## The Discributive Propercy

## Interactive

 Study GuideSee pages 149-150 for:

- Getting Started
- Real-World Link
- Notes


## Essential Question

Why are algebraic rules useful?

## Common Core

State Standards

## Content Standards

7.NS.2, 7.NS.2c, 7.EE.1,
7.EE. 2

Mathematical Practices
1, 3, 4, 5

## Vocabulary

equivalent expressions
Distributive Property

## What You'll Learn

- Use the Distributive Property to write equivalent numerical expressions.
- Use the Distributive Property to write equivalent algebraic expressions.


## Real-World Link

Entertainment The Newport Aquarium in Kentucky has acrylic tunnels that allow visitors to walk underneath aquatic life. The cost of admission is $\$ 23$ per person. The aquarium also offers Behind-the-Scenes Tours for $\$ 15$ per person and Penguin Encounters for $\$ 25$ per person.

## Numerical Expressions

Expressions are equivalent expressions when they have the same value. Example 1 shows how the Distributive Property relates to equivalent expressions.

## Key Concept $>$ Distributive Property

Words To multiply a sum or difference by a number, multiply each term inside the parentheses by the number outside the parentheses.

Symbols $a(b+c)=a b+a c$

Examples
$5(6+7)=5 \cdot 6+5 \cdot 7$

$$
\begin{aligned}
& \underbrace{a(b-c)}=a b-a c \\
& (9-3) 8=9 \cdot 8-3 \cdot 8
\end{aligned}
$$

## Example 1

Use the Distributive Property to write each expression as an equivalent numeric expression. Then evaluate the expression.
a. $5(12+4)$
b. $(20-3) 8.2$

$$
\begin{aligned}
\underbrace{5(12+4)} & =5 \cdot 12+5 \cdot 4 \\
& =60+20 \quad \text { Multiply. } \\
& =80 \quad \quad \text { Add. }
\end{aligned}
$$

$$
\begin{array}{rlr}
(20-3) 8.2 & =20 \cdot 8.2-3 \cdot 8.2 \\
& =164-24.6 \quad \text { Multiply. } \\
& =139.4 \quad \text { Subtract. }
\end{array}
$$

## Gof If? Do these problems to find out.

1b. $\frac{3}{4}(9-2) 5 \frac{1}{4}$

The Distributive Property allows you to find some products mentally. For example, you can find $7 \cdot 34$ mentally by evaluating $7 \cdot(30+4)$.

$$
\begin{array}{rlrl}
7 \cdot(30+4) & =7 \cdot 30+7 \cdot 4 & \\
& =210+28 & & \text { Think: } \quad 7 \cdot 30=210 \\
& =238 & & \text { Think: } \quad 210+28=238
\end{array}
$$

## Example 2

Financial Literacy On a school visit to Washington, D.C., Dichali and his class visited the Smithsonian National Air and Space Museum. Tickets to the IMAX movie cost $\$ 8.99$. Find the total cost for $\mathbf{2 0}$ students to see the IMAX movie.

You can use the Distributive Property and mental math to find the total cost for the movie. To find the total cost mentally, find $20(\$ 9.00-\$ 0.01)$.

$$
\begin{aligned}
20(\$ 9.00-\$ 0.01) & =20(\$ 9.00)-20(\$ 0.01) & & \text { Distributive Property } \\
& =\$ 180-\$ 0.20 & & \text { Multiply. } \\
& =\$ 179.80 & & \text { Subtract. }
\end{aligned}
$$

So, the total cost is $\$ 179.80$.
You can check your result by multiplying $20 \cdot \$ 9$ to get $\$ 180$. Since $\$ 180$ is close to $\$ 179.80$, the answer is reasonable.

## Gof If? Do these problems to find out.

2a. A spaghetti dinner at the Italian Village restaurant costs $\$ 10.25$. Use the Distributive Property and mental math to find the total cost of the dinner for Sherita, her brother, and her parents. $4(\$ 10+\$ 0.25) ; 4(\$ 10)+4(\$ 0.25) ; \$ 41$
2b. After dinner, they each order gelato for $\$ 1.50$. What is the new total? 4(\$1 + \$0.50); 4 (\$1) + 4 (\$0.50); \$6; \$47 total

## Algebraic Expressions

Vocabulary Link Distribute Everyday Use to deliver to each member of a group
Math Use a property that allows you to multiply each member of a sum by a number

You can model the Distributive Property by using algebra tiles and variables.


The expressions $2(x+4)$ and $2 x+8$ are equivalent expressions because no matter what the value of $x$ is, these expressions have the same value.

## Example 3

Use the Distributive Property to write each expression as an equivalent algebraic expression.

Watch Out!
Distributive Property In Example 3a, remember to distribute the 4 to both values inside the parentheses.
a. $4(x+5)$
$\underbrace{4(x+5)}=4 x+4 \cdot 5$
$=4 x+20$
b. $(y+10) 6$
Simplify.
$(y+10) 6=y \cdot 6+10 \cdot 6$

$$
=6 y+60
$$

Simplify.

Gof If? Do these problems to find out.
3a. $2.4(a+5) 2 \cdot 4 a+12$
3b. $(b+6) 33 b+18$

## Example 4

## Use the Distributive Property to write each expression as an equivalent

 algebraic expression.a. $3(m-4)$

$$
\begin{aligned}
\underbrace{3(m-4)} & =3[m+(-4)] & & \text { Rewrite } m-4 \text { as } m+(-4) . \\
& =3 \cdot m+3 \cdot(-4) & & \text { Distributive Property } \\
& =3 m+(-12) & & \text { Simplify. } \\
& =3 m-12 & & \text { Definition of subtraction }
\end{aligned}
$$

b. $-9.5(n-7)$

$$
\begin{aligned}
-9.5(n-7) & =-9.5[n+(-7)] & & \text { Rewrite } n-7 \text { as } n+(-7) . \\
& =-9.5 \cdot n+(-9.5)(-7) & & \text { Distributive Property } \\
& =-9.5 n+66.5 & & \text { Simplify. }
\end{aligned}
$$

Gof It? Do these problems to find out.
4a. $\frac{2}{3}(d-3) \frac{2}{3} d-2$
4b. $-7(e-4)-7 e+28$

## Guided Practice

Use the Distributive Property to write each expression as an equivalent numeric expression. Then evaluate the expression. (Example 1)

1. $7(9+3) 7 \cdot 9+7 \cdot 3 ; 84$
2. $\frac{2}{5}(3+5) \frac{2}{5} \cdot 3+\frac{2}{5} \cdot 5 ; 3 \frac{1}{5}$
3. $(7+8) 2.27 \cdot 2.2+8 \cdot 2.2 ; 33$
4. $(5+6) 85 \cdot 8+6 \cdot 8 ; 88$
5. You purchase 3 blue notebooks and 2 red notebooks. Each notebook costs $\$ 1.30$. Use mental math to find the total cost of the notebooks. Justify your answer by using the Distributive Property. (Example 2) $\$ 6.50 ; 5(\$ 1+\$ 0.30)=5(\$ 1)+5(\$ 0.30)$

Use the Distributive Property to write each expression as an equivalent algebraic expression. (Examples 3 and 4 )
6. $\frac{3}{4}(m+4) \frac{3}{4} m+3$
7. $(p+4) 55 p+20$
8. $-6(b-5)-6 b+30$
9. $9.5(a-10) 9.5 a-95$

