

## 6-2

Exponents and  
Multiplication

You will need Evernote and your clicker today.

**What You'll Learn**

To multiply powers with the same base

**Why Learn This?**

Computer programmers often use exponents with base 2, base 8, or base 16 to express numbers. To perform calculations within these number systems, you need to know how to multiply with exponents.



You can write the expression  $3^2 \cdot 3^4$  using a single exponent.

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

The two factors of 3 together with four factors of 3 give a total of six factors of 3. Notice that the exponent 6 is equal to the sum of the exponents 2 and 4.

Put this in  
your notes

**KEY CONCEPTS** Multiplying Powers With the Same Base

To multiply numbers or variables with the same base, add the exponents.

**Arithmetic**

$$3^2 \cdot 3^7 = 3^{(2+7)} = 3^9$$

**Algebra**

$$a^m \cdot a^n = a^{(m+n)}$$

## EXAMPLE Multiplying Powers

1 Write the expression  $(-2)^3 \cdot (-2)^5$  using a single exponent.

$$\begin{aligned}(-2)^3 \cdot (-2)^5 &= (-2)^{(3+5)} && \leftarrow \text{Add the exponents.} \\ &= (-2)^8 && \leftarrow \text{Simplify the exponent.}\end{aligned}$$

**Table talk: What word will correctly complete this sentence?**

### Multiplying Powers With the Same Base

To multiply numbers or variables with the same base,  the exponents.

**Arithmetic**  
 $3^2 \cdot 3^7 = 3^{(2+7)} = 3^9$

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

## TABLE TALK TO ARRIVE AT AN ANSWER

### Examples

- ① **Multiplying Powers** Write the expression  $(-3)^2 \cdot (-3)^4$  using a single exponent.

$$(-3)^2 \cdot (-3)^4 = (-3)^{\square + \square} \leftarrow \text{Add the exponents.}$$

$$= (-3)^{\square} \leftarrow \text{Simplify the exponent.}$$



$$6^2 \times 6^3 = 6^?$$

Text in the exponent that should go in place of the question mark.



$$(-4)^4 \times (-4)^4 =$$

**A**  $4^8$

**B**  $(-4)^8$

**C**  $4^{16}$

**D**  $(-4)^{16}$



$$3 \times 3^2 \times 3^3 = ?$$

**A**  $3^6$

**B**  $3^5$

**C**  $3^{12}$

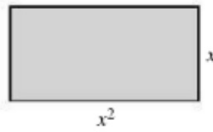
**D** not given

**Vocabulary Tip**

Terms raised to the second power are often referred to as *squared*, while terms to the third power are said to be *cubed*.

**EXAMPLE****Application: Geometry**

2 **Multiple Choice** Find the area of the rectangle.



- (A)  $x^2$       (B)  $x^3$       (C)  $2x^2$       (D)  $2x^3$

Recall that the area of a rectangle is  $A = \ell \cdot w$ , where  $\ell$  is the length and  $w$  is the width.

Let  $\ell = x^2$  and  $w = x$ .

$$A = \ell \cdot w \quad \leftarrow \text{Write the area formula.}$$

$$A = x^2 \cdot x \quad \leftarrow \text{Substitute } x^2 \text{ for } \ell \text{ and } x \text{ for } w.$$

$$A = x^{(2+1)} \quad \leftarrow \text{Add the exponents.}$$

$$A = x^3 \quad \leftarrow \text{Simplify.}$$

The area of the rectangle is  $A = x^3$ .

The correct answer is choice B.

**TABLE TALK ABOUT THIS PROBLEM**

2 **Application: Geometry** Find the area of the square.



- A.  $x^{10} \text{ cm}^2$       B.  $x^{25} \text{ cm}^2$       C.  $2x^{10} \text{ cm}^2$       D.  $2x^{25} \text{ cm}^2$

$$A = s \cdot s$$

$\leftarrow$  Write the area formula.

$$A = x^5 \cdot x^5$$

$\leftarrow$  Substitute  $\square$  for  $s$ .

$$A = x(\square + \square)$$

$\leftarrow$  Add the exponents.

$$A = x \square$$

$\leftarrow$  Simplify.

