

**Essential Question** Does the order in which you perform an operation matter?



## 1 ACTIVITY: Does Order Matter?

Work with a partner. Place each statement in the correct oval.

- |                               |                            |
|-------------------------------|----------------------------|
| a. Fasten 5 shirt buttons.    | b. Put on a shirt and tie. |
| c. Fill and seal an envelope. | d. Floss your teeth.       |
| e. Put on your shoes.         | f. Chew and swallow.       |

Order Matters



Order Doesn't Matter



Think of some math problems using the four operations where order matters and some where order doesn't matter.

## The Meaning of a Word ● Commute

When you **commute** the positions of two stuffed animals on a shelf,

you switch their positions.



## 2 ACTIVITY: Commutative Properties

Work with a partner.

- a. Which of the following are true?

$$3 + 5 \stackrel{?}{=} 5 + 3$$

$$3 - 5 \stackrel{?}{=} 5 - 3$$

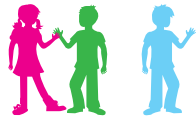
$$9 \times 3 \stackrel{?}{=} 3 \times 9$$

$$9 \div 3 \stackrel{?}{=} 3 \div 9$$

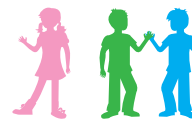
- b. The true equations show the Commutative Properties of Addition and Multiplication. Why are they called “commutative?” Write the properties.

## The Meaning of a Word ● Associate

You have two best friends. Sometimes you **associate** with one of them.



And sometimes you **associate** with the other.



### 3 ACTIVITY: Associative Properties

Work with a partner.

- a. Which of the following are true?

$$8 + (3 + 1) \stackrel{?}{=} (8 + 3) + 1$$

$$8 - (3 - 1) \stackrel{?}{=} (8 - 3) - 1$$

$$12 \times (6 \times 2) \stackrel{?}{=} (12 \times 6) \times 2$$

$$12 \div (6 \div 2) \stackrel{?}{=} (12 \div 6) \div 2$$

- b. The true equations show the Associative Properties of Addition and Multiplication. Why are they called “associative?” Write the properties.

## What Is Your Answer?

4. **IN YOUR OWN WORDS** Does the order in which you perform an operation matter?
5. **MENTAL MATH** Explain how you can use the Commutative and Associative Properties of Addition to add the sum in your head.

$$11 + 7 + 12 + 13 + 8 + 9$$

6. **SECRET CODE** The creatures on a distant planet use the symbols  $\blacksquare$ ,  $\blacklozenge$ ,  $\star$ , and  $\bullet$  for the four operations.

- a. Use the codes to decide which symbol represents addition and which symbol represents multiplication. Explain your reasoning.

$$3 \bullet 4 = 4 \bullet 3$$

$$3 \star 4 = 4 \star 3$$

$$2 \bullet (5 \bullet 3) = (2 \bullet 5) \bullet 3$$

$$2 \star (5 \star 3) = (2 \star 5) \star 3$$

$$0 \bullet 4 = 0$$

$$0 \star 4 = 4$$



- b. Make up your own symbols for addition and multiplication. Write codes using your symbols. Trade codes with a classmate. Decide which symbol represents addition and which symbol represents multiplication.

### Practice

Use what you learned about the properties of addition and multiplication to complete Exercises 5–8 on page 18.

**Key Vocabulary**

equivalent expressions, p. 16

Expressions with the same value, like  $12 + 7$  and  $7 + 12$ , are **equivalent expressions**. The commutative and associative properties can be used to write equivalent expressions.

