Math 7 - Unit D - Rational Number Arithmetic

Unit Focus

This unit begins by revisiting ideas familiar from grade 6: how signed numbers are used to represent quantities such as measurements of temperature and elevation, opposites (pairs of numbers on the number line that are the same distance from zero), and absolute value.

Next, students extend addition and subtraction from fractions to all rational numbers. They begin by considering how changes in temperature and elevation can be represented—first with tables and number line diagrams, then with addition and subtraction expressions and equations. Initially, physical contexts provide meanings for sums and differences that include negative numbers. Students work with numerical addition and subtraction expressions and equations, becoming more fluent in computing sums and differences of signed numbers. Using the meanings that they have developed for addition and subtraction of signed numbers, they write equivalent numerical addition and subtraction expressions, e.g., -8 + (-3) and -8 - 3; and they write different equations that express the same relationship.

Next students study multiplication and division. They build understanding of these operations through repeated addition of signed numbers and by examining patterns. Later, in the process of solving problems set in contexts, they write and solve multiplication and division equations.

By this point students will need practice using all four operations on rational numbers, making use of structure, e.g., to see without calculating that the product of two factors is positive because the values of the factors are both negative. They solve problems that involve interpreting negative numbers in context, for instance, when a negative number represents a rate at which water is flowing. They begin working with linear equations in one variable that have rational number coefficients. At first the focus is representing situations with equations and what it means for a number to be a solution for an equation, rather than methods for solving equations. Such methods are the focus of a later unit.

During the Stock Market PBA students select a group of stocks, track their value and then compare the percent increase/decrease in value to that of their peers to determine a winner.

Stage 1: Desired Results - Key Understandings

Standard(s)

Standards

- Common Core
  - *Mathematics: 7*
    - Recognize and represent proportional relationships between quantities. *(CCSS.MATH.CONTENT.7.RP.A.2)*
    - Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn. *(CCSS.MATH.CONTENT.7.RP.A.2C)*
    - 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. *(CCSS.MATH.CONTENT.7.NS.A.1)*

Transfer

Students will be able to independently use their learning to...

T1 Represent situations using mathematical reasoning and symbols (MP 2)

T2 Identify and generalize patterns and structure in numbers, expressions, data and objects. (MP 7)

T3 Demonstrate fluency with mathematical computations and definitions. (MP 6)

Meaning

Understanding(s)	Essential Question(s)
Students will understand that... **U1** Mathematicians calculate efficiently and accurately while using appropriate symbols and labels.	*Students will keep considering...* **Q1** How do I check my work for accuracy and completeness?

Stage 1: Desired Results - Key Understandings

- 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. *(CCSS.MATH.CONTENT.7.NS.A.1A)*
- 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. *(CCSS.MATH.CONTENT.7.NS.A.1B)*
- 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. *(CCSS.MATH.CONTENT.7.NS.A.1C)*
- Apply properties of operations as strategies to add and subtract rational numbers. *(CCSS.MATH.CONTENT.7.NS.A.1D)*
- Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. *(CCSS.MATH.CONTENT.7.NS.A.2)*
- 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. *(CCSS.MATH.CONTENT.7.NS.A.2A)*
- Apply properties of operations as strategies to multiply and divide rational numbers. *(CCSS.MATH.CONTENT.7.NS.A.2C)*
- Apply and extend previous understandings of operations with fractions.
- Solve real-world and mathematical problems involving the four operations with rational numbers. *(CCSS.MATH.CONTENT.7.NS.A.3)*
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- 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 a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her 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. *(CCSS.MATH.CONTENT.7.EE.B.3)*

Madison Public Schools Profile of a Graduate

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. *(POG.1.2)*

U2 Mathematicians make sense of quantities to represent situations mathematically.

Q2 How can the relationship between quantities be represented?

Acquisition of Knowledge and Skill

Knowledge

Students will know...

K1 Vocabulary: absolute value, positive number, negative number, signed numbers, opposite, deposit, withdrawl, account balance, debt, sum, difference, opperation, distance, solution (to an equation), factor, rational number, variable, increase, decrease

K2 the sum of a number and its opposite is zero.

K3 that p - q = p + (-q)

K4 that the 'difference' between two numbers may be positive or negative while the 'distance' between two numbers is always positive.

K5 that number lines can model addtitionand subtraction problems.

K6 using the commutative property can make simplifying expressions more efficient.

K7 the rules for multiplying (and dividing) signed numbers.

Skill(s)

Students will be skilled at...

S1 adding and subtracting signed rational numbers (up to three).

S2 determining whether an expression involving addition or subtraction will result in a positive or negative number.

S3 determining whether a one step equation will result in a positive or negative number.

S4 can use substitution to evaluate expressions that invovle addition and/or subtraction of signed rational numbers.

S5 determining whether an expression involving multiplication or division will result in a positive or negative number.

S6 multiplying and dividing signed rational numbers (up to three).

S7 ordering and comparing signed numbers.

S8 can use substitution to evaluate expressions that invovle multiplication and/or division of signed rational numbers.

S9 solving one step equations invovling signed rational numbers.

S10 respresenting story problems with one step equations involving signed rational numbers.