MATHEMATICAL IDEAS & CONCEPTS:

- Continue to understand the place value system
- Continue to perform operations with multi-digit whole numbers
- Continue to apply previous understandings of multiplication and division when working with fractions
- Continue to develop understanding of the concepts of volume
- Classify two-dimensional figures into categories based on their properties *new this quarter*
- Continue to develop strategies for multiplying multi-digit whole numbers
- Convert like measurement units within a given measurement system *new this quarter*

ESSENTIAL QUESTIONS:

1. *What patterns occur in our number system?*
2. *How do I notate my thinking when decomposing numbers to divide?*
3. *How can I use visual models to represent division involving fractions?*
4. *How can I apply my understanding of multiplication with whole numbers to multiplication with fractions?*
5. *How does volume relate to the operations of multiplication and addition?*
6. *How can two-dimensional figures belong to multiple categories?*

STANDARDS:

Aligned to Essential Questions; Big Idea/Concept Standard (★) with supporting standards (➔) connected below

Notes in gray font are from the AR Mathematics standards; RPS instructional pacing notes are in red font

EQ 1: What patterns occur in our number system?

★ **5.NBT.A.2** Understand why multiplying or dividing by a power of 10 shifts the *value* of the digits of a whole number or decimal:

- Explain patterns in the number of zeros of the *product* when multiplying a whole number by powers of 10
- 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

Q2 Focus: decimals; understanding and explaining the multiplicative pattern

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

➔ **5.NBT.A.3** Read, write, and compare decimals to thousandths: *new this quarter*

- Read and write decimals to thousandths using base-ten numerals, number names, and *expanded form*(s)

  Examples could include:
  - Base-ten numerals "standard form" (347.392)
  - Number name form (three-hundred forty seven and three hundred ninety-two thousandths)
  - *Expanded form*(s):
    - 300 + 40 + 7 + .3 + .09 +.002 = 300 +40 +7 +3/10 + 9/100 + 2/100 =
    - 3 x 100 + 4 x 10 + 7 x 1 + 3 x (1/10) + 9 x (1/100) +2 x (1/1000)=
    - $3 \times 10^2 + 4 \times 10^1 \times 7 \times 10^0 + 3\times (1/10^1) + 9\times (1/10^2) + 2 \times (1/10^3)$
- Compare two decimals to thousandths based on the *value* of the digits in each place, using >, =, and < symbols to record the results of comparisons

➔ **5.NBT.A.4** Apply *place value* understanding to round decimals to any place. *new this quarter*

EQ 2: How do I notate my thinking when decomposing numbers to divide?

★ **5.NBT.B.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
  - Divisibility rules; and
  - The relationship between multiplication and division
- Illustrate and explain calculations by using *equations*, *rectangular arrays*, and area models

➔ **5.NBT.B.5** Fluently (efficiently, accurately and with some degree of flexibility) multiply multi-digit *whole numbers* using a standard *algorithm.*

This standard is connected to promote the relationship between multiplication and division and to help students identify similarities in strategies through operations. Q1-Q3 should focus on developing use of a variety of base-ten strategies so that fluency can be obtained by end of year.

Notes 5.NBT.B.5:

- *A standard algorithm can be viewed as, but should not be limited to, the traditional recording system.*
- *A standard algorithm denotes any valid base-ten strategy.*

EQ 3: How can I use visual models to represent division involving fractions?

When performing operations with fractions at this grade level, the use of visual models to represent fractions is considered a proficient practice.

End of year expectations include using visual fraction models and/or equations.

★ **5.NF.B.3**

- Interpret a *fraction* as division of the *numerator* by the *denominator* ($a/b = a \div b$), where a and b are natural numbers
  For example: Interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4.
- Solve word problems involving division of natural numbers leading to answers in the form of *fractions* or mixed numbers.
  For example: Use *visual fraction models* or *equations* to represent the problem. 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?

Equal share problems should be used to solidify this understanding, and students must have this understanding prior to working with partial groups.

<u>Equal Share Problems</u>

- *# of objects is greater than the # of sharers that result in a mixed number*
- *# of shares is greater than the # of objects that result in a proper fraction*

Students may experience addition and subtraction of fractions within the context of equal share situations; however, formal instruction of addition and subtraction of fractions will begin in 3rd quarter

Standards associated with this essential standard continue on next page...

When performing operations with fractions at this grade level, the use of visual models to represent fractions is considered a proficient practice.
End of year expectations include using visual fraction models and/or equations.

