



## LESSON 6.4

# Properties Scmoperties

Objective

Using Number Properties to Interpret Expressions with Signed Numbers

## Warm-Up



Copy and use the Order of Operations to simplify each expression.

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

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

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

## 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.  $-8 + 5 + 8$

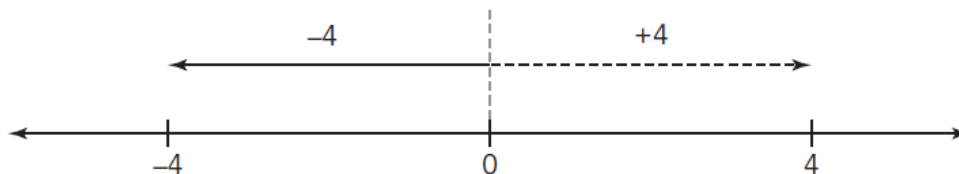
b.  $-\frac{1}{2} + \frac{3}{5} + -\frac{1}{2}$

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

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



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

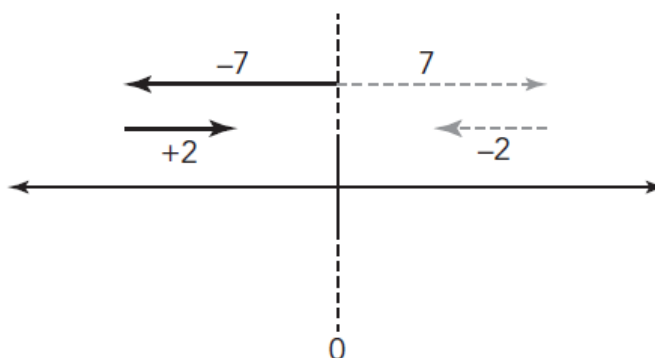


This illustrates that the opposite of 4 is  $-4$ , or  $(-1)(4) = -4$ .

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.  $-4 + 5$

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.  $-2 + (-4) = -1(\text{_____})$

b.  $-5 - 8 = -1(\text{_____})$

c.  $-9 - (-9) = -1(\text{_____})$

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



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.



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

Equation

Number Property

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

b.  $\left(3\frac{1}{2}\right)\left(2\frac{1}{5}\right)5 = 3\frac{1}{2}\left(2\frac{1}{5}\right)(5)$

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

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

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.

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

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

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

$$5. \frac{\frac{8}{9} + -\frac{4}{5}}{4}$$

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

**Show You  
KNOW**

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.

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

$$-2 - 9 = -1(2 + 9)$$

$$3 - (-4) = -1(-3 - 4)$$

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.





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## Practice

Factor out a negative 1 from each expression.

- $7 + (-6)$
- $-4 - (5 + 3)$
- $-9 - 1$
- 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.  $-\frac{3}{5} + \left(\frac{1}{5} - \frac{3}{2} + 0\right)$

## Review

- 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

- Who ran the mile faster, Carl or Joe? How much faster?
  - Who ran 2 miles faster, Carl or Joe? How much faster?
- A small submarine is at an elevation of  $-30$  feet compared to sea level. What is its elevation after it ascends 9 feet?
  - 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.
  - What is 12% of 350?
  - What is 35% of 120?

