

PROPERTIES OF EXPONENTS The properties of exponents you learned in Lessons 8.1 and 8.2 can be used with negative or zero exponents.

KEY CONCEPT

For Your Notebook

Properties of Exponents

Let a and b be real numbers, and let m and n be integers.

$$a^m \cdot a^n = a^{m+n} \quad \text{Product of powers property}$$

$$(a^m)^n = a^{mn} \quad \text{Power of a power property}$$

$$(ab)^m = a^m b^m \quad \text{Power of a product property}$$

$$\frac{a^m}{a^n} = a^{m-n}, a \neq 0 \quad \text{Quotient of powers property}$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0 \quad \text{Power of a quotient property}$$

EXAMPLE 2 Evaluate exponential expressions

$$\text{a. } 6^{-4} \cdot 6^4 = 6^{-4+4} \quad \text{Product of powers property}$$

$$= 6^0 \quad \text{Add exponents.}$$

$$= 1 \quad \text{Definition of zero exponent}$$

$$\text{b. } (4^{-2})^2 = 4^{-2 \cdot 2} \quad \text{Power of a power property}$$

$$= 4^{-4} \quad \text{Multiply exponents.}$$

$$= \frac{1}{4^4} \quad \text{Definition of negative exponents}$$

$$= \frac{1}{256} \quad \text{Evaluate power.}$$

$$\text{c. } \frac{1}{3^{-4}} = 3^4 \quad \text{Definition of negative exponents}$$

$$= 81 \quad \text{Evaluate power.}$$

$$\text{d. } \frac{5^{-1}}{5^2} = 5^{-1-2} \quad \text{Quotient of powers property}$$

$$= 5^{-3} \quad \text{Subtract exponents.}$$

$$= \frac{1}{5^3} \quad \text{Definition of negative exponents}$$

$$= \frac{1}{125} \quad \text{Evaluate power.}$$



GUIDED PRACTICE for Example 2

Evaluate the expression.

$$5. \frac{1}{4^{-3}}$$

$$6. (5^{-3})^{-1}$$

$$7. (-3)^5 \cdot (-3)^{-5}$$

$$8. \frac{6^{-2}}{6^2}$$