Represent the frequency of data by creating a number line with fractional intervals and placing an X above the locations that indicate each data value. For example, if a data set includes data points $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1, then a number line with tick marks at $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, and $\frac{4}{4}$ can be created with 1 X above $\frac{1}{4}$, 2 Xs stacked vertically above $\frac{2}{4}$, 1 X above $\frac{3}{4}$, and 1 X above $\frac{4}{4}$.

How can information about data presented in line plots be determined using the four operations?

M.P.8. Look for and express regularity in repeated reasoning. Apply knowledge of addition, subtraction, multiplication, and division to determine information about a set of data displayed on a line plot. For example, if the lengths, in inches, of some insects are shown on a line plot to be $\frac{3}{4}$, $\frac{5}{2}$, $\frac{7}{8}$, $\frac{8}{8}$, and $\frac{9}{4}$, then it can be determined that the total length of all 5 insects is $7\frac{3}{8}$ inches because $\frac{3}{4}+\frac{5}{2}+\frac{7}{8}+\frac{8}{8}+\frac{9}{4}=7\frac{3}{8}$.

Key Academic Terms:

line plot, frequency, fraction, operation, data, number line, fractional intervals

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.MD.20 Recognize volume as an attribute of solid figures, and understand concepts of volume measurement. **5.MD.20a** 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.

Guiding Questions with Connections to Mathematical Practices:

What is volume and what are examples of objects that do and do not have volume?

M.P.4. Model with mathematics. Understand that volume represents the amount of space enclosed within a three-dimensional figure. For example, a cube has volume but a square does not.

What is a unit cube and how does it relate to volume?

M.P.4. Model with mathematics. Understand that a unit cube is a cube with a side length of 1 unit and a volume of 1 cubic unit that can be used to represent and measure the volume of solid figures. For example, if a three-dimensional shape contains the same amount of space as a cube with a side length of 1 inch, then that shape has a volume of 1 cubic inch.

Key Academic Terms:

volume, space, cube, unit cube, three-dimensional, cubic unit, attribute

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.MD.20 Recognize volume as an attribute of solid figures, and understand concepts of volume measurement. **5.MD.20b** 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.

Guiding Question with Connections to Mathematical Practices:

How can multiple cubes be used to measure the volume of a figure?

M.P.4. Model with mathematics. Recognize that if the amount of space enclosed within a three-dimensional figure is exactly the same as the amount of space within a set of cubes, then the volume of the figure can be expressed as the number of cubes used to fill the figure. For example, if a figure is packed with 12 cubes with side length 1 centimeter with no gaps or overlaps, then the volume of the figure is 12 cubic centimeters.

Key Academic Terms:

volume, space, cube, unit cube, cubic units, solid figure

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.MD.21 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

Guiding Question with Connections to Mathematical Practices:

How can the volume of a right rectangular prism that is composed of identical cubes be determined?

M.P.6. Attend to precision. Recognize that when a right rectangular prism is composed of identical cubes with no gaps or overlaps, counting the total number of cubes produces a measurement of the volume of the prism. For example, if a figure is composed entirely of 24 cubes with side lengths of 1 inch, then the volume of the figure is 24 cubic inches.

Key Academic Terms:

volume, space, cube, unit cube, cubic centimeters, cubic inches, cubic feet

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.MD.22 Relate volume to the operations of multiplication and addition, and solve real-world and mathematical problems involving volume. **5.MD.22a** 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.

Guiding Questions with Connections to Mathematical Practices:

What are the attributes of a rectangular prism?

M.P.2. Reason abstractly and quantitatively. Recognize that a rectangular prism is a solid object with 6 faces that are all rectangles. For example, a cube is a rectangular prism because the bases are congruent rectangles.

How can the volume of a right rectangular prism that is packed with unit cubes be determined without counting the total number of cubes?

M.P.7. Look for and make use of structure. Recognize that rectangular prisms are composed of layers of unit cubes and connect the volume of the rectangular prism to the area of a single layer multiplied by the total number of layers. For example, a right rectangular prism with a length of 3 inches, a width of 4 inches, and a height of 5 inches contains a total of 60 1-inch cubes, which is equivalent to $(3 \times 4) \times 5$.

M.P.3. Construct viable arguments and critique the reasoning of others. Compare volumes of rectangular prisms to explore conservation of volume. For example, a rectangular prism with the dimensions of 2 units, 4 units, and 3 units will have the same volume as a rectangular prism with the dimensions of 1 unit, 2 units, and 12 units.

Key Academic Terms:

volume, unit cube, rectangular prism, base, face, length, width, height, congruent rectangles, equivalent, conservation of volume, layer, attribute

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.MD.22 Relate volume to the operations of multiplication and addition, and solve real-world and mathematical problems involving volume. **5.MD.22b** Apply the formulas $V = l \times w \times h$ and $V = B \times h$ 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.

Guiding Questions with Connections to Mathematical Practices:

What does each of the variables represent in the formulas $V = B \times h$ and $V = l \times w \times h$, and how do the formulas $V = B \times h$ and $V = l \times w \times h$ relate to each other?

M.P.2. Reason abstractly and quantitatively. Define each variable in the formulas $V = B \times h$ and $V = l \times w \times h$ as Volume = Base × height and Volume = length × width × height. For example, if the edge lengths of a right rectangular prism are 2 inches, 4 inches, and 6 inches, then any two of those values can represent the base B (length × width) while the remaining value represents the height.

Why does switching the length and width of a rectangular prism have no effect on the volume of the prism?

