

### 7-3 Multiplication Properties of Exponents

Warm Up

Lesson Presentation

Lesson Quiz

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### 7-3 Multiplication Properties of Exponents

To find a power of a power, you can use the meaning of exponents.

$(w^3)^2$        $(4^3)^2 = 4^3 \cdot 4^3 = (4 \cdot 4 \cdot 4) \cdot (4 \cdot 4 \cdot 4) = 4^6$

$(8^3)^2$        $(8^3)^2 = 8^3 \cdot 8^3 = (8 \cdot 8 \cdot 8) \cdot (8 \cdot 8 \cdot 8) = 8^6$

Notice the relationship between the exponents in the original power and the exponent in the final power:

$3 \cdot 2 = 6.$

√	Power
÷	x
-	+
Nothing	Nothing

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### 7-3 Multiplication Properties of Exponents

#### Power of a Power Property

WORDS	NUMBERS	ALGEBRA
A power raised to another power equals that base raised to the product of the exponents.	$(6^7)^4 = 6^{7 \cdot 4} = 6^{28}$	If $a$ is any nonzero real number and $m$ and $n$ are integers, then $(a^m)^n = a^{mn}$ .

When taking a power to a power multiply the exponents.

$(4^2)^6 = 4^{12}$

$(4x^2)^6 = 4096x^{12}$

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### 7-3 Multiplication Properties of Exponents

#### Example 3: Finding Powers of Powers

Simplify.

A.  $(5^2)^4$       Use the Power of a Power Property.

$5^{2 \cdot 4}$

$5^8$       Simplify.

B.  $(4^3)^0$       Use the Power of a Power Property.

$4^{3 \cdot 0}$       Zero multiplied by any number is zero

$4^0$       Any number raised to the zero power is 1.

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**7-3 Multiplication Properties of Exponents**

**Example 3: Finding Powers of Powers Continued**

Simplify.

c.  $(x^3)^{-5} \cdot x^4$

$x^{3 \cdot (-5)} \cdot x^4$   
 $x^{-15} \cdot x^4$   
 $x^{-15+4}$   
 $x^{-11}$   
 $\frac{1}{x^{11}}$

$(x^3)^{-5} \cdot x^4$

$\frac{1}{(x^3)^5} \cdot x^4$

$\frac{1}{x^3 \cdot x^3 \cdot x^3 \cdot x^3 \cdot x^3} \cdot x^4$

$\frac{1}{x^{15}} \cdot x^4 = \frac{1}{x^{11}}$

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**7-3 Multiplication Properties of Exponents**

**Check It Out! Example 3**

Simplify.

5.  $(6^4)^2$

$6^8$

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

$4^{-6} = \frac{1}{4^6}$

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**7-3 Multiplication Properties of Exponents**

**Check It Out! Example 3c Continued**

Simplify.

8.  $(x^2)^{-4} \cdot y^{-3}$

$\frac{x^{-8}}{1} \cdot \frac{y^{-3}}{1} = \frac{1}{x^8 y^3}$

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**7-3 Multiplication Properties of Exponents**

Powers of products can be found by using the meaning of an exponent.

$8x^3$

**Power of a Product Property**

WORDS	NUMBERS	ALGEBRA
A product raised to a power equals the product of each factor raised to that power.	$(2 \cdot 4)^3 = 2^3 \cdot 4^3$ $= 8 \cdot 64$ $= 512$	If $a$ and $b$ are any nonzero real numbers and $n$ is any integer, then $(ab)^n = a^n b^n$ .

$(8x)^3 = 8x \cdot 8x \cdot 8x = 8 \cdot 8 \cdot 8 \cdot x \cdot x \cdot x = 8^3 x^3 = 512x^3$

$8x^3$

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### 7-3 Multiplication Properties of Exponents

#### Example 4: Finding Powers of Products

Simplify.

A.  $-(2y)^2$

$$-(2^2 \cdot y^2) \quad \text{Use the Power of a Product Property.}$$

$$-(4 \cdot y^2)$$

$$-4y^2 \quad \text{Simplify.}$$

B.  $(-2y)^3$

$$(-2)^3 \cdot y^3 \quad \text{Use the Power of a Product Property.}$$

$$-8y^3 \quad \text{Simplify.}$$

### 7-3 Multiplication Properties of Exponents

#### Example 4: Finding Powers of Products

Simplify.

C.  $(x^6 \cdot y^{-3})^2$

$$\cancel{(x^6)^2} \cdot \cancel{(y^{-3})^2} \quad \text{Use the Power of a Product Property.}$$

$$\cancel{x^{6 \cdot 2}} \cdot \cancel{y^{-3 \cdot 2}} \quad \text{Use the Power of a Power Property.}$$

$$x^{12} \cdot y^{-6}$$

Write  $y^{-6}$  as  $\frac{1}{y^6}$ .

$$\frac{x^{12}}{y^6}$$

Simplify.

$$\frac{x^{12}}{y^6}$$

### 7-3 Multiplication Properties of Exponents

#### Check It Out! Example 4

Simplify.

11.  $(2h^3)^2$   
 $4h^6$

13.  $(-4x^5)^2$   
 $16x^{10}$

### 7-3 Multiplication Properties of Exponents

#### Check It Out! Example 4 Continued

Simplify.

C.  $(x^2y^3)^4 \cdot (x^2y^4)^{-4} = x^8 y^{12} \cdot x^{-8} y^{-16}$

$$\frac{(x^2y^3)^4}{(x^2y^4)^4} = \frac{x^8 y^{12}}{x^8 y^{16}} = \frac{1}{y^4}$$

$$x^0 y^{-4} = \frac{1}{y^4}$$

## 7-3 Multiplication Properties of Exponents

### Lesson Quiz: Part I

Simplify.

1.  $3^2 \cdot 3^4$   $3^6$

2.  $z^4 \cdot z^{-2} \cdot z$   $z^3$

3.  $(x^3)^2$   $x^6$

4.  $-(t^{-3})^5$   $-\frac{1}{t^{15}}$

5.  $(5g)^3$   $125g^3$

6.  $(-3f^{-4})^2$   $\frac{9}{f^8}$

7.  $(x^2y)^3 \cdot (x^3y^2)^{-2}$   $\frac{1}{y}$

8.  $(2.9 \times 10^3)(2.3 \times 10^2)$   $(2.9x^3)(2.3x^2)$   
 $6.67 \times 10^5$   $x^5$