The area of the square is  $x \square \text{ cm}^2$ . The correct answer choice is

**EXAMPLE****Using the Commutative Property**

3 Simplify the expression  $-3x^2 \cdot 5x^4$ .

$$-3x^2 \cdot 5x^4 = -3 \cdot 5 \cdot x^2 \cdot x^4 \quad \leftarrow \text{Use the Commutative Property of Multiplication.}$$

$$= -15x^{(2+4)} \quad \leftarrow \text{Add the exponents of powers with the same base.}$$

$$= -15x^6 \quad \leftarrow \text{Simplify.}$$

Ⓔ **Using the Commutative Property** Simplify the expression  $-6x^5 \cdot 3x^4$ .

$$-6x^5 \cdot 3x^4 = \square \cdot \square \cdot x^5 \cdot x^4 \quad \leftarrow \text{Use the Commutative Property of Multiplication.}$$

$$= \square x^{(\square + \square)} \quad \leftarrow \square \text{ the exponents of powers with the same base.}$$

$$= -18x^{\square} \quad \leftarrow \text{Simplify.}$$

### Quick Check

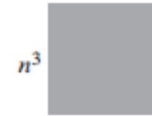
1. Write each expression using a single exponent.

a.  $6^2 \cdot 6^3$

b.  $(-4) \cdot (-4)^7$

c.  $3 \cdot 3^2 \cdot 3^3$

2. A square has a side length of  $n^3$ . Find the area of the square.



3. Simplify each expression.

a.  $2a^2 \cdot 3a$

b.  $x^{10} \cdot x^3$

c.  $-4y^5 \cdot -3y^5$



**True or false? When you multiply exponential numbers, you add their exponents.**

**A** True

**B** False



Compare using  $<$ ,  $>$ , or  $=$

$$4^6 \bigcirc 4^3 \times 4^2$$

**A**  $<$

**B**  $>$

**C**  $=$



Compare using  $<$ ,  $>$ , or  $=$

$$36 \bigcirc 6^2 \times 6^2$$

**A**  $<$

**B**  $>$

**C**  $=$





Compare using  $<$ ,  $>$ , or  $=$

$5^{16}$    $5^8 \times 5^2$

**A**  $<$

**B**  $>$

**C**  $=$

**You have an assignment on socrative. Go to the internet (either Chrome or Safari)**

**Type in this url:  
[m.socrative.com](https://m.socrative.com)**

**enter room number 262013**

**Wait for me to begin the assignment. It must be done in this class.**

**You can power down your clickers and put them away.**

**Practice 6-2** Exponents and Multiplication

Write each expression using a single exponent.

1.  $3^2 \cdot 3^5$   
\_\_\_\_\_

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

3.  $0.8^3 \cdot 0.8$   
\_\_\_\_\_

4.  $(-1.3)^2 \cdot (-1.3)^4$   
\_\_\_\_\_

5.  $3^3 \cdot 3 \cdot 3^4$   
\_\_\_\_\_

6.  $5 \cdot 5^4 \cdot 5^3$   
\_\_\_\_\_

Simplify each expression.

7.  $a^1 \cdot a^2$   
\_\_\_\_\_

8.  $m^5 \cdot m$   
\_\_\_\_\_

9.  $4d \cdot 9d^8$   
\_\_\_\_\_

10.  $x^2y \cdot xy^2$   
\_\_\_\_\_

11.  $2p^3q^2 \cdot 3p^2q^3$   
\_\_\_\_\_

12.  $5x^2 \cdot x^6 \cdot x^3$   
\_\_\_\_\_

Replace each  $\underline{\quad}$  with =, <, or >.

13.  $3^8 \underline{\quad} 3 \cdot 3^7$   
\_\_\_\_\_

14.  $49 \underline{\quad} 7^2 \cdot 7^2$   
\_\_\_\_\_

15.  $5^3 \cdot 5^4 \underline{\quad} 25^2$   
\_\_\_\_\_

16. A square has a side length of  $7x^4$  in. Find the area of the square.  
\_\_\_\_\_

17. The formula for the volume of a rectangular prism is  $V = \ell \cdot w \cdot h$ . What is the volume of a prism with length  $2x^2$  mm, width  $4x$  mm, and height  $x^3$  mm?  
\_\_\_\_\_

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