EQ 3: How can I use visual models to represent division involving fractions? *continued...*

★ **5.NF.B.7** Apply and extend previous understandings of division to divide ***unit fractions*** by *whole numbers* and *whole numbers* by *unit fractions*:
Note 5.NF.B.7: Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division, but division of a fraction by a fraction is not a requirement at this grade *new this quarter*

- Interpret division of a ***unit fraction*** by a natural number, and compute such *quotients*
  For example: Create a story context for (1/3) ÷ 4, and use a ***visual fraction model*** **to show the *quotient***. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3). *Ex: 4 children share $\frac{1}{3}$ of a cake equally. How much would each child get? $\frac{1}{3} \div 4 = n$; $\frac{1}{4} \times \frac{1}{3} = n$*
- Interpret division of a whole number by a ***unit fraction***, and compute such *quotients*
  For example: Create a story context for 4 ÷ (1/5), and use a ***visual fraction model*** **to show the *quotient*.** Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4). *Ex: $\frac{1}{5}$ of a bag of cement weighs 4 pounds. How much would the whole bag weigh? $4 \div \frac{1}{5} = n$; $\frac{1}{5} \times n = 4$*
- Solve real world problems involving division of ***unit fractions*** by natural numbers and division of *whole numbers* by *unit fractions*
  For example: Use ***visual fraction models*** **and *equations* to represent the problem**. How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?

EQ 4: How can I apply my understanding of multiplication with whole numbers to multiplication with fractions?

★ **5.NF.B.4** Apply and extend previous understandings of multiplication to multiply a *fraction* or whole number by a *fraction*:

- Interpret the *product* $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$.
  For example: Use a *visual fraction model* to show (2/3) × 12 means to take 12 and divide it into thirds (1/3 of 12 is 4) and take two of the parts (2 X 4 is 8), so (2/3) X 12 = 8, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.).
- Find the area of a rectangle with fractional (less than and/or greater than 1) side lengths, by tiling it with unit squares of the appropriate *unit fraction* side lengths, by multiplying the fractional side lengths, and then show that both procedures yield the same area

Area is a visual support for understanding multiplication as scaling

➔ **5.NF.B.5** Interpret multiplication as scaling (resizing), by: *new this quarter*
  - 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 *For example:* Understand that 2/3 is twice as large as 1/3.
  - Explaining why multiplying a given number by a *fraction* greater than 1 results in a *product* greater than the given number
  - Explain why multiplying a given number by a *fraction* less than 1 results in a *product* smaller than the given number
  - Relate the principle of *fraction* equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1

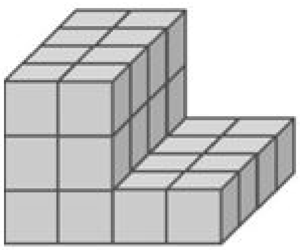
➔ **5.NF.B.6** Solve real world problems involving multiplication of *fractions* and mixed numbers. *For example:* Use *visual fraction models* or *equations* to represent the problem.

Q2 & Q3 Focus:
- *Extend ideas to a fraction x a fraction*
- *Mixed number x a fraction (partial groups)*
- *Mixed number x a mixed number*

EQ 5: How does volume relate to the operations of multiplication and addition?

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

- Find the volume of a right *rectangular prism* with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base (**B**)
- Represent threefold whole-number *products* as volumes (e.g., to represent the associative property of multiplication)
- Apply the formulas V = l × w × h and V = **B** × h for *rectangular prisms* to find volumes of right *rectangular prisms* with whole-number edge lengths in the context of solving real world and mathematical problems
- 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



For Example:
John was finding the volume of this figure. He decided to break it apart into two separate rectangular prisms. John found the volume of the solid by using this expression: (4 x 4 x 1) + (2 x 4 x 2).
Decompose the figure into two rectangular prisms and shade them in different colors to show how John might have thought about it.

Phillis also broke this solid into two rectangular prisms, but she did it differently than John. She found the volume of the solid below using this expression: (2 x 4 x 3) + (2 x 4 x 1).
Decompose the figure into two rectangular prisms and shade them in different colors to show how Phillis might have thought about it.

EQ 6: How can two-dimensional figures belong to multiple categories?

★ **5.G.B.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. All isosceles triangles have at least two sides *congruent* and equilateral triangles are isosceles. Therefore, equilateral triangles have at least two *congruent* sides.

Application of the following standards will be seen throughout most of your mathematical experiences:

➔ **5.OA.A.1** Use *grouping symbols* including parentheses, brackets, or braces in numerical *expressions*, and evaluate *expressions* with these symbols. *Note: 5.OA.A.1 Expressions should not contain nested grouping symbols such as [4+2(10+3)] and they should be no more complex than the expressions one finds in an application of the associative or distributive property (e.g., (8+7) x2 or {6 X 30} + {6 X 7}).*

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

Additional Standards:

- **5.MD.A.1** *new this quarter; Metric conversion work connects to ideas in EQ 1.*
  - Convert among different-sized standard measurement units within the metric system. *For example:* Convert 5 cm to 0.05 m.
  - Convert among different-sized standard measurement units within the customary system. *For example:* Convert 1½ ft to 18 in.
  - Use these conversions in solving multi-step, real world problems