MATHEMATICAL IDEAS & CONCEPTS:

- Understand the place value system
- Perform operations with multi-digit whole numbers
- Apply previous understandings of multiplication and division when working with fractions
- Develop understanding of the concepts of volume
- Develop strategies for multiplying multi-digit whole numbers

ESSENTIAL QUESTIONS:

1. *How does the position of a digit in the number affect its value?*
2. *How can I decompose numbers to help me divide?*
3. *How can a fraction represent the division of two natural numbers?*
4. *How can I use visual models to represent multiplication involving fractions?*
5. *What is volume and how do we measure it?*

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: How does the position of the number affect its value?

★ **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

Q1 Focus: Whole Numbers; Formal assessment begins in 2nd quarter

➔ **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. *Note: "10 times as much" is a continuation of 4th grade work with multiplicative comparison*

EQ 2: How can I decompose numbers to help me divide?

★ **5.NBT.B.6** *Extension of 4th grade division standard (4-digit dividends and 1-digit divisors)*

- 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.*

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 expectation includes using visual fraction models and/or equations.

EQ 3: How can a fraction represent the division of two natural numbers?

★ **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.

Equal Share Problems

- *# 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

EQ 4: How can I use visual models to represent multiplication involving 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 with fractional side lengths is not formally assessed until 2nd quarter*

➔ **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.

Q1 Focus:

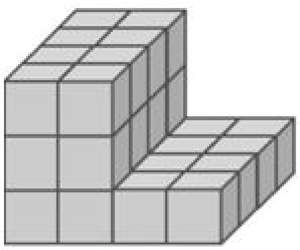
- *Whole number x a fraction or a whole number x a mixed number (multiple groups)*
- *A fraction x a whole number (partial groups) [**NOT** a fraction x a fraction]*
  Note: Fraction x a whole number is new for fifth grade; a whole number x a fraction is a continuation of 4th grade understanding

EQ 5: What is volume and how do we measure it?

Q1 will focus on the idea of volume as an attribute of a solid and begin to develop concepts of volume measurement (5.MD.C.3 & 5.MD.C.4) based on prior understanding of area measurement. Experiences in Q1 involve hands-on explorations and ***do not*** *involve application of the formula.*

★ **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.

➔ **5.MD.C.3** Recognize volume as an attribute of solid figures and understand concepts of volume measurement: *Q1 Focus*
- 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
- 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.C.4** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. *Q1 Focus*

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.*