

## LESSON

## 7-3

**Practice C****Multiplication Properties of Exponents**

Simplify.

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

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

3.  $5^6 \cdot 5^{-2}$   
\_\_\_\_\_

4.  $t^{-4} \cdot t^{-5}$   
\_\_\_\_\_

5.  $x^4 \cdot x^2$   
\_\_\_\_\_

6.  $s^4 \cdot s^6 \cdot t^3$   
\_\_\_\_\_

7.  $(2^4)^2$   
\_\_\_\_\_

8.  $(m^4)^0$   
\_\_\_\_\_

9.  $(y^{-2})^{-4}$   
\_\_\_\_\_

10.  $m^4 \cdot (n^2)^3 \cdot n^{-2}$   
\_\_\_\_\_

11.  $y \cdot x^3 \cdot (y^2)^2 \cdot (x^3)^6$   
\_\_\_\_\_

12.  $(4x)^3$   
\_\_\_\_\_

13.  $(gh)^{-1}$   
\_\_\_\_\_

14.  $-(3bc)^2$   
\_\_\_\_\_

15.  $(j^2 k^3)^3$   
\_\_\_\_\_

16.  $(5d)^2 \cdot d^4$   
\_\_\_\_\_

17.  $(3xy^3)^{-2} \cdot (9y)^2$   
\_\_\_\_\_

18.  $(r^{-3} s^4)^2 \cdot (r^2 s^7)^0$   
\_\_\_\_\_

19.  $(a^2 b^{-2})^{-3} \cdot (a^{-1} b^2)^{-3}$   
\_\_\_\_\_

20.  $(x^3 y^{-1})^4 \cdot (x^{-2} y^2)^{-3}$   
\_\_\_\_\_

21.  $-(j^{-3} k^{-2})^2 \cdot (j^2)^6$   
\_\_\_\_\_

Find the missing exponent in each expression.

22.  $b^{\square} \cdot b^5 = b^9$

23.  $(t^{\square})^4 = t^{12}$

24.  $(h^3)^{\square} = \frac{1}{h^6}$

25. Most states are irregularly shaped. However, the shapes of some western states approximate rectangles.

Wyoming is nearly rectangular, with a width of about  $1.5 \times 10^6$  feet and a length of about  $1.9 \times 10^6$  feet.

What is the approximate area of Wyoming?

Write your answer in scientific notation.  
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**LESSON** **Practice A**  
**7-3** **Multiplication Properties of Exponents**

Complete each equation to show the property.

1.  $a^m \cdot a^n = a^{m+n}$     2.  $(a^m)^n = a^{mn}$     3.  $(ab)^n = a^n b^n$

Simplify.

4.  $7^5 \cdot 7^8$     5.  $3^{-2} \cdot 3^7$     6.  $x^3 \cdot x^{-5}$   
 $\frac{7^5 \cdot 7^8}{7^{13}}$      $\frac{3^{-2} \cdot 3^7}{3^5}$      $\frac{x^3 \cdot x^{-5}}{x^{-2}}$

7.  $a^2 \cdot b^6 \cdot b^{-2}$     8.  $n^5 \cdot n^{-1} \cdot n^{-3}$     9.  $r^{-4} \cdot s^5 \cdot r^6$   
 $\frac{a^2 b^4}{n}$      $r^2 s^5$

10.  $(2^3)^4$     11.  $(4^0)^5$     12.  $(b^2)^{-4}$   
 $\frac{2^3 \cdot 4}{2^{12}}$      $\frac{4^0 \cdot 5}{4^0}$      $\frac{b^2 \cdot 4}{b^{-8}}$

13.  $3n^4$     14.  $(2x)^3$     15.  $(t^3)^4 \cdot t^3$   
 $\frac{3 \cdot 4 \cdot 4}{81n^4}$      $\frac{2 \cdot 3 \cdot 3}{8x^3}$      $\frac{t^{12} \cdot t^3}{t^{12} \cdot 3}$

16.  $(b^4)^2 \cdot (b^3)^3 \cdot b^{-2}$     17.  $(a^2)^3 \cdot a^{-6}$     18.  $(c^{-5})^2 \cdot (c^3)^{-2}$   
 $b^{15}$     1     $\frac{1}{c^{16}}$

19. The volume of a cube can be found by using the formula  $V = s^3$ , where  $s$  represents the length of each side of the cube. Find the volume of a cube if each side is  $4a^2b^4$ .  
 **$64a^6b^{12}$**

**LESSON** **Practice B**  
**7-3** **Multiplication Properties of Exponents**

Simplify.

1.  $3^4 \cdot 3^2$     2.  $2^5 \cdot 2^4$     3.  $2^3 \cdot 2^5 \cdot 2^1$   
 $3^6$  or 729     $2^9$  or 512     $2^9$  or 512

4.  $q^{-6} \cdot q^{-1}$     5.  $r^{-3} \cdot r^4 \cdot s^{-4}$     6.  $j^{-2} \cdot j^{-4} \cdot j^2$   
 $\frac{1}{q^7}$      $\frac{r}{s^4}$      $\frac{1}{j^4}$

7.  $c^5 \cdot b^{-2} \cdot c^3$     8.  $(h^2)^5$     9.  $(g^4)^{-2}$   
 $\frac{c^8}{b^2}$      $h^{10}$      $\frac{1}{g^8}$

10.  $(w^6)^0$     11.  $(v^2)^5 \cdot v^4$     12.  $(w^5)^{-2} \cdot w^{-3}$   
1     $v^{14}$      $\frac{1}{w^{13}}$

13.  $(f^6)^{-4} \cdot (f^{-2})^{-3}$     14.  $(a^{-2})^{-3} \cdot (a^5)^2$     15.  $(3b)^4$   
 $\frac{1}{f^{18}}$      $a^{16}$      $81b^4$

