Archdiocesan Curriculum > MS Advanced 1> Math > Length of unit 43 to 48 days

Stage 1: Desired Results

General Information

In this unit, students will develop a deep understanding of rational numbers and build fluency with all four operations involving them. They will identify, compare, and order rational numbers using number lines, apply absolute value and opposites in real-world contexts, and use greatest common factor (GCF) and least common multiple (LCM) to support fraction operations. Students will divide fractions and mixed numbers using multiplicative inverses, perform multi-digit operations with decimals and whole numbers using standard algorithms, and solve real-world problems involving decimals. They will use number lines to add and subtract integers and rational numbers, apply properties such as the additive inverse, and express rational numbers as decimals. Finally, students will solve multi-step problems involving combinations of operations with rational numbers, applying mathematical properties and reasoning throughout.

Mathematical Practices
- MP1 – Make sense of problems and persevere in solving them
- MP2 – Reason abstractly and quantitatively
- MP6 – Attend to precision
- MP7 – Look for and make use of structure

Essential Question(s)

- How can we use the number line to represent, compare, and understand rational numbers, including negative values and their opposites?

- Why is absolute value useful in understanding real-world situations, and how does it help describe the magnitude of numbers?

- How do the greatest common factor and least common multiple help us perform operations with fractions and compare rational numbers?

- What patterns and properties help us add, subtract, multiply, and divide rational numbers accurately and efficiently?

- How can we use rational numbers and operations to solve multi-step problems and explain real-world situations?

Enduring Understanding/Knowledge

Students will:
- Identify and interpret rational numbers using a number line.
- Use number lines to compare and order rational numbers.
- Find and use absolute value in real-world situations.
- Compare rational numbers using the GCF and LCM.
- Use strategies to order rational numbers.

Review/Assess
- Divide fractions with like and unlike denominators.
- Divide mixed numbers.
- Divide fractions and mixed numbers.
- Use LCM and GCF to add, subtract, multiply, and divide fractions.

Review/Assess
- Add and subtract multi-digit decimals.
- Multiply multi-digit decimals.
- Divide multi-digit whole numbers using the standard algorithm.
- Divide multi-digit decimals using the standard algorithm.

Vocabulary

New	Review
- absolute value - integer - negative number - opposites - positive number - rational number - inequality - magnitude - greatest common factor - least common multiple - multiplicative inverse - reciprocal - Addition Property of Opposites - additive inverse	- common denominator - common factor - common multiple - Distributive Property - factor - denominator - expression - numerator - quotient - mixed number - simplify - simplest form - equivalent - degree - opposites - absolute value - dividend - divisor - inverse operations - equivalent fractions - rational number

- Solve real-world problems involving operations with multi-digit decimals

Review/Assess
- Use a number line to add and subtract positive integers.
- Use a number line to add and subtract a negative integer and then assess the results for reasonableness.
- Use a number line to add and subtract rational numbers.

Review/Assess
- Calculate the sum of rational numbers.
- Calculate the difference of rational numbers.
- Develop rules to find products and quotients of rational numbers.
- Express rational numbers as decimals.
- Use products and quotients of rational numbers to solve problems.
- Use properties to solve multi-step problems involving positive and negative rational numbers.
- Solve multi-step problems involving a combination of rational number operations.

Review/Assess

Connections to Catholic Identity / Other Subjects

Religion/Catholic Identity:
- The ephah and the bath shall be the same quantity, so that the bath will contain a tenth of a homer and the ephah a tenth of a homer; their standard shall be according to the homer. The shekel shall be twenty gerahs; twenty shekels, twenty-five shekels, and fifteen shekels shall be your maneh. (Ez 45:11-12)
- This is how you shall make it: the length of the ark is three hundred cubits, its breadth fifty cubits, and its height thirty cubits. You shall make a window for the ark, and finish it to a cubit from the top; and set the door of the ark in the side of it; you shall make it with lower, second, and third decks. (Gen 6:15-16)

Subject Here:
- **Social Studies:** We assign sea level the number 0. Anything below sea level is represented with a negative integer, while anything above sea level is represented with a positive integer.
- **Science:** Temperature: Hot and cold temperatures can be thought of in relation to the number of degrees above or below 0

