Name ______________________________ Class ____________ Date ____________

# 6-4 Reteaching

## Rational Exponents

You can simplify a number with a rational exponent by converting the expression to a radical expression:

$x^{\frac{1}{n}} = \sqrt[n]{x}$, for $n > 0$ $\qquad 9^{\frac{1}{2}} = \sqrt[2]{9} = 3$ $\qquad 8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

You can simplify the product of numbers with rational exponents $m$ and $n$ by raising the number to the sum of the exponents using the rule

$$a^m \cdot a^n = a^{m+n}$$

**Problem**

What is the simplified form of each expression?

**a.** $36^{\frac{1}{4}} \cdot 36^{\frac{1}{4}}$

$36^{\frac{1}{4}} \cdot 36^{\frac{1}{4}} = 36^{\frac{1}{4}+\frac{1}{4}}$ Use $a^m \cdot a^n = a^{m+n}$.

$= 36^{\frac{1}{2}}$ Add.

$= \sqrt[2]{36}$ Use $x^{\frac{1}{n}} = \sqrt[n]{x}$.

$= 6$ Simplify.

**b.** Write $\left(6x^{\frac{2}{3}}\right)\left(2x^{\frac{3}{4}}\right)$ in simplified form.

$\left(6x^{\frac{2}{3}}\right)\left(2x^{\frac{3}{4}}\right) = 6 \cdot 2 \cdot x^{\frac{2}{3}} \cdot x^{\frac{3}{4}}$ Commutative and Associative Properties of Multiplication

$= 6 \cdot 2 \cdot x^{\frac{2}{3}+\frac{3}{4}}$ Use $x^m \cdot x^n = x^{m+n}$.

$= 12x^{\frac{17}{12}}$ Simplify.

## Exercises

**Simplify each expression. Assume that all variables are positive.**

**1.** $5^{\frac{1}{3}} \cdot 5^{\frac{2}{3}}$ **5**

**2.** $\left(2y^{\frac{1}{4}}\right)\left(3y^{\frac{1}{3}}\right)$ $\mathbf{6y^{\frac{7}{12}}}$

**3.** $(-11)^{\frac{1}{3}} \cdot (-11)^{\frac{1}{3}} \cdot (-11)^{\frac{1}{3}}$ **−11**

**4.** $-y^{\frac{2}{3}}y^{\frac{1}{5}}$ $\mathbf{-y^{\frac{13}{15}}}$

**5.** $5^{\frac{1}{4}} \cdot 5^{\frac{1}{4}}$ $\mathbf{\sqrt{5}}$

**6.** $\left(-3x^{\frac{1}{6}}\right)\left(7x^{\frac{2}{6}}\right)$ $\mathbf{-21\sqrt{x}}$

# 6-4 Reteaching (continued)

## Rational Exponents

To write an expression with rational exponents in simplest form, simplify all exponents and write every exponent as a positive number using the following rules for $a \neq 0$ and rational numbers $m$ and $n$:

$$a^{-n} = \frac{1}{a^n} \qquad \frac{1}{a^{-m}} = a^m \qquad (a^m)^n = a^{mn} \qquad (ab)^m = a^m b^m$$

**Problem**

What is $(8x^9y^{-3})^{-\frac{2}{3}}$ in simplest form?

| | |
|---|---|
| $(8x^9y^{-3})^{-\frac{2}{3}} = (2^3x^9y^{-3})^{-\frac{2}{3}}$ | Factor any numerical coefficients. |
| $= (2^3)^{-\frac{2}{3}}(x^9)^{-\frac{2}{3}}(y^{-3})^{-\frac{2}{3}}$ | Use the property $(ab)^m = a^mb^m$. |
| $= 2^{-2}x^{-6}y^2$ | Multiply exponents, using the property $(a^m)^n = a^{mn}$. |
| $= \dfrac{y^2}{2^2x^6}$ | Write every exponent as a positive number. |
| $= \dfrac{y^2}{4x^6}$ | Simplify. |

## Exercises

**Write each expression in simplest form. Assume that all variables are positive.**

**7.** $(16x^2y^8)^{-\frac{1}{2}}$ $\frac{1}{4xy^4}$

**8.** $(z^{-3})^{\frac{1}{9}}$ $\frac{1}{z^{\frac{1}{3}}}$

**9.** $(2x^{\frac{1}{4}})^4$ $16x$

**10.** $(25x^{-6}y^2)^{\frac{1}{2}}$ $\frac{5y}{x^3}$

**11.** $(8a^{-3}b^9)^{\frac{2}{3}}$ $\frac{4b^6}{a^2}$

**12.** $\left(\frac{16z^4}{25x^8}\right)^{-\frac{1}{2}}$ $\frac{5x^4}{4z^2}$

**13.** $\left(\frac{x^2}{y^{-1}}\right)^{\frac{1}{5}}$ $x^{\frac{2}{5}}y^{\frac{1}{5}}$

**14.** $(27m^9n^{-3})^{-\frac{2}{3}}$ $\frac{n^2}{9m^6}$

**15.** $\left(\frac{32r^2}{2s^4}\right)^{\frac{1}{4}}$ $\frac{2r^{\frac{1}{2}}}{s}$

**16.** $(9z^{10})^{\frac{3}{2}}$ $27z^{15}$

**17.** $(-243)^{-\frac{1}{5}}$ $-\frac{1}{3}$

**18.** $\left(\frac{x^{\frac{2}{5}}}{y^{\frac{1}{2}}}\right)^{10}$ $\frac{x^4}{y^5}$