16.  $(-5k)^2$     17.  $-(4m)^3$     18.  $(-3p)^{-2}$   
 $25k^2$      $-64m^3$      $\frac{1}{9p^2}$

19.  $(s^4 t)^3 \cdot (s^4 t^3)^2$     20.  $(a^2 b^4)^2 \cdot (a^{-2} b^3)^{-1} \cdot a^4$     21.  $(x^3 y^2)^{-4} \cdot (x^2 y^{-3})^{-2}$   
 $s^{20} t^9$      $a^{10} b^5$      $\frac{1}{x^{16} y^2}$

22. The pitch of a sound is determined by the number of vibrations produced per second. The note "middle C" produces  $2.62 \times 10^5$  vibrations per second. If a pianist plays middle C for  $5 \times 10^{-1}$  seconds, how many vibrations will occur?  
 **$1.31 \times 10^2$  or 131 vibrations**

**LESSON** **Practice C**  
**7-3** **Multiplication Properties of Exponents**

Simplify.

1.  $2^3 \cdot 2^5$     2.  $6^4 \cdot 6^1$     3.  $5^6 \cdot 5^{-2}$   
 $2^8$  or 256     $6^5$  or 7776     $5^4$  or 625

4.  $t^{-4} \cdot t^{-5}$     5.  $x^4 \cdot x^2$     6.  $s^4 \cdot s^6 \cdot t^3$   
 $\frac{1}{t^9}$      $x^6$      $s^{10} t^3$

7.  $(2^4)^2$     8.  $(m^4)^0$     9.  $(y^{-2})^{-4}$   
 $2^8$  or 256    1     $y^8$

10.  $m^4 \cdot (n^2)^3 \cdot n^{-2}$     11.  $y \cdot x^3 \cdot (y^2)^2 \cdot (x^3)^6$     12.  $(4x)^3$   
 $m^4 n^4$      $x^{21} y^5$      $64x^3$

13.  $(gh)^{-1}$     14.  $-(3bc)^2$     15.  $(j^2 k^3)^3$   
 $\frac{1}{gh}$      $-9b^2 c^2$      $j^6 k^9$

16.  $(5d)^2 \cdot d^4$     17.  $(3xy^3)^{-2} \cdot (9y)^2$     18.  $(r^{-3} s^4)^2 \cdot (r^2 s^7)^0$   
 $25d^6$      $\frac{9}{x^2 y^4}$      $\frac{s^8}{r^6}$

19.  $(a^2 b^{-2})^{-3} \cdot (a^{-1} b^2)^{-3}$     20.  $(x^3 y^{-1})^4 \cdot (x^{-2} y^2)^{-3}$     21.  $-(j^{-3} k^{-2})^2 \cdot (j^2)^6$   
 $\frac{1}{a^3}$      $\frac{x^{18}}{y^{10}}$      $-\frac{j^6}{k^4}$

Find the missing exponent in each expression.

22.  $b^4 \cdot b^5 = b^9$     23.  $(j^3)^4 = j^{12}$     24.  $(h^3)^{-2} = \frac{1}{h^6}$

25. Most states are irregularly shaped. However, the shapes of some western states approximate rectangles. Wyoming is nearly rectangular, with a width of about  $1.5 \times 10^5$  feet and a length of about  $1.9 \times 10^5$  feet. What is the approximate area of Wyoming? Write your answer in scientific notation.  
 **$2.85 \times 10^{12}$  square feet**

**LESSON** **Reteach**  
**7-3** **Multiplication Properties of Exponents**

You can multiply a power by a power by expanding each factor.

Simplify  $(4^3)(4^5)$ .

$(4^3)(4^5)$   
 $(4 \cdot 4 \cdot 4)(4 \cdot 4 \cdot 4 \cdot 4 \cdot 4)$  *Expand each factor.*  
 $4^8$  *Count the number of factors.*  
*The number of factors is the exponent.*

Or you can use the **Product of Powers Property**:

$a^m \cdot a^n = a^{m+n}$  ( $a \neq 0$ ,  $m$  and  $n$  are integers.)

Simplify  $(4^3)(4^5)$ .

$(4^3)(4^5)$      $a^4 \cdot b^5 \cdot a^{-2}$   
 $4^{3+5}$      $a^4 + (-2) \cdot b^5$   
 $4^8$      $a^2 \cdot b^5$   
 $a^2 b^5$

You can use the **Power of a Power Property** to find a power raised to another power.

$(a^m)^n = a^{mn}$  ( $a \neq 0$ ,  $m$  and  $n$  are integers.)

Simplify  $(2^3)^2$ .

$(2^3)^2$      $(x^5)^4 \cdot y$   
 $2^{3 \cdot 2}$      $x^{5 \cdot 4} \cdot y$   
 $2^6$      $x^{20} y$

Simplify.

1.  $2^3 \cdot 2^4$     2.  $8^{-2} \cdot 5^3 \cdot 8^6$     3.  $2^4 \cdot 3^5 \cdot 2^8 \cdot 3^{-2}$   
 $2^7$      $8^4 \cdot 5^3$      $2^{12} \cdot 3^3$

4.  $m^8 \cdot n^4 \cdot m^7$     5.  $(6^4)^2$     6.  $(4 \cdot 3)^2$   
 $m^{15} n^4$      $6^8$      $\frac{1}{4^6}$

7.  $(5^{-3})^3 \cdot 4^0$     8.  $(x^2)^{-4} \cdot y^{-3}$     9.  $(u^5)^{-2} \cdot (v^3)^4$   
 $\frac{1}{5^9}$      $\frac{1}{x^8 y^3}$      $\frac{v^{12}}{u^{10}}$