

POWER OF A QUOTIENT Notice what happens when you raise a quotient to a power.

$$\left(\frac{a}{b}\right)^4 = \frac{a}{b} \cdot \frac{a}{b} \cdot \frac{a}{b} \cdot \frac{a}{b} = \frac{a \cdot a \cdot a \cdot a}{b \cdot b \cdot b \cdot b} = \frac{a^4}{b^4}$$

The example above suggests the following property of exponents, known as the power of a quotient property.

KEY CONCEPT

For Your Notebook

Power of a Quotient Property

Let a and b be real numbers with $b \neq 0$, and let m be a positive integer.

Words To find a power of a quotient, find the power of the numerator and the power of the denominator and divide.

Algebra $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$

Example $\left(\frac{3}{2}\right)^7 = \frac{3^7}{2^7}$

SIMPLIFY EXPRESSIONS

When simplifying powers with numerical and variable bases, evaluate the numerical power, as in part (b).

EXAMPLE 2 Use the power of a quotient property

a. $\left(\frac{x}{y}\right)^3 = \frac{x^3}{y^3}$

b. $\left(-\frac{7}{x}\right)^2 = \left(\frac{-7}{x}\right)^2 = \frac{(-7)^2}{x^2} = \frac{49}{x^2}$

EXAMPLE 3 Use properties of exponents

a. $\left(\frac{4x^2}{5y}\right)^3 = \frac{(4x^2)^3}{(5y)^3}$ **Power of a quotient property**

$= \frac{4^3 \cdot (x^2)^3}{5^3 y^3}$ **Power of a product property**

$= \frac{64x^6}{125y^3}$ **Power of a power property**

b. $\left(\frac{a^2}{b}\right)^5 \cdot \frac{1}{2a^2} = \frac{(a^2)^5}{b^5} \cdot \frac{1}{2a^2}$ **Power of a quotient property**

$= \frac{a^{10}}{b^5} \cdot \frac{1}{2a^2}$ **Power of a power property**

$= \frac{a^{10}}{2a^2 b^5}$ **Multiply fractions.**

$= \frac{a^8}{2b^5}$ **Quotient of powers property**