**Key Ideas**
**Commutative Properties**

**Words** Changing the order of addends or factors does not change the sum or product.

<b>Numbers</b>	$5 + 8 = 8 + 5$	<b>Algebra</b>	$a + b = b + a$
	$5 \cdot 8 = 8 \cdot 5$		$a \cdot b = b \cdot a$

**Associative Properties**

**Words** Changing the grouping of addends or factors does not change the sum or product.

<b>Numbers</b>	$(7 + 4) + 2 = 7 + (4 + 2)$
	$(7 \cdot 4) \cdot 2 = 7 \cdot (4 \cdot 2)$
<b>Algebra</b>	$(a + b) + c = a + (b + c)$
	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

**EXAMPLE 1** Using Properties to Simplify Expressions

- a. Simplify the expression  $7 + (12 + x)$ .

$$\begin{aligned}
 7 + (12 + x) &= (7 + 12) + x && \text{Associative Property of Addition} \\
 &= 19 + x && \text{Add 7 and 12.}
 \end{aligned}$$

- b. Simplify the expression  $(6.1 + x) + 8.4$ .

$$\begin{aligned}
 (6.1 + x) + 8.4 &= (x + 6.1) + 8.4 && \text{Commutative Property of Addition} \\
 &= x + (6.1 + 8.4) && \text{Associative Property of Addition} \\
 &= x + 14.5 && \text{Add 6.1 and 8.4.}
 \end{aligned}$$

- c. Simplify the expression  $5(11y)$ .

$$\begin{aligned}
 5(11y) &= (5 \cdot 11)y && \text{Associative Property of Multiplication} \\
 &= 55y && \text{Multiply 5 and 11.}
 \end{aligned}$$

**On Your Own**

Simplify the expression. Explain each step.

1.  $10 + (a + 9)$       2.  $(c + 25.3) + 17.9$       3.  $5(4n)$

**Now You're Ready**  
Exercises 5–8

## Key Ideas

### Addition Property of Zero

**Words** The sum of any number and 0 is that number.

**Numbers**  $7 + 0 = 7$

**Algebra**  $a + 0 = a$

### Multiplication Properties of Zero and One

**Words** The product of any number and 0 is 0.

The product of any number and 1 is that number.

**Numbers**  $9 \times 0 = 0$

**Algebra**  $a \cdot 0 = 0$

$4 \times 1 = 4$

$a \cdot 1 = a$

## EXAMPLE 2 Using Properties to Simplify Expressions

- a. Simplify the expression  $9 \cdot 0 \cdot p$ .

$$9 \cdot 0 \cdot p = (9 \cdot 0) \cdot p$$

Associative Property of Multiplication

$$= 0 \cdot p = 0$$

Multiplication Property of Zero

- b. Simplify the expression  $4.5 \cdot r \cdot 1$ .

$$4.5 \cdot r \cdot 1 = 4.5 \cdot (r \cdot 1)$$

Associative Property of Multiplication

$$= 4.5 \cdot r$$

Multiplication Property of One

$$= 4.5r$$

## EXAMPLE 3 Real-Life Application

### Common Error

You **and** six friends are on the team, so use the expression  $7x$ , not  $6x$ , to represent the cost of the T-shirts.

You and six friends play on a basketball team. A sponsor paid \$100 for the league fee,  $x$  dollars for each player's T-shirt, and \$68.25 for trophies. Write an expression for the total amount paid by the sponsor.

Add the entry fee, the cost of the T-shirts, and the cost of the trophies.

$$100 + 7x + 68.25 = 7x + 100 + 68.25$$

Commutative Property of Addition

$$= 7x + 168.25$$

Add 100 and 68.25.

 An expression for the total amount is  $7x + 168.25$ .

### On Your Own

Simplify the expression. Explain each step.

4.  $12 \cdot b \cdot 0$

5.  $1 \cdot m \cdot 24$

6.  $(t + 15) + 0$

7. **WHAT IF?** In Example 3, your sponsor paid \$54.75 for trophies. Write an expression for the total amount paid by the sponsor.

 Now You're Ready  
Exercises 9–23



## Vocabulary and Concept Check

- NUMBER SENSE** Write an example of a sum of fractions. Show that the Commutative Property of Addition is true for the sum.
- OPEN-ENDED** Write an algebraic expression that can be simplified using the Associative Property of Addition.
- OPEN-ENDED** Write an algebraic expression that can be simplified using the Associative Property of Multiplication and the Multiplication Property of One.
- WHICH ONE DOESN'T BELONG?** Which statement does *not* belong with the other three? Explain your reasoning.

$$7 + (x + 4) = 7 + (4 + x)$$

$$(3 + b) + 2 = (b + 3) + 2$$

$$9 + (7 + w) = (9 + 7) + w$$

$$(4 + n) + 6 = (n + 4) + 6$$



## Practice and Problem Solving

Tell which property is illustrated by the statement.

