

Rational Exponents

We can express roots as rational exponents

$$\sqrt{2} = 2^{\frac{1}{2}}$$

$$\sqrt[3]{x} = x^{\frac{1}{3}}$$

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

One way to remember how to express roots as rational expressions is the phrase: POWER over ROOT

$\sqrt[5]{x^4}$ is written as $x^{\frac{4}{5}}$
since **4** is the power
and **5** is the root.

Example 1:

Simplify each expression

a.) $9^{\frac{1}{2}}$

$$9^{\frac{1}{2}} = \sqrt{9} = 3$$

b.) $4^{\frac{3}{2}}$

$$4^{\frac{3}{2}} \text{ means } \sqrt{4^3} = \sqrt{64} = 8$$

Example 2:

Evaluate

a.) $8^{\frac{3}{8}} \cdot 8^{\frac{1}{2}}$

$$8^{\frac{3}{8}} \cdot 8^{\frac{1}{2}} = 8^{\frac{3}{2} + \frac{1}{2}} = 8^{\frac{4}{2}} = 8^2 = 64$$

$$b.) \mathbf{3^{\frac{1}{4}} \cdot 3^{\frac{3}{4}}}$$

$$c.) \frac{\mathbf{6^{\frac{1}{2}}}}{\mathbf{6^{-\frac{1}{2}}}}$$

$$\frac{\mathbf{6^{\frac{1}{2}}}}{\mathbf{6^{-\frac{1}{2}}}} = \mathbf{6^{\frac{1}{2} - (-\frac{1}{2})}} = \mathbf{6^{\frac{1}{2} + \frac{1}{2}}} = \mathbf{6^{\frac{2}{2}}} = \mathbf{6^1} = \mathbf{6}$$

$$d.) \mathbf{x^{\frac{1}{3}} \cdot x^{\frac{2}{3}}}$$

Example 3:

Rewrite each radical expression as an exponential expression.

$$a.) \mathbf{x^{\frac{3}{4}}}$$

$$\mathbf{x^{\frac{3}{4}} = \sqrt[4]{x^3}}$$

$$b.) \mathbf{\sqrt[9]{8^2}}$$

$$c.) \mathbf{\sqrt[6]{27^3}}$$

Rational Exponents

Practice Problems

Evaluate

1. $4^{\frac{1}{2}}$

2. $5^{\frac{3}{2}}$

3. $\frac{x^{\frac{1}{2}} \cdot x^{\frac{3}{2}}}{x}$

4. $\sqrt[4]{x^2} \cdot \sqrt{x}$