The Distributive Property

Today we will learn to use the distributive property to simplify expressions in solving problems. We will also learn how to factor numeric expressions and algebraic expressions.

No clickers, but you need your notebook to work out these problems along with me.

Algebra

3-6 The Distributive Property

What You'll Learn

To use the Distributive Property to simplify expressions in problem solving situations

New Vocabulary Distributive Property, equivalent expressions

CONTENT STANDARDS

6.EE.2.b, 6.EE.3, 6.EE.4

Why Learn This?

The amount you earn depends on the number of hours you work. The Distributive Property helps you use mental math to calculate your earnings quickly. The **Distributive Property** shows how multiplication affects addition or subtraction.

KEY CONCEPTS The Distributive Property

Arithmetic	Algebra
$8 \times (4 + 6) = (8 \times 4) + (8 \times 6)$	$a(b + c) = ab + ac$
$7 \times (6 - 2) = (7 \times 6) - (7 \times 2)$	$a(b - c) = ab - ac$

Notice that $a(b + c)$ is a product of two factors, a and $(b + c)$. You can look at $(b + c)$ as both a single entity (because the two variables are within parentheses) and a sum of two numbers. For example, $3(1 + 4)$ is a product of 3 and $(1 + 4)$; $(1 + 4)$ is its own unit, and when you add the two numbers within parentheses you get a sum of 5.

EXAMPLE Using the Distributive Property with Algebraic Expressions

1 Write an equivalent expression for $2(6x - 3y + 7)$.

$$2(6x - 3y + 7) = 2 \cdot 6x - 2 \cdot 3y + 2 \cdot 7 \quad \leftarrow \text{Use the Distributive Property.}$$
$$= 12x - 6y + 14 \quad \leftarrow \text{Multiply.}$$

Check

$$2(6x - 3y + 7) \stackrel{?}{=} 12x - 6y + 14 \quad \leftarrow \text{Check if the two expressions are equivalent.}$$
$$2(6 \cdot 2 - 3 \cdot 3 + 7) \stackrel{?}{=} 12 \cdot 2 - 6 \cdot 3 + 14 \quad \leftarrow \text{Substitute values, such as 2 for } x \text{ and 3 for } y.$$
$$20 = 20 \quad \leftarrow \text{They are equivalent; your expression is correct.}$$

Example

1 Using the Distributive Property with Algebraic Expressions Write an equivalent expression for $3(9x + 3)$.

$3(9x + 3) = (\boxed{3} \times \boxed{9x}) + (\boxed{3} \times \boxed{3})$ ¬ **Use the Distributive Property.**

$= \boxed{27x} + \boxed{9}$ ¬ **Multiply.**

Check

$3(9x + 3) \stackrel{?}{=} \boxed{27x + 9}$ ¬ **Check if the two expressions are equivalent.**

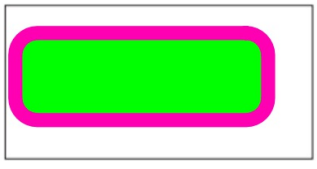
$3(9 \cdot \boxed{2} + 3) \stackrel{?}{=} \boxed{27(2) + 9}$ ¬ **Substitute a value, such as 2, for *x*.**

$\boxed{63} = \boxed{63}$ ¬ **Simplify.**

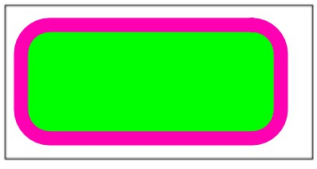
Quick Check

1. Simplify each expression.

a. $4(3n + 6)$



b. $8(7 - 3m + 4p)$



c. $12(2a + 3b - 5)$

Equivalent expressions have the same value. They name the same number regardless of which number the variable stands for.

The Distributive Property can also be used in reverse. Applying the Distributive Property this way is called factoring.

EXAMPLE 2 Factoring Numeric Expressions

Factor $20 + 8$.

$20 = 5 \times 2 \times 2$
$8 = 2 \times 2 \times 2$
← Find the GCF of 20 and 8. The GCF is $2 \times 2 = 4$.

$20 + 8 = 4(5) + 4(2)$ ← Write each term as a product of the GCF and its remaining factors.

$= 4(5 + 2)$ ← Use the Distributive Property.