M.P.3. Construct viable arguments and critique the reasoning of others. Recognize that the formula for calculating volume of a rectangular prism ($V = l \times w \times h$) only requires multiplication. Since multiplication is commutative, the order of multiplication can be rearranged without changing the product. For example, if a rectangular prism has a length of 5 centimeters, a width of 3 centimeters, and a height of 6 centimeters, the volume of the rectangular prism would be $5 \times 3 \times 6 = 15 \times 6 = 90$ cubic centimeters. If the length and width are switched, the calculation $3 \times 5 \times 6$ also equals $15 \times 6 = 90$ cubic centimeters.

How can a right rectangular prism be constructed when the volume is known?

M.P.2. Reason abstractly and quantitatively. Determine possible values for the length, width, and height of a right rectangular prism by identifying the product of three values that equal the same value as the given volume. For example, if a right rectangular prism has a volume of 60 cubic centimeters, then 2 centimeters, 3 centimeters, and 10 centimeters are possible (not exclusive) values for the length, width, and height of that prism because $2 \times 3 \times 10 = 60$.

Key Academic Terms:

volume, rectangular prism, base, length, width, height, formula, edge

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.MD.22 Relate volume to the operations of multiplication and addition, and solve real-world and mathematical problems involving volume. **5.MD.22c** Recognize volume as additive. Find volumes of solid figures composed of two nonoverlapping right rectangular prisms by adding the volumes of the nonoverlapping parts, applying this technique to solve real-world problems.

Guiding Question with Connections to Mathematical Practices:

How can decomposition be used to determine the volume of solid figures?

M.P.4. Model with mathematics. Recognize that if a three-dimensional solid figure can be decomposed into two or more right rectangular prisms, then the sum of the volumes of the right rectangular prisms is equivalent to the volume of the original solid figure. For example, if two prisms, one with dimensions of 16 inches, 8 inches, and 8 inches and one with dimensions of 16 inches, 8 inches, and 16 inches, are placed together to create a set of steps, then the total volume of the steps is 3,072 cubic inches because the sum of the volumes of the individual prisms, 1,024 and 2,048, equals 3,072.

Key Academic Terms:

volume, rectangular prism, composition, decomposition, additive, three-dimensional, sum, equivalent

Geometry
Graph points on the coordinate plane to solve real-world and mathematical problems.
5.G.23 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).

Guiding Questions with Connections to Mathematical Practices:

What does the origin of a coordinate system represent and how is it used?

M.P.5. Use appropriate tools strategically. Recognize that the origin of a coordinate system is the location where the horizontal *x*-axis intersects with the vertical *y*-axis, and that this location is used to determine the location of all other ordered pairs. For example, the ordered pair (0, 0) represents the origin, and all other ordered pairs refer to a horizontal and vertical distance from this location.

How is the location of an ordered pair in the first quadrant determined on a coordinate system?

M.P.5. Use appropriate tools strategically. Recognize that the first coordinate of an ordered pair indicates how far to move to the right from the origin while the second coordinate indicates how far to move above the origin. For example, the ordered pair (3, 2) indicates a location that is 3 units to the right of the origin and 2 units above that location on the *x*-axis.

Key Academic Terms:

coordinate system, coordinate, *x*-axis, *y*-axis, origin, ordered pair, plane, horizontal, vertical

Geometry
Graph points on the coordinate plane to solve real-world and mathematical problems.
5.G.24 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.

Guiding Questions with Connections to Mathematical Practices:

What is the first quadrant?

M.P.4. Model with mathematics. Understand that the intersection of the horizontal *x*-axis and the vertical *y*-axis creates four distinct sections called quadrants, and that the first quadrant refers to the section that is above the *x*-axis and to the right of the *y*-axis. For example, the ordered pair (3, 2) is in the first quadrant because it is 3 units to the right of the *y*-axis and 2 units above the *x*-axis.

How can the first quadrant of the coordinate plane be used to represent real-world locations and situations?

M.P.4. Model with mathematics. Recognize that the coordinate plane can serve as a map that shows locations and the distances between locations. For example, if the library and the pharmacy are 2 miles apart on the same street, then the ordered pairs (2, 2) and (4, 2) could be used to represent these locations on a coordinate plane where 1 unit is assumed to represent 1 mile, because (2, 2) and (4, 2) are exactly two units apart from each other.

Key Academic Terms:

coordinates, coordinate plane, first quadrant, *x*-axis, *y*-axis, ordered pair

Geometry
Classify two-dimensional figures into categories based on their properties.
5.G.25 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. Example: All rectangles have four right angles, and squares are rectangles, so all squares have four right angles.

Guiding Question with Connections to Mathematical Practices:

How are attributes used to categorize and subcategorize two-dimensional figures?

M.P.6. Attend to precision. Identify attributes such as number of sides, side lengths, angles, and presence of parallel or perpendicular lines to categorize and subcategorize two-dimensional figures. Use these attributes to make connections between categories and subcategories. For example, all rectangles, squares, and rhombuses have opposite sides that are parallel and congruent. As such, all rectangles, squares, and rhombuses are parallelograms.

Key Academic Terms:

attribute, category, subcategory, two-dimensional, figure, right angle, parallel, perpendicular

Geometry
Classify two-dimensional figures into categories based on their properties.
5.G.26 Classify two-dimensional figures in a hierarchy based on properties.

Guiding Question with Connections to Mathematical Practices:

How is a hierarchy of figures created based on properties?

M.P.6. Attend to precision. Recognize that a hierarchy of figures is created by identifying and distinguishing properties that are more general from those that are more specific and making connections between and within categories of figures. For example, a quadrilateral is a figure with the general property of having 4 sides while a parallelogram is a specific type of quadrilateral that has two pairs of opposite sides that are both parallel and congruent. Based on this hierarchy, all parallelograms are quadrilaterals, but not all quadrilaterals are parallelograms.

Key Academic Terms:

two-dimensional, properties