Differentiation

Enrichment
- **Explore Rational Number Patterns on Number Lines** – Challenge students to create their own number line with rational numbers including integers, fractions, and decimals, and explain the placement and ordering.
- **Advanced Fraction Division Problems** – Have students divide mixed numbers and fractions in multi-step problems involving real-world contexts (e.g., recipes, construction measurements).
- **Decimal Operations with Estimation** – Encourage students to estimate sums, differences, products, and quotients of multi-digit decimals before solving to check reasonableness.
- **Investigate Properties of Rational Numbers** – Guide students to prove and explain properties such as additive inverses and the distributive property with rational numbers using algebraic expressions.
- **Create and Solve Multi-Step Rational Number Word Problems** – Invite students to write complex word problems combining addition, subtraction, multiplication, and division of rational numbers, then solve and justify their answers.

Support
- **Number Line Visuals for Comparing and Ordering** – Use physical or digital number lines for hands-on practice with ordering and comparing rational numbers, highlighting positive/negative and opposites.
- **Step-by-Step Fraction Division Models** – Provide visual fraction models (e.g., area models, number lines) to illustrate division of fractions and mixed numbers, supported by guided practice.
- **Decimal Place Value Review** – Use place value charts and base-10 blocks to reinforce

	understanding of multi-digit decimals before operations. • **Addition and Subtraction with Number Lines** – Scaffold adding and subtracting positive and negative rational numbers using number lines and explicit reasoning prompts about opposites and additive inverses. • **Guided Multi-Step Problem Solving** – Break down multi-step problems into smaller parts and use sentence frames to help students articulate each step and operation applied.

Standards & Benchmarks
Rational Number Concepts:

6.NS.2
Explain how opposite signs of numbers indicate locations on opposite sides of 0 on the number line; identify the opposite of the opposite of a number.

6.NS.6
Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers from 1 to 100, with a common factor as a multiple of a sum of two whole numbers with no common factor.

6.NS.3
Compare and order rational numbers and plot them on a number line. Write, interpret, and explain statements of order for rational numbers in real-world contexts.

6.NS.C.5
Describe quantities having opposite directions or values using positive and negative numbers: temperature above/below zero, elevation above/below sea level, credits/debits, and positive/negative electric charge. Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.C.6.a
Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself. For example, –(–3) = 3, and that 0 is its own opposite.

6.NS.C.7.a
Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

6.NS.C.7.b
Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write $-3°CC >$ $-7°CC$ to express the fact that $-3°\ CC$ is warmer than $-7°CC$.

6.NS.C.7.c
Describe the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of −30 dollars, write |−30| = 30 to describe the size of the debt in dollars.

6.NS.C.6.c
Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.C.7.d
Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than −30 dollars represents a debt greater than 30 dollars.

6.NS.7b
Write, interpret, and explain statements of order for rational numbers in real-world contexts.

6.NS.7c
Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.

6.NS.5
Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.N.1.1
Use manipulatives and models (e.g., number lines) to determine positive and negative numbers and their contexts, identify opposites, and explain the meaning of 0 (zero) in a variety of situations.

6.A.1.1
Plot integer- and rational-valued (limited to halves and fourths) ordered-pairs as coordinates in all four quadrants and

recognize the reflective relationships among coordinates that differ only by their signs.

6.N.2.6

Determine the greatest common factors and least common multiples. Use common factors and multiples to calculate with fractions, find equivalent fractions, and express the sum of two-digit numbers with a common factor using the distributive property.

Fraction Division:

6.NS.A.1

Use and interpret models to compute quotients of fractions. Solve word problems involving division of fractions by fractions. Be able to use visual fraction models and equations to represent the problem. For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction - model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ad/bc$). If $2/3$ of a shoelace is $1/2$ meter long, how many meters long is the shoelace? How many $3/4$ cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square-mile?

6.NS.1

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

6.N.4.3

Multiply and divide fractions and decimals using efficient and generalizable procedures.

Fluency with Multi-Digit Decimal Operations:

6.NS.B.3

Add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. For more complex cases, use technology.