Example

2 Factoring Expressions Factor $40 + 16$.

$40 =$ $5 \times 2 \times 2 \times 2$ ← Write the prime factors of 40 and 16. Then determine the GCF.

$16 =$ $2 \times 2 \times 2 \times 2$

$40 + 16 =$ $8(5) + 8(2)$ ← Write each term as a product of the GCF and its remaining factors.

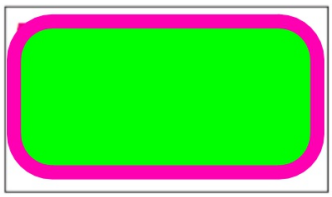
$=$ $8(5 + 2)$ ← Use the Distributive Property.

Quick Check

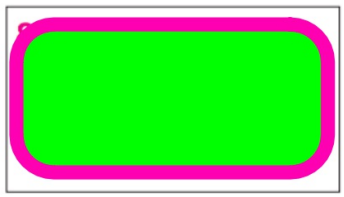
2. Factor each expression.

a. $18 + 24$

b. $56 + 49$



c. $84 + 60$



EXAMPLE Factoring Algebraic Expressions

3 Factor $27x + 18 + 36y$.

$$27x = 3 \cdot 3 \cdot 3 \cdot x$$
$$18 = 3 \cdot 3 \cdot 2$$
$$36y = 3 \cdot 3 \cdot 2 \cdot 2 \cdot y$$

← Find the GCF of $27x$, 18, and $36y$. The GCF is $3 \cdot 3 = 9$.

$$27x + 18 + 36y = 9(3x) + 9(2) + 9(4y)$$

← Write each term as a product of the GCF and its remaining factors.

$$= 9(3x + 2 + 4y)$$

← Use the Distributive Property.

Example

3 Factor Algebraic Expressions Factor $20x + 8 + 12y$.

$20x = 2 \cdot 2 \cdot 5 \cdot x$

$8 =$ 2 · 2 · 2 ← Write the prime factors of 20x, 8, and 12y.

$12y =$ 2 · 2 · 3 · y ← The GCF is 2 · 2 = 4.

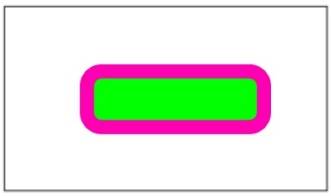
$20x + 8 + 12y =$ 4(5x) + 4(2) + 4(3y) ← Write each term as a product of the GCF and its remaining factors.

$=$ 4(5x + 2 + 3y) ← Use the Distributive Property.

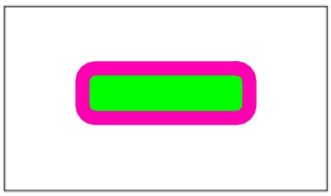
Quick Check

3. Factor each expression.

a. $3n + 21$



b. $72 + 16h$



c. $48y + 80z + 64$

Check Your Understanding

Use the Distributive Property to write an equivalent expression for each expression.

3. $2(4 + t)$ [redacted]
4. $5(x + 3)$ [redacted]
5. $4(g - 9 + 5h)$ [redacted]

You have an assignment worksheet.

You have time to begin this worksheet now.

Name _____ Class _____ Date _____

Practice 3-6

The Distributive Property

Use the Distributive Property to write an equivalent expression for each of the following.

1. $6(x + 7)$

2. $8(7 + 9p)$

3. $(5n + 12) \times 4$

4. $6(7c + 4d + 11)$

Factor each expression. Check your solution.

5. $27 + 33$

6. $30 + 72$

7. $45 + 55 + 20$

8. $12 + 56$

9. $56 + 120$

10. $27 + 63 + 54$

11. $4x + 18$

12. $65 + 15x$

13. $15b + 24c + 33$

14. The auditorium at the School for the Arts has 7 rows of seats, and each row has 102 seats in it. Use the Distributive Property to find the number of seats in the auditorium.

15. A movie theater charges $5.50 for a student ticket. Use the Distributive Property to find the cost for 8 students.

16. Samantha has saved $35 from doing chores around the house. She buys 5 packs of gum and 8 packs of erasers from the school store. Use the Distributive Property to find how much Samantha spent at the school store. How much change should she receive from the cashier?

Item	Cost per pack
Pencils	$3.00
Erasers	$1.75
Gum	$2.50
Taffy	$2.00