Lesson 8: Applying the Properties of Operations to Add and Subtract Rational Numbers

Classwork

Example 1: The Opposite of a Sum is the Sum of its Opposites

Explain the meaning of "The opposite of a sum is the sum of its opposites." Use a specific math example.

Rational Number	Rational Number	Sum	Opposite of the Sum

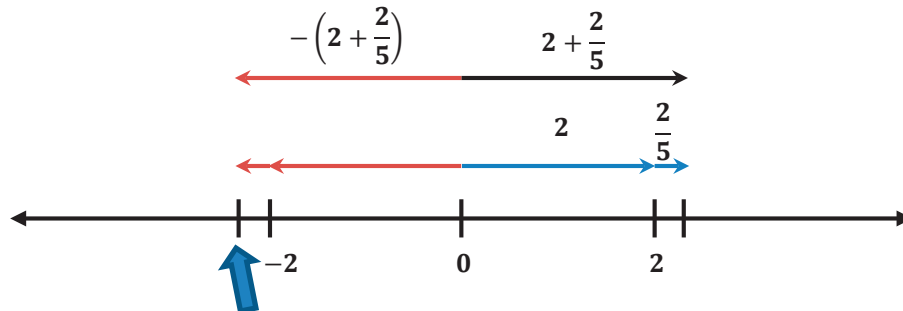| Opposite Rational Number	Opposite Rational Number	Sum

Exercise 1

Represent the following expression with a single rational number.

$$-2\frac{2}{5} + 3\frac{1}{4} - \frac{3}{5}$$

Example 2: A Mixed Number Is a Sum

Use the number line model shown below to explain and write the opposite of $2\frac{2}{5}$ as a sum of two rational numbers.

The opposite of a sum (top single arrow pointing left) and the sum of the opposites correspond to the same point on the number line.

Exercise 2

Rewrite each mixed number as the sum of two signed numbers.

a. $-9\frac{5}{8}$ b. $-2\frac{1}{2}$ c. $8\frac{11}{12}$

Exercise 3

Represent each sum as a mixed number.

a. $-1 + \left(-\frac{5}{12}\right)$ b. $30 + \frac{1}{8}$ c. $-17 + \left(-\frac{1}{9}\right)$

Exercise 4

Mr. Mitchell lost 10 pounds over the summer by jogging each week. By winter, he had gained $5\frac{1}{8}$ pounds. Represent this situation with an expression involving signed numbers. What is the overall change in Mr. Mitchell's weight?

Exercise 5

Jamal is completing a math problem and represents the expression $-5\frac{5}{7} + 8 - 3\frac{2}{7}$ with a single rational number as shown in the steps below. Justify each of Jamal's steps. Then, show another way to solve the problem.

$$= -5\frac{5}{7} + 8 + \left(-3\frac{2}{7}\right)$$

$$= -5\frac{5}{7} + \left(-3\frac{2}{7}\right) + 8$$

$$= -5 + \left(-\frac{5}{7}\right) + (-3) + \left(-\frac{2}{7}\right) + 8$$

$$= -5 + \left(-\frac{5}{7}\right) + \left(-\frac{2}{7}\right) + (-3) + 8$$

$$= -5 + (-1) + (-3) + 8$$

$$= -6 + (-3) + 8$$

$$= (-9) + 8$$

$$= -1$$

Lesson Summary

- Use the properties of operations to add and subtract rational numbers more efficiently. For instance,

$$-5\frac{2}{9} + 3.7 + 5\frac{2}{9} = \left(-5\frac{2}{9} + 5\frac{2}{9}\right) + 3.7 = 0 + 3.7 = 3.7.$$

- The opposite of a sum is the sum of its opposites as shown in the examples that follow:

$$-4\frac{4}{7} = -4 + \left(-\frac{4}{7}\right)$$

$$-(5 + 3) = -5 + (-3)$$

Problem Set

1. Represent each sum as a single rational number.

   a. $-14 + \left(-\frac{8}{9}\right)$

   b. $7 + \frac{1}{9}$

   c. $-3 + \left(-\frac{1}{6}\right)$

Rewrite each of the following to show that *the opposite of a sum is the sum of the opposites.* Problem 2 has been completed as an example.

2. $-(9 + 8) = -9 + (-8)$
   $-17 = -17$

3. $-\left(\frac{1}{4} + 6\right)$

4. $-\left(10 + (-6)\right)$

5. $-\left((-55) + \frac{1}{2}\right)$

Use your knowledge of rational numbers to answer the following questions.

6. Meghan said the opposite of the sum of -12 and 4 is 8. Do you agree? Why or why not?

7. Jolene lost her wallet at the mall. It had $10 in it. When she got home, her brother felt sorry for her and gave her $5.75. Represent this situation with an expression involving rational numbers. What is the overall change in the amount of money Jolene has?

8. Isaiah is completing a math problem and is at the last step: $25 - 28\frac{1}{5}$. What is the answer? Show your work.

9. A number added to its opposite equals zero. What do you suppose is true about *a sum added to its opposite*?

    Use the following examples to reach a conclusion. Express the answer to each example as a single rational number.

    a. $(3 + 4) + (-3 + -4)$

    b. $(-8 + 1) + (8 + (-1))$

    c. $\left(-\frac{1}{2} + \left(-\frac{1}{4}\right)\right) + \left(\frac{1}{2} + \frac{1}{4}\right)$