# 7-2: MULTIPLICATION PROPERTIES OF EXPONENTS

Lesson Objectives:

- Multiply powers
- Work with scientific notation

Multiplying

# PROPERTY: MULTIPLYING POWERS WITH THE SAME BASE

For every nonzero number *a* and integers *m* and *n*,

## **EXAMPLE 1: MULTIPLYING POWERS**

Simplify each expression.			
<b>1.</b> $11^4 \cdot 11^3$	2. $5^{-2} \bullet 5^2$	3. $4^3 \cdot 4^2$	4. $5^{-6} \bullet 5^4$

$J_1 J_2 J_3 J_4 J_5 J_6 J_6 J_6 J_6 J_6 J_6 J_6 J_6 J_6 J_6$	5. $3^8 \cdot 3^5$	6. $6^{-7} \bullet 6^9$	7. $(-2)^3 \bullet (-2)^{-5}$	8. $2^8 \cdot 2^{-9} \cdot 2$
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When variable factors have more than one base, be careful to combine only the powers with the same base.

#### **EXAMPLE 2: MULTIPLYING POWERS IN AN ALGEBRAIC EXPRESSION**

Simplify each expression. 9.  $(3d^{-4})(5d^8)$  10.  $(-8m^4)(4m^8)$  11.  $n^{-6} \cdot n^{-9}$  12.  $a^3 \cdot a$ 

13. 
$$(3p^{-15})(6p^{11})$$
  
14.  $p^7 \cdot q^5 \cdot p^6$   
15.  $(-1.5a^5b^2)(6a)$   
16.  $\frac{1}{b^7 \cdot b^5}$   
17.  $(-2d^3e^3)(6d^4e^6)$   
18.  $p^{-5} \cdot q^2 \cdot p^4$   
19.  $\frac{1}{n^7 \cdot n^{-5}}$   
20.  $(8d^4)(4d^7)$ 

Working With Scientific Notation

#### **EXAMPLE 3: MULTIPLYING NUMBERS IN SCIENTIFIC NOTATION**

Simplify each expression. Write each answer in proper scientific notation.

21.  $(7 \times 10^{2})(4 \times 10^{5})$  22.  $(7 \times 10^{7})(5 \times 10^{-5})$  23.  $(3 \times 10^{8})(3 \times 10^{4})$  24.  $(9.5 \times 10^{-4})(3 \times 10^{-5})$ 

25. 
$$(5 \times 10^7)(4 \times 10^3)$$
 26.  $(6 \times 10^{-6})(5.2 \times 10^4)$  27.  $(4 \times 10^6)(9 \times 10^8)$  28.  $(6.1 \times 10^9)(8 \times 10^{14})$ 

### **EXAMPLE 4: REAL-WORLD PROBLEM SOLVING**

29. A human body contains about  $3.2 \times 10^4 \mu L$  (microliters) of blood for each pound of body weight. Each microliter of blood contains about  $5 \times 10^6$  red blood cells. Find the approximate number of red blood cells in the body of a 125-pound person.

30. In 1990, the St. Louis metropolitan area had an average of  $82 \times 10^{-6} \frac{g}{m^3}$  of pollution in the air. How many grams of pollutants where there in  $2 \times 10^3 m^3$  of air?

31. Light travels approximately  $5.87 \times 10^{12}$  miles in one year. This distance is called a light-year. Suppose a star is  $2 \times 10^4$  light-years away. How many miles away is that star?

32. The weight of 1 m<sup>3</sup> of air is approximately  $1.3 \times 10^3$  grams. Suppose that the volume of air inside of a building is  $3 \times 10^6$  m<sup>3</sup>. How much does the air inside the building weigh?

33. Light travels  $1.18 \times 10^{10}$  inches in 1 second. How far will light travel in 1 nanosecond or  $1 \times 10^{-9}$  seconds?

Name		8-3 Practice Worksheet	Period
Simplify each expression. 1. $10^{-6} \cdot 10^5 \cdot 10^1$	2. $(1.025)^2 (1.025)^{-2}$	3. $5t^{-2} \cdot 2t^{-5}$	4. $(-2.4n^4)(2n^{-1})$
5. $(15a^3)(-3a)$	6. $(4c^4)(ac^3)(3a^5c)$	7. $-m^2 \cdot 4r^3 \cdot 12r^{-4} \cdot 5m$	

8. 
$$(4 \times 10^{6})(2 \times 10^{-3})$$
 9.  $(5 \times 10^{7})(3 \times 10^{14})$ 

10. Earth's crust contains approximately 120 trillion metric tons of gold. One metric ton of gold is worth about \$64 million. What is the approximate value of the gold in the Earth's crust?

11. Light travels through space at a constant speed of about  $3 \times 10^5$  km/s. Sunlight reflecting from the moon takes about  $1.28 \times 10^0$  s to reach Earth. Find the distance from the moon to Earth.

Complete each equation.
$$2^? \bullet 2^4 = 2^{-1}$$
 $c^? \bullet c^{-5} = c^6$  $x^3 y^2 \bullet x^2 = y^2$ 12.13.14.

# Find the area of each figure.

15.  $A_{rectangle} = lw$ 





Simplify.			
19. $\frac{5}{c \bullet c^{-4}}$	20. $2a^2(3a+5)$	<b>21.</b> $8m^3(m^2 + 7)$	22. $-4x^3(2x^2-9x)$
23. $3^x \bullet 3^{2-x} \bullet 3^2$	24. $2^n \cdot 2^{n+2} \cdot 2$	25. $(a+b)^2(a+b)^{-1}$	26. $5^{x+1} \cdot 5^{1-x}$