Name _____ Date _____

Applying the Properties of Operations to Add and Subtract Rational Numbers

Mariah and Shane both started to work on a math problem and were comparing their work in math class. Are both of their representations correct? Explain, and finish the math problem correctly to arrive at the correct answer.

Math Problem

Jessica's friend lent her \$5. Later that day Jessica gave her friend back $1\frac{3}{4}$ dollars.

Which rational number represents the overall change to the amount of money Jessica's friend has?

Mariah started the problem as follows:

$$-5 - \left(-1\frac{3}{4}\right)$$

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

Shane started the problem as follows:

$$-5 - \left(-1\frac{3}{4}\right)$$

$$= -5 + \left(1\frac{3}{4}\right)$$

$$= -5 + \left(1 + \frac{3}{4}\right)$$

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. $-\big(10 + (-6)\big)$

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

Mariah and Shane both started to work on a math problem and were comparing their work in math class. Are both of their representations correct? Explain, and finish the math problem correctly to arrive at the correct answer.

Math Problem

Jessica's friend lent her $\$5$. Later that day Jessica gave her friend back $1\frac{3}{4}$ dollars.

Which rational number represents the overall change to the amount of money Jessica's friend has?

Mariah started the problem as follows:

$$-5-\left(-1\frac{3}{4}\right)$$
$$=-5+1-\frac{3}{4}$$

Shane started the problem as follows:

$$-5-\left(-1\frac{3}{4}\right)$$
$$=-5+\left(1\frac{3}{4}\right)$$
$$=-5+\left(1+\frac{3}{4}\right)$$

Shane's method is correct. In Mariah's math work, she only dealt with part of the mixed number. The fractional part should have been positive too because the opposite of $-1\frac{3}{4}$ is $1\frac{3}{4}$, which contains both a positive 1 and a positive $\frac{3}{4}$. The correct work would be

$$-5-\left(-1\frac{3}{4}\right)=-5+\left(1\frac{3}{4}\right)=-5+\left(1+\frac{3}{4}\right)=(-5+1)+\frac{3}{4}=-4+\frac{3}{4}=-3\frac{1}{4}.$$

The rational number would be $-3\frac{1}{4}$, which means Jessica's friend gave away $3\frac{1}{4}$ dollars, or $\$3.25$.

1. Represent each sum as a single rational number.

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

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

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

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

   $-17=-17$ *Answer provided in student materials.*

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

$-6\frac{1}{4}=-6\ \frac{1}{4}$

4. $-(10+(-6))=-10+6$

$-4=-4$

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

$54\frac{1}{2}=54\frac{1}{2}$

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?**

Yes, I agree. The sum of -12 and 4 is -8, and the opposite of -8 is 8.

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?**

$-10+5.75=-4.25$. *The overall change in the amount of money Jolene has is -4.25 dollars.*

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.**

$25-28\frac{1}{5}=25+\left(-28+\left(-\frac{1}{5}\right)\right)=(25+-28)+\left(-\frac{1}{5}\right)=-3\frac{1}{5}$

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 sum added to its opposite is zero.

a. $(3+4)+(-3+-4)=7+(-7)=0$

b. $(-8+1)+(8+(-1))=(-7)+7=0$

c. $\left(-\frac{1}{2}+(-\frac{1}{4})\right)+\left(\frac{1}{2}+\frac{1}{4}\right)=\left(-\frac{3}{4}\right)+\frac{3}{4}=0$