

Accentuate the Negative

Investigation 1

Standards:

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. *Problems 1, 2, 3, and 4*

7.NS.A.1a Describe situations in which opposite quantities combine to make 0. *Problem 2*

7.NS.A.1b Understand $p + q$ as a number located a distance $|q|$ from p , in a positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of zero. Interpret sums of rational numbers by describing real-world contexts. *Problems 2, 3, and 4*

7.NS.A.1c Understand subtraction of rational numbers as adding the 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. *Problems 1, 3, and 4*

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers. *Problems 1, 2, 3, and 4*

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. *Problem 2*

7.EE.B.4b Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *Problem 2*

Objectives:

This Investigation gives students experiences with rational numbers, ordering numbers, and informal operation computations in a variety of contexts. Subsequent formal work can therefore be based on “what makes sense.” Positive and negative numbers in the form of integers, fractions, and decimals are represented on a number line. Students use horizontal and vertical number lines when representing positive and negative numbers. They also reinforce skills in graphing inequalities when exploring relationships between rational numbers.

Students informally develop methods for adding integers by working on problems that have real-life contexts, such as money or scores in a game. They connect the operations of addition and subtraction (including the relationships between these two operations) to actions on chip-board displays. Students extend their work around comparing and ordering positive and negative integers to rational numbers.

Investigation 2

Standards:

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. *Problems 1, 2, 3, and 4*

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

7.NS.A.1b Understand $p+q$ as a number located a distance $|q|$ from p , in a positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of zero. Interpret sums of rational numbers by describing real-world contexts. *Problems 1 and 2*

7.NS.A.1c Understand subtraction of rational numbers as adding the 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. *Problems 2, 3, and 4*

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

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers. *Problems 1, 2, 3, and 4*

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. *Problems 1, 2, and 3*

Objectives:

This Investigation gives students experience with adding and subtracting positive and negative rational numbers. Students experiment with addition and subtraction by modeling real-world situations on chip boards with black and red chips representing positive and negative integers.

Students also use the more sophisticated model of a number line. These experiences build the foundation for developing algorithms for addition and subtraction with positive and negative rational numbers. Students will use these operations with whole numbers, fractions, and decimals.

They examine the Commutative Property of Addition with rational numbers and then use it to simplify more complicated problems. The usefulness of fact families is revisited with positive and negative rational numbers.

Investigation 3

Standards:

7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to divide rational numbers. *Problems 1, 2, 3, and 4*

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. *Problems 1, 2, 3, and 4*

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. *Problem 3*

7.NS.A.2c Apply properties of operations as strategies to multiply and divide rational numbers. *Problems 2, 3, and 4*

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. *Problem 3*

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers. *Problems 1, 2, 3, and 4*

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. *Problems 1, 2, and 3*

Objective:

This Investigation gives students experience with multiplying and dividing rational numbers. The Investigation uses time, distance, speed, and direction to think about multiplication and division of rational numbers. Students also examine number patterns and develop algorithms for multiplying and dividing rational numbers.

Problem 3.1 focuses on multiplication patterns with positive and negative integers. Problem 3.2 builds on the first problem by examining algorithms for multiplying rational numbers that include fractions. Problem 3.3 looks at positive and negative fractions and fact families to develop multiplication and division further. Finally, students play the Integer Product Game to solidify their experiences with positive and negative integers.

Investigation 4

Standards:

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. *Problems 1, 2, and 3*

7.NS.A.1d Apply properties of operations as strategies to add or subtract rational numbers. *Problems 1, 2, and 3*

7.NS.A.2 Apply and extend previous understandings of multiplication and division of fractions to divide rational numbers. *Problems 1, 2, and 3*

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. *Problems 1, 2, and 3*

7.NS.A.2c Apply properties of operations as strategies to multiply and divide rational numbers. *Problems 1, 2, and 3*

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers. *Problems 1, 2, and 3*

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. *Problems 1, 2, and 3*

Objective:

This Investigation focuses on properties of operations. Problem 4.1 reviews the Order of Operations convention that students learned in Grade 6 and extends it to include integers.

Problem 4.2 examines the Distributive Property over subtraction. Students encounter more complicated strings of computations in which they have to use their knowledge of the Order of Operations to carry out the needed computations. Problem 4.2 also challenges students to work in both directions with expressions. Students expand and factor expressions that involve positive and negative numbers.

Problem 4.3 gives students an opportunity to use their knowledge of and experience with operations to solve problem situations. These problem situations have no labels suggesting a particular algorithm to use. Students have to decide which of the algorithms they have studied are appropriate.