6.NS.B.2

Divide multi-digit numbers using the standard algorithm. For at least 4 digits by 1-digit division by hand; more complicated cases using technology. For example, 6,389/7.

6.NS.2

Fluently divide multi-digit numbers using the standard algorithm.

6.NS.3

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Understand Addition and Subtraction of Rational Numbers:

7.NS.A.1.a

Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.

7.NS.A.1.b

Use a model to describe $p + q$ as a number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

7.NS.1b

Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

Fluency with Rational Number Operations:

8.NS.4

Solve real-world problems with rational numbers by using multiple operations. (E)

7.RP.2

Use proportional relationships to solve ratio and percent problems with multiple operations (e.g., simple interest, tax, markups, markdowns, gratuities, conversions within and across measurement systems, and percent increase and decrease). (E)

7.AF.2

Solve real-world problems with rational numbers by using one or two operations. (E)

7.NS.7

Compute fluently with rational numbers using an algorithmic approach. (E)

7.NS.A.1.a

Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.

7.NS.A.1.b

Use a model to describe $p + q$ as a number located a distance $|q|$ from p, in the positive or negative direction depending

on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

7.NS.A.1.c
Use a model to describe subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference and apply this principle in real-world contexts.

7.NS.A.1.d
Apply properties of operations as strategies to add and subtract rational numbers.

7.NS.A.2.b
Use properties of operations, particularly the distributive property, leading to generalizations for quotients of integers (provided that the divisor is not zero). If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

7.EE.B.3
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example, If someone making $25 an hour gets a 10% raise, that is an additional 1/10 of their salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

7.NS.A.2.c
Multiply and divide rational numbers.

7.NS.A.2.d
Convert a rational number to a decimal; know that the decimal form of a rational number terminates in 0s or eventually repeats.

7.NS.1b
Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

7.NS.1a
Describe situations in which opposite quantities combine to make 0.

7.NS.2d
Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

7.NS.2c
Apply properties of operations as strategies to multiply and divide rational numbers.

7.EE.3
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

7.NS.2b
Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then -(p/q) = (-p)/q = p/(-q). Interpret quotients of rational numbers by describing real-world contexts.

7.NS.2a
Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (−1)(−1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

7.NS.1c
Understand subtraction of rational numbers as adding the additive inverse, p − q = p + (−q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

7.RP.3
Use proportional relationships to solve multistep ratio and percent problems.

7.CE.1
The student will estimate, solve, and justify solutions to multistep contextual problems involving operations with rational numbers.

7.CE.1.a
Students will demonstrate the following Knowledge and Skills: Estimate, solve, and justify solutions to contextual problems involving addition, subtraction, multiplication, and division with rational numbers expressed as integers, fractions (proper or improper), mixed numbers, and decimals. Fractions may be positive or negative. Decimals may be positive or negative and are limited to the thousandths place.

7.A.2.a
Write one- and two-step equations involving rational numbers from words, tables, and authentic situations.
7.N.2.b
Apply properties of operations (commutative, associative, distributive, identity, inverse, zero) as strategies for problem solving with rational numbers.
7.A.2.2
Solve multi-step problems with proportional relationships (e.g., distance-time, percent increase or decrease, discounts, tips, unit pricing, mixtures and concentrations, similar figures, other mathematical situations).

Teaching Ideas/Resources
Websites/Resources:
- **Operations with Positive and Negative Numbers** – Desmos Free Classroom unit lessons on operations with positive and negative numbers.
- **My Math Tutor-Operations with Rational Numbers** – Video series on Operations with Rational Numbers
- **The Number Line: Rational Numbers and Football** – In this interactive, students add and subtract plays on a football field to practice working with negative and positive integers on the number line.
- UnboundEd Lesson - Opposite Quantities Make Zero
- Free 7th Grade Games- there are plenty of ads here, but the games are good
- Gimkit - live learning game show-there is a free part and a paid part; the free part provides games that are just as engaging as the paid section
- Mash Up Math provides games, worksheets, etc…
- Fermi Problems for Students
  https://innovativeteachingideas.com/blog/an-excellent-collection-of-fermi-problems-for-your-class/