1 EXAMPLE **Rewrite each expression using each base only once.**

7·7·7 7·7

a. $7^3 \cdot 7^2 = 7^{3+2}$ Add exponents of powers with the same base.

Base

$= 7^5 = 16{,}807$ Simplify the sum of the exponents.

b. $4^4 \cdot 4^1 \cdot 4^{-2} = 4^{4+1-2}$ Think of $4 + 1 - 2$ as $4 + 1 + (-2)$ to add the exponents.

$= 4^3 = 64$ Simplify the sum of the exponents.

c. $6^8 \cdot 6^{-8} = 6^{8+(-8)}$ Add exponents of powers with the same base.

$= 6^0$ Simplify the sum of the exponents.

$= 1$ Use the definition of zero as an exponent.

Multiplying Exponents

2 EXAMPLE **Simplify each expression.**

a. $p^2 \cdot p \cdot p^5 = p^{2+1+5}$ Add exponents of powers with the same base.

$= p^8$ Simplify.

b. $4x^6 \cdot 5x^{-4} = (4 \cdot 5)(x^6 \cdot x^{-4})$ Commutative Property of Multiplication

$= 20(x^{6+(-4)})$ Add exponents of powers with the same base.

$= 20x^2$ Simplify.

3 EXAMPLE **Simplify each expression.**

a. $a^2 \cdot b^{-4} \cdot a^5 = a^2 \cdot a^5 \cdot b^{-4}$ Commutative Property of Multiplication

$= a^{2+5} \cdot b^{-4}$ Add exponents of powers with the same base.

$= \dfrac{a^7}{b^4}$ Simplify.

b. $2q \cdot 3p^3 \cdot 4q^4 = (2 \cdot 3 \cdot 4)(p^3)(q \cdot q^4)$ Commutative and Associative Properties of Multiplication

$= 24(p^3)(q^1 \cdot q^4)$ Multiply the coefficients. Write q as q^1.

$= 24(p^3)(q^{1+4})$ Add exponents of powers with the same base.

$= 24p^3q^5$ Simplify.

4 EXAMPLE **Simplify $(3 \times 10^{-3})(7 \times 10^{-5})$. Write the answer in scientific notation.**

$(3 \times 10^{-3})(7 \times 10^{-5}) = (3 \cdot 7)(10^{-3} \cdot 10^{-5})$	Commutative and Associative Properties of Multiplication
$= 21 \times 10^{-8}$	Simplify.
$= 2.1 \times 10^{1} \cdot 10^{-8}$	Write 21 in scientific notation.
$= 2.1 \times 10^{1 + (-8)}$	Add exponents of powers with the same base.
$= 2.1 \times 10^{-7}$	Simplify.

5 EXAMPLE **The speed of light is 3×10^{8} m/s. If there are 1×10^{-3} km in 1 m, and 3.6×10^{3} s in 1 h, find the speed of light in km/h.**

Speed of light $= \frac{\text{meters}}{\text{seconds}} \cdot \frac{\text{kilometers}}{\text{meters}} \cdot \frac{\text{seconds}}{\text{hour}}$	Use dimensional analysis.
$= (3 \times 10^{8}) \frac{\cancel{m}}{\cancel{s}} \cdot (1 \times 10^{-3}) \frac{km}{\cancel{m}} \cdot (3.6 \times 10^{3}) \frac{\cancel{s}}{h}$	Substitute.
$= (3 \cdot 1 \cdot 3.6) \times (10^{8} \cdot 10^{-3} \cdot 10^{3})$	Commutative and Associative Properties of Multiplication
$= 10.8 \times (10^{8 + (-3) + 3})$	Simplify.
$= 10.8 \times 10^{8}$	Add exponents.
$= 1.08 \times 10^{1} \cdot 10^{8}$	Write 10.8 in scientific notation.
$= 1.08 \times 10^{9}$	Add the exponents.

The speed of light is about 1.08×10^{9} km/h.