## Properties of Rational Exponents and Radicals

Essential Question How can you use properties of exponents to simplify products and quotients of radicals?

## EXPLORATION 1 Reviewing Properties of Exponents

Work with a partner. Let $a$ and $b$ be real numbers. Use the properties of exponents to complete each statement. Then match each completed statement with the property it illustrates.

## Statement

a. $a^{-2}=$ $\qquad$ ,$a \neq 0$
b. $(a b)^{4}=$ $\qquad$

## Property

A. Product of Powers
B. Power of a Power
c. $\left(a^{3}\right)^{4}=$ $\qquad$ C. Power of a Product
d. $a^{3} \cdot a^{4}=$ $\qquad$ D. Negative Exponent
e. $\left(\frac{a}{b}\right)^{3}=$ $\qquad$ ,$b \neq 0$
E. Zero Exponent
f. $\frac{a^{6}}{a^{2}}=$ $\qquad$ $a \neq 0$
F. Quotient of Powers
g. $a^{0}=$ $\qquad$ ,$a \neq 0$
G. Power of a Quotient

## EXPLORATION 2 Simplifying Expressions with Rational Exponents

Work with a partner. Show that you can apply the properties of integer exponents to rational exponents by simplifying each expression. Use a calculator to check your answers.
a. $5^{2 / 3} \cdot 5^{4 / 3}$
b. $3^{1 / 5} \cdot 3^{4 / 5}$
c. $\left(4^{2 / 3}\right)^{3}$
d. $\left(10^{1 / 2}\right)^{4}$
e. $\frac{8^{5 / 2}}{8^{1 / 2}}$
f. $\frac{7^{2 / 3}}{7^{5 / 3}}$

## EXPLORATION 3 Simplifying Products and Quotients of Radicals

Work with a partner. Use the properties of exponents to write each expression as a single radical. Then evaluate each expression. Use a calculator to check your answers.
a. $\sqrt{3} \cdot \sqrt{12}$
b. $\sqrt[3]{5} \cdot \sqrt[3]{25}$
c. $\sqrt[4]{27} \cdot \sqrt[4]{3}$
d. $\frac{\sqrt{98}}{\sqrt{2}}$
e. $\frac{\sqrt[4]{4}}{\sqrt[4]{1024}}$
f. $\frac{\sqrt[3]{625}}{\sqrt[3]{5}}$

## Communicate Your Answer

4. How can you use properties of exponents to simplify products and quotients of radicals?
5. Simplify each expression.
a. $\sqrt{27} \cdot \sqrt{6}$
b. $\frac{\sqrt[3]{240}}{\sqrt[3]{15}}$
c. $\left(5^{1 / 2} \cdot 16^{1 / 4}\right)^{2}$
