

Math 7 week of 3/9

4

Properties Schmoperties

Using Number Properties to Interpret
Expressions with Signed Numbers

WARM UP

Use the Order of Operations to simplify each expression.

1. $18 + 6 \times (-3) - 4$

2. $5 \div (1 - 6) \times 10$

3. $8 + (-3) \times 9 \times 0$

LEARNING GOALS

- Use the Commutative, Associative, and Distributive Properties, Additive and Multiplicative Inverses, Identity, and Zero Properties to rewrite numeric expressions with signed numbers in order to interpret their meanings and solve problems.
- Apply the properties of operations to add, subtract, multiply, and divide with rational numbers.
- Use number properties to solve mathematical problems involving signed numbers and other rational numbers more efficiently.

You have learned how to add, subtract, multiply, and divide with signed numbers and other rational numbers. How can you use number properties with rational numbers to solve problems?

Getting Started

All in Your Head

You have used mental math before to solve problems without calculating on paper. Now try it with signed numbers!

1. Determine each sum or difference using mental math.

a. $-8 + 5 + 8$

b. $-\frac{1}{2} + \frac{3}{5} + -\frac{1}{2}$

c. $\frac{3}{8} + \left(\frac{5}{8} + \left(-\frac{5}{6}\right)\right)$

The Commutative Property says that you can add or multiply in any order without changing the sum or product.

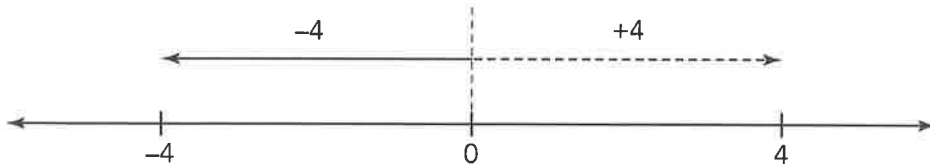
The Associative Property says that you can group addends or factors without changing the sum or product.

2. Explain how you can use the Commutative and Associative Properties to help you solve the problems in your head.

Distributing and Factoring with -1



When first learning about negative numbers, you reflected a positive value across 0 to determine the opposite of the value.

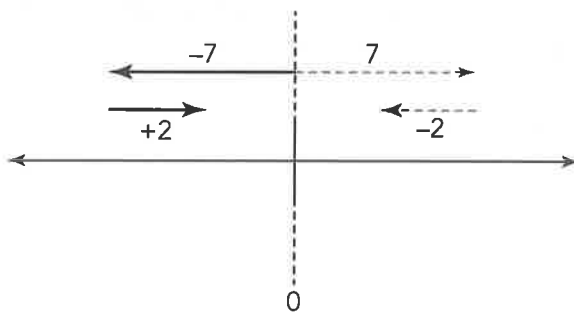


This illustrates that the opposite of 4 is -4 , or $(-1)(4) = -4$.

In the same way, you can use reflections across 0 on the number line to determine the opposite of an expression.

WORKED EXAMPLE

Consider the expression $-7 + 2$. When the model of $-7 + 2$ is reflected across 0 on the number line, the result is $7 - 2$.



So, $(-7 + 2)$ is the opposite of $(7 - 2)$.

This means that $-7 + 2 = -(7 - 2)$.

1. Draw models like the ones in the worked example to show the opposite of each expression. Rewrite each as an opposite of a different expression.

a. $-1 - 6$

b. $2 + (-3)$

c. $-4 + 5$

How would your answer be different if the expression were -4×5 ?

Adam



To reflect an expression across 0 on the number line, multiply the expression by -1 .

$$\begin{aligned} -1(2 + 3) &= (-1)(2) + (-1)(3) \\ &= -2 + -3 \end{aligned}$$

2. What property did Adam use to show his reasoning?

3. Does Adam's expression, $-1(2 + 3)$, mean the same thing as $-(2 + 3)$? Draw a model and explain your reasoning.

4. Rewrite each expression as an addition or subtraction expression using a factor of -1 .

a. $-2 + (-4) = -1(\underline{\hspace{2cm}})$

b. $-5 - 8 = -1(\underline{\hspace{2cm}})$

c. $-9 - (-9) = -1(\underline{\hspace{2cm}})$

5. Use the Distributive Property to show that your expressions in Question 4 are correct.

Rewriting an expression as a product with -1 is also called *factoring out a -1* .

Subtraction as Adding the Opposite



You know that subtracting a number is the same as adding the opposite of that number. Rewriting subtraction as addition allows you to apply the Commutative Property to any expression involving addition and subtraction.

For example, $-4.5 - 3 + 1.5 = -4.5 + 1.5 + (-3)$. Rewriting expressions helps you to see patterns and use mental math to make solving simpler.

You can use what you know about adding opposites to help you solve problems more efficiently.

