Unit 1 - Number system (operations with real numbers)

Content Area: **Mathematics**
Course(s): **Math 7**
Time Period: **September**
Length: **9 weeks**
Status: **Published**

Unit Summary

In this unit, students review and extend learning of operations with rational numbers and learn to classify all real numbers. Students will use their prior understanding of basic math facts and operations and apply it to evaluating expressions using order of operations, including expressions with powers and roots. Students will evaluate expressions using signed numbers and fractions. Students will study the operations of addition, subtraction, multiplication, and division to include positive and negative rational numbers. Students will evaluate numerical expressions, using the properties of operations. Properties (including commutative, associative, distributive) and relationships between numbers will be used with rational numbers, including negative numbers.

Standards

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A	Know that there are numbers that are not rational, and approximate them by rational numbers.
MA.8.NS.A.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
MA.7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.7.NS.A.1a	Describe situations in which opposite quantities combine to make 0.
MA.7.NS.A.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.
MA.7.NS.A.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.
MA.7.NS.A.1d	Apply properties of operations as strategies to add and subtract rational numbers.

MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.NS.A.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.
MA.7.NS.A.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.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
MA.7.NS.A.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.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.6.NS.C.7	Understand ordering and absolute value of rational numbers.
MA.6.NS.C.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.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.D.CS2	Demonstrate personal responsibility for lifelong learning.

Student Learning Objectives

- Students will learn to determine and order fraction, decimal, percent equivalents.
- Students will learn to evaluate fractions (all operations).
- Students will learn to classify a number (real, rational, integer, whole, natural).
- Students will learn to use order of operations to evaluate expressions.
- Students will learn to use powers and roots to evaluate expressions (within order of operations).
- Students will learn to compare, define and evaluate expressions with integers and signed numbers (all operations).
- Students will learn to identify real life situations in terms of integers (positive or negative).
- Students will learn to write an addition problem represented by a vector diagram.
- Students will learn to draw a vector diagram representing adding of integers.
- Students will learn to define absolute value; evaluate expressions with absolute value.
- Students will learn to solve multi-step word problems.

Essential Questions

- How do you compare, add, subtract, multiply and divide real numbers (including integers)?
- Why is division of zero undefined?
- How does the correct use of order of operations affect the outcome?

- How does the use of real world relationships help you understand integers?

Enduring Understandings

- Students will understand that it is essential to follow specific rules for mathematical calculations when solving real-world problems.
- Students will understand that division by zero is undefined.
- Students will understand that order of operations is essential for accurate computation in all math problems; there are no "order of operations" problems.
- Students will understand that integers, as part of a real number system, allow us to represent positive and negative whole numbers. An integer and its opposite have the same absolute value.

Application

- Students will be able to independently use their learning to understand that zero is the only integer that has its own opposite and it is neither positive nor negative.
- Students will be able to independently use their learning to identify that a number and its opposite have the same absolute value.
- Students will be able to independently use their learning to evaluate an expression in the following order: Parentheses, Exponents/Roots, Multiplication and Division (left to right), Addition and Subtraction (left to right).
- Students will be able to independently use their learning to apply the additive inverse when subtracting integers.
- Students will be able to independently use their learning to accurately utilize mathematical vocabulary such as real numbers, rational numbers, irrational numbers, integers, whole numbers, natural (counting) numbers, additive inverse, absolute value, opposite, reciprocal, divisor (as denominator).
- Students will be able to independently use their learning to accurately utilize mathematical properties such as commutative, associative, multiplicative inverse, zero property of multiplication, zero product, distributive, equality, identity.

Skills

Students will be skilled at:

- Modeling addition and subtraction with integers using a number line (vertical number line diagram; vector diagram).
- Determining the opposite of a number, including zero; find the sum of a number and its opposite.
- Utilizing the real number system, classify numbers as real, rational, irrational, whole, integer, and/or natural/counting.
- Comparing and ordering rational numbers (including fractions, decimals, integers).
- Adding and subtracting rational numbers, including fractions and integers.
- Multiplying and dividing rational numbers, including fractions and integers.
- Recognizing and evaluating complex fractions (fraction in numerator and denominator).
- Solving real-world problems involving the four operations with integers.
- Defining absolute value.
- Determining the absolute value of given numbers.
- Evaluating expressions with absolute value symbols.
- Converting a rational number to a decimal using long division.
- Utilizing order of operations to evaluate expressions.
- Finding the square root and nth root of numbers.
- Utilizing powers and exponents in expressions and equations.
- Evaluating non-zero bases with an exponent of zero.

- Utilizing properties to evaluate expressions.
- Writing fractions as terminating or repeating decimals.
- Comparing rational numbers.
- Converting between fractions, decimals, and percents; non-calculator and calculator.
- Evaluating squares and square roots of numbers; non-calculator and calculator.
- Adding fractions with like and unlike denominators.
- Subtracting fractions with like and unlike denominators.
- Multiplying fractions.
- Cross canceling/cross simplifying when multiplying fractions.
- Dividing fractions.
- Converting between mixed numbers and improper fractions.
- Determining fraction and decimal equivalents.
- Determining decimal equivalent when denominator is nine (trick).
- Identifying real life situations in terms of integers.
- Identifying and use properties of operations (commutative, associative, multiplicative inverse, zero property of multiplication, zero product, distributive, equality, identity).