

## 8.2 Lesson

### Key Ideas

#### Common Error

When multiplying powers, do not multiply the bases.

$$4^2 \cdot 4^3 = 4^5, \text{ not } 16^5.$$

#### Product of Powers Property

**Words** To multiply powers with the same base, add their exponents.

**Numbers**  $4^2 \cdot 4^3 = 4^{2+3} = 4^5$

**Algebra**  $a^m \cdot a^n = a^{m+n}$

#### Power of a Power Property

**Words** To find a power of a power, multiply the exponents.

**Numbers**  $(4^6)^3 = 4^{6 \cdot 3} = 4^{18}$

**Algebra**  $(a^m)^n = a^{mn}$

#### Power of a Product Property

**Words** To find a power of a product, find the power of each factor and multiply.

**Numbers**  $(3 \cdot 2)^5 = 3^5 \cdot 2^5$

**Algebra**  $(ab)^m = a^m b^m$

### EXAMPLE 1 Multiplying Powers with the Same Base

a.  $2^4 \cdot 2^5 = 2^{4+5}$   
 $= 2^9$

Product of Powers Property

Simplify.

b.  $-5 \cdot (-5)^6 = (-5)^1 \cdot (-5)^6$   
 $= (-5)^{1+6}$   
 $= (-5)^7$

Rewrite  $-5$  as  $(-5)^1$ .

Product of Powers Property

Simplify.

c.  $x^3 \cdot x^7 = x^{3+7}$   
 $= x^{10}$

Product of Powers Property

Simplify.

**Try It** Simplify the expression. Write your answer as a power.

1.  $6^2 \cdot 6^4$

2.  $\left(-\frac{1}{2}\right)^3 \cdot \left(-\frac{1}{2}\right)^6$

3.  $z \cdot z^{12}$

When a number is written without an exponent, its exponent is 1.

## EXAMPLE 2 Finding a Power of a Power

$$\begin{aligned} \text{a. } (3^4)^3 &= 3^{4 \cdot 3} \\ &= 3^{12} \end{aligned}$$

Power of a Power Property  
Simplify.

$$\begin{aligned} \text{b. } (w^5)^4 &= w^{5 \cdot 4} \\ &= w^{20} \end{aligned}$$

Power of a Power Property  
Simplify.

**Try It** Simplify the expression. Write your answer as a power.

4.  $(4^3)^5$

5.  $(y^2)^4$

6.  $((-4)^3)^2$

## EXAMPLE 3 Finding a Power of a Product

$$\begin{aligned} \text{a. } (2x)^3 &= 2^3 \cdot x^3 \\ &= 8x^3 \end{aligned}$$

Power of a Product Property  
Simplify.

$$\begin{aligned} \text{b. } (3xy)^2 &= 3^2 \cdot x^2 \cdot y^2 \\ &= 9x^2y^2 \end{aligned}$$

Power of a Product Property  
Simplify.

**Try It** Simplify the expression.

7.  $(5y)^4$

8.  $(ab)^5$

9.  $(0.5mn)^2$



## Self-Assessment for Concepts & Skills

Solve each exercise. Then rate your understanding of the success criteria in your journal.

**FINDING POWERS** Simplify the expression. Write your answer as a power.

10.  $4^7 \cdot 4^4$

11.  $(g^6)^3$

12.  $\left(-\frac{1}{3}\right)^5 \cdot \left(-\frac{1}{3}\right)^7$

**FINDING A POWER OF A PRODUCT** Simplify the expression.

13.  $(8t)^4$

14.  $(yz)^6$

15.  $\left(\frac{1}{4}gh\right)^3$

16. **CRITICAL THINKING** Can you use the Product of Powers Property to simplify  $5^2 \cdot 6^4$ ? Explain.

17. **OPEN-ENDED** Write an expression that simplifies to  $x^{12}$  using the Product of Powers Property.