- |   |  |                                  |
|---|--|----------------------------------|
| 1 | 5. $5 \cdot p = p \cdot 5$                       | 6. $2 + (12 + r) = (2 + 12) + r$ |
|   | 7. $4 \cdot (x \cdot 10) = (4 \cdot x) \cdot 10$ | 8. $x + 7.5 = 7.5 + x$           |
| 2 | 9. $(c + 2) + 0 = c + 2$                         | 10. $a \cdot 1 = a$              |

11. **ERROR ANALYSIS** Describe and correct the error in stating the property illustrated by the statement.



$$(7 + x) + 3 = (x + 7) + 3$$

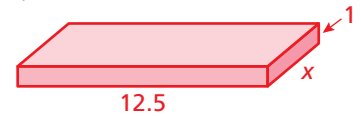
Associative Property of Addition

Simplify the expression. Explain each step.

- |                         |                              |                          |
|-------------------------|------------------------------|--------------------------|
| 12. $6 + (5 + x)$       | 13. $(14 + y) + 3$           | 14. $6(2b)$              |
| 15. $7(9w)$             | 16. $3.2 + (x + 5.1)$        | 17. $(0 + a) + 8$        |
| 18. $9 \cdot c \cdot 4$ | 19. $(18.6 \cdot d) \cdot 1$ | 20. $(3k + 4.2) + 8.6$   |
| 21. $(2.4 + 4n) + 9$    | 22. $(3s) \cdot 8$           | 23. $z \cdot 0 \cdot 12$ |
24. **GEOMETRY** The expression  $12 + x + 4$  represents the perimeter of a triangle. Simplify the expression.
25. **SCOUT COOKIES** A case of Scout cookies has 10 cartons. A carton has 12 boxes. The amount you make on a whole case is  $10(12x)$  dollars.
- What does  $x$  represent?
  - Simplify the expression.

26. **GEOMETRY** The volume of the rectangular prism is  $12.5 \cdot x \cdot 1$ .

- a. Simplify the expression.
- b. Match  $x = 0.25$ ,  $12.5$ , and  $144$  with the object.



- A. siding for a house
- B. ruler
- C. square floor tile

Write the phrase as an expression. Then, simplify the expression.

- 27. 7 plus the sum of a number  $x$  and 5
- 28. the product of 8 and a number  $y$  multiplied by 9

Copy and complete the statement using the specified property.

	Property	Statement
29.	Associative Property of Multiplication	$7(2y) = \square$
30.	Commutative Property of Multiplication	$13.2 \cdot (x \cdot 1) = \square$
31.	Associative Property of Addition	$17 + (6 + 2x) = \square$
32.	Addition Property of Zero	$2 + (c + 0) = \square$
33.	Multiplication Property of One	$1 \cdot w \cdot 16 = \square$

- 34. **HATS** You and a friend sell hats at a fair booth. You sell 16 hats on the first shift and 21 hats on the third shift. Your friend sells  $x$  hats on the second shift.
  - a. Write an expression for the number of hats sold.
  - b. The expression  $37(14) + 10x$  represents the amount made for both of you. How can you tell that your friend was selling the hats for a discounted price?
  - c. **Reasoning** You took in more money than your friend. What can you say about the value of  $x$ ?



### Fair Game Review What you learned in previous grades & lessons

Evaluate the expression.

- 35.  $7(10 + 4)$
- 36.  $12(10 - 1)$
- 37.  $6(5 + 10)$
- 38.  $8(30 - 5)$

Find the prime factorization of the number.

- 39. 37
- 40. 144
- 41. 147
- 42. 205

43. **MULTIPLE CHOICE** A bag has 16 blue, 20 red, and 24 green marbles. What fraction of the marbles in the bag are blue?

- (A)  $\frac{1}{5}$
- (B)  $\frac{4}{15}$
- (C)  $\frac{4}{11}$
- (D)  $\frac{11}{15}$