1. Simplify each expression.

a. $10.5 + 6 + 2 - 0.5$

b. $-\frac{1}{2} + \left(\frac{1}{2} - \frac{4}{5}\right)$

c. $3\frac{7}{8} - 4\frac{1}{2}$

2. Explain how you can use the Commutative, Associative, and Distributive Properties to help you simplify the expressions in Question 1.

You can rewrite a mixed number as the sum of a whole number and a fraction.
 $7\frac{1}{2} = 7 + \frac{1}{2}$
 How can you rewrite $-7\frac{1}{2}$?





1. For each equation, identify the number property or operation used.

Equation	Number Property
a. $-3\frac{1}{2} + 5 = 5 + (-3\frac{1}{2})$	
b. $(3\frac{1}{2})(2\frac{1}{5})5 = 3\frac{1}{2}(2\frac{1}{5})(5)$	
c. $-3\frac{1}{2} + (-2\frac{1}{2} + 5) = (-3\frac{1}{2} + (-2\frac{1}{2})) + 5$	
d. $-(-3\frac{1}{2} + 2\frac{1}{4}) = -1(-3\frac{1}{2}) + -1(2\frac{1}{4})$	
e. $\frac{-3\frac{1}{2} - 2\frac{1}{4}}{4} = \frac{-3\frac{1}{2}}{4} - \frac{2\frac{1}{4}}{4}$	
f. $(-7.02)(-3.42) = (-3.42)(-7.02)$	

Evaluate each expression. Describe your strategy.

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

3. $\left(-3\frac{1}{4} - 2\frac{1}{5}\right) + \left(-6\frac{3}{5}\right)$

4. $\frac{7}{8}\left(-\frac{4}{5}\right)\left(-\frac{8}{7}\right)$

5. $\frac{\frac{8}{9} + \left(-\frac{4}{5}\right)}{4}$

6. $(-11.4)(6.4) + (-11.4)(-12.4)$

TALK the TALK **What's It All About?**

When you rewrite addition and subtraction expressions using a factor of -1 , you are "factoring out" a -1 . Here are some other examples.

$$-8 + 5 = -1(8 - 5) \quad -2 - 9 = -1(2 + 9) \quad 3 - (-4) = -1(-3 - 4)$$

- 1. Describe how you can factor out a -1 from any addition or subtraction expression.**
- 2. How is factoring out a negative 1 from an addition or subtraction expression different from factoring out a negative 1 from a multiplication or division expression?**
- 3. Demonstrate using words and models why the product of -1 and any expression is the opposite of that expression.**

Assignment

hw Math 7

Write

Describe in your own words how to factor a -1 out of an addition or subtraction expression.

Remember

When you multiply any expression by -1 , the result is the opposite of that expression.

Practice

Factor out a negative 1 from each expression.

1. $7 + (-6)$

2. $-4 - (5 + 3)$

3. $-9 - 1$

4. Use the Distributive Property to show that your answers to Questions 1 through 3 are correct.

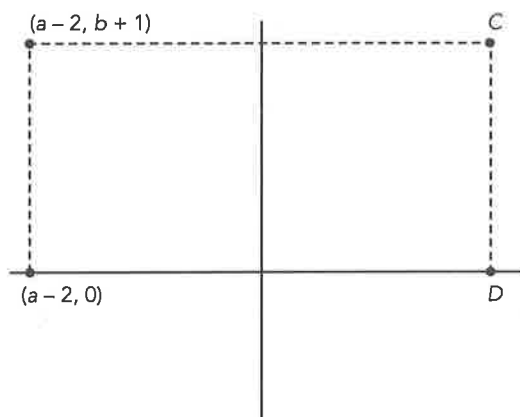
Use a number property to solve each problem efficiently. Show your work and list the property or properties used.

5. $-9.9 + 5.2 + 3.9 + 1$

6. $-\frac{3}{5} + \left(\frac{1}{5} - \frac{3}{2} + 0\right)$

Stretch

The rectangle shown is formed by a reflection of points C and D across the y -axis of the coordinate plane. Point C has the coordinates $(4, 4)$. Determine a and b and then calculate the perimeter of the rectangle.



Review

1. Carl and Joe recorded how fast they ran 1 mile and 2 miles. Carl recorded his times using fractions, and Joe recorded his times using decimals.

Distance	Carl	Joe
1 mi	$10\frac{1}{2}$ min	10.4 min
2 mi	$22\frac{1}{4}$ min	22.3 min

- a. Who ran the mile faster, Carl or Joe? How much faster?
b. Who ran 2 miles faster, Carl or Joe? How much faster?
2. A small submarine is at an elevation of -30 feet compared to sea level. What is its elevation after it ascends 9 feet?
3. On Tuesday, Marissa was \$45 short of her fundraising goal. The next day, she was \$5 over her goal. Write an equation to show how much she raised in one day.
4. What is 12% of 350?
5. What is 35% of 120?