Lesson 6.4 Warm Up

Simplify:

1. $\sqrt{5x} * \sqrt{8x^2}$

2. $(2 + \sqrt{3})(4 - 2\sqrt{3})$

3. $(2xy)^3(4x^2y)$

Lesson 6.4 Rational Exponents (Clickers)

Essential Understanding: You can write a radical expression in an equivalent form using a fractional (rational) exponent instead of a radical sign.

In general, $\sqrt[n]{x} = x^{\frac{1}{n}}$ for any positive integer n. Like the radical form, the exponent form indicates the principal root.

$\sqrt{36} = 36^{\frac{1}{2}}$ $\quad \sqrt[3]{64} = 64^{\frac{1}{3}}$ $\quad \sqrt[4]{16} = 16^{\frac{1}{4}}$

Key Concept Rational Exponent

If the nth root of a is a real number, m is an integer, and $\frac{m}{n}$ is in lowest terms, then $a^{\frac{1}{n}} = \sqrt[n]{a}$ and $a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$. If m is negative, $a \neq 0$.

*The denominator is the root. The numerator is the exponent.

Ex. What are $x^{\frac{3}{7}}$ and $y^{-3.5}$ in radical form?

Ex. What are $\sqrt{a^5}$ and $(\sqrt[5]{b})^3$ in exponential form?

1 Put the following in radical form.

$x^{\frac{5}{8}}$

2 Put the following in radical form.

$x^{0.2}$

3 Write the expression in exponential form.

$\sqrt[4]{x^3}$

4 Write in exponential form:

$(\sqrt[5]{y})^4$

Properties Properties of Rational Exponents

Let m and n represent rational numbers. Assume that no denominator equals 0.

Property	Example	Property	Example
$a^m \cdot a^n = a^{m+n}$	$8^{\frac{1}{3}} \cdot 8^{\frac{2}{3}} = 8^{\frac{1}{3}+\frac{2}{3}} = 8^1 = 8$	$a^{-m} = \frac{1}{a^m}$	$9^{-\frac{1}{2}} = \frac{1}{9^{\frac{1}{2}}} = \frac{1}{3}$
$(a^m)^n = a^{mn}$	$(5^{\frac{1}{2}})^4 = 5^{\frac{1}{2}\cdot 4} = 5^2 = 25$	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{7^{\frac{3}{2}}}{7^{\frac{1}{2}}} = 7^{\frac{3}{2}-\frac{1}{2}} = 7^1 = 7$
$(ab)^m = a^m b^m$	$(4 \cdot 5)^{\frac{1}{2}} = 4^{\frac{1}{2}} \cdot 5^{\frac{1}{2}} = 2 \cdot 5^{\frac{1}{2}}$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{5}{27}\right)^{\frac{1}{3}} = \frac{5^{\frac{1}{3}}}{27^{\frac{1}{3}}} = \frac{5^{\frac{1}{3}}}{3}$

Ex. Simplify $\dfrac{\sqrt[4]{x^3}}{\sqrt[8]{x^2}}$

Ex. Simplify:

a. $\dfrac{\sqrt{x^3}}{\sqrt[3]{x^2}}$

b. $\sqrt{3}\left(\sqrt[4]{3}\right)$

5 Simplify:

$\sqrt{7}\left(\sqrt[3]{7}\right)$

Ex. What is each expression in simplest form?

a. $\left(-8x\sqrt{xy}\right)^{\frac{2}{3}}$

b. $\left(16y^{-8}\right)^{-\frac{3}{4}}$

6 Write in simplified radical form:

$$(8x^{15})^{-\frac{1}{3}}$$

7 Write in simplest radical form:

$$(9\sqrt[4]{y})^{\frac{3}{2}}$$