## 3.3 Rational Exponents – Lesson

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Intro to Rational Exponents (fraction exponents):

$$\sqrt{x}$$

**Powers with a rational exponent of the form $\frac{1}{n}$**

A power involving a rational exponent with numerator 1 and denominator *n* can be interpreted as the *n*th root of the base:

**Example 1:** Evaluate each of the following

**a)** $8^{\frac{1}{3}}$

**b)** $\sqrt[5]{-32}$

**c)** $-16^{\frac{1}{4}}$

**d)** $\sqrt[4]{\frac{16}{81}}$

**e)** $(-27)^{-\frac{1}{3}}$

**Powers with a rational exponent of the form $\frac{m}{n}$**

You can evaluate a power involving a rational exponent with numerator *m* and denominator *n* by taking the *n*th root of the base raised to the exponent *m*:

**Example 2:** Simplify each of the following powers

**a)** $\sqrt[5]{y^2}$ **b)** $\sqrt[3]{x}$ **c)** $\sqrt{a^{-3}b^{\frac{4}{3}}}$

**d)** $\sqrt[4]{x^3y^2}$ **e)** $\frac{\sqrt[3]{x^2y}\cdot y^2}{x^3}$

**Example 3:** Evaluate each of the following

**a)** $8^{\frac{2}{3}}$ **b)** $81^{\frac{5}{4}}$ **c)** $\left(\frac{49}{81}\right)^{-\frac{3}{2}}$

## Apply Exponent Rules

**Example 4:** Simplify and express answer using only positive exponents

**a)** $\dfrac{\left(x^{\frac{2}{3}}\right)\left(x^{\frac{2}{3}}\right)}{\left(x^{\frac{1}{3}}\right)}$

**b)** $\left(y^{\frac{1}{4}}\right)^2 \times \left(y^{-\frac{1}{3}}\right)^2$

**c)** $\left(5x^{\frac{1}{2}}\right)^2 \times 4x^{-\frac{1}{2}}$

**d)** $\dfrac{\left(m^{-2}\right)^3\sqrt{m^4}}{m\sqrt{pq^{-3}}}$

**e)** $\dfrac{\left(x^2\right)^{-4} \cdot \sqrt[5]{y^3}}{y\sqrt{x^{-2}y}}$