

## 7-3

## Reteaching

## More Multiplication Properties of Exponents

When a power is raised to another power, like  $(x^y)^z$ , multiply the exponents.

**Problem**

What is the simplified form of  $(d^3)^4$ ?

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

The expression is a power,  $d^3$ , raised to another power, 4. Multiply the exponents. Simplify.

Simplifying powers may require you to use multiple properties of exponents. You should follow the order of operations when simplifying exponential expressions.

**Problem**

What is the simplified form of  $(n^{-3})^6 n^4$ ?

Using the order of operations, first simplify the power  $(n^{-3})^6$ .

$$(n^{-3})^6 n^4 = (n^{-3} \cdot 6) n^4 = n^{-18} n^4$$

Next, multiply. The two powers have the same base, so simplify by adding the exponents.

$$n^{-18} n^4 = n^{-18+4} = n^{-14}$$

Finally, write the expression using positive exponents. Rewrite the expression using the reciprocal of the base and the opposite of the exponent.

$$n^{-14} = \frac{1}{n^{14}}$$

You should follow the same rules when simplifying numbers written in scientific notation raised to a power.

**Problem**

What is the simplified form of  $(4.2 \times 10^{-7})^2$  written in scientific notation?

$$(4.2 \times 10^{-7})^2 = (4.2)^2 (10^{-7})^2$$

This is a product raised to the exponent 2, so each factor of the product must be raised to the exponent 2.

$$= 17.64 \times 10^{-14}$$

Multiply 4.2 by itself. Multiply the exponents on the expression with base 10.

$$= 1.764 \times 10^{-13}$$

Move the decimal point one place left and adjust the exponent on 10 to write in scientific notation.

## Exercises

Simplify each expression.

1.  $(y^2)^3$

2.  $(v^9)^6$

3.  $(h^4)^5$

4.  $(n^4)^{11}$

5.  $(p^{-1})^5$

6.  $(z^3)^{-6}$

7.  $(x^{-4})^{-5}x$

8.  $(f^5)^{-1}f^8$

9.  $\left(3a^{\frac{1}{2}}\right)^4$

10.  $(6c)^{-3}$

11.  $(7k)^0$

12.  $\left(10s^{\frac{3}{2}}\right)^2$

13.  $(2y^{-5})^3(x^{11}y^{-10})^2$

14.  $u^{-9}(u^{-1}v)^4u^{-5}$

15.  $(x^{13}y^6)^{-2}(y^{-5}x^{10})^6$

16.  $4m^0n^0(6m^5)^2$

Simplify. Write each answer in scientific notation.

17.  $(2 \times 10^{-8})^3$

18.  $(3 \times 10^5)^3$

19.  $(9 \times 10^{-15})^3$

20.  $(6 \times 10^5)^2$

21.  $(6.7 \times 10^{11})^2$

22.  $(9.5 \times 10^7)^3$

23.  $(4.7 \times 10^{-11})^{-2}$

24.  $(5.14 \times 10^6)^2$

25. The radius of a cylinder is  $6.8 \times 10^5$  m. The height of the cylinder is  $2.2 \times 10^3$  m. What is the volume of the cylinder? (Hint:  $V = 3.14r^2h$ )

Complete each equation.

26.  $(y^3)^\square = y^{\frac{3}{2}}$

27.  $(6p^3q^\square)^2 = 36p^6$

28.  $(4a^\square)^3 = 64a^{-6}$

29.  $(k^{11})^\square = 1$

30.  $(t^{-8})^\square = t^{16}$

31.  $15(c^{-1})^\square = 15c^{10}$