

## Sec. 7.5 Rational Exponents and Radicals

$$\begin{array}{c} \text{index} \rightarrow n \\ \sqrt[n]{a} \\ \downarrow \\ \text{radicand} \end{array} \quad \begin{array}{c} \nearrow \\ \text{radical sign} \end{array}$$

$$\sqrt{3} = \sqrt[2]{3} \quad x \rightarrow |x|$$

$$\text{Ex: } \sqrt{9} = \sqrt[2]{3 \cdot 3} = 3$$

$$9^{\frac{1}{2}} = (3 \cdot 3)^{\frac{1}{2}} = 3$$

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

$$\sqrt[n]{a^m} = a^{\frac{m}{n}}$$

Problem 1: Simplify

$$\text{a. } \sqrt[3]{27} = \sqrt[3]{\boxed{3 \cdot 3 \cdot 3}} = 3 \quad \left| \quad 27^{\frac{1}{3}} = (3 \cdot 3 \cdot 3)^{\frac{1}{3}} = 3$$

$$\text{b. } \sqrt[4]{256} = \sqrt[4]{\boxed{2 \cdot 2 \cdot 2 \cdot 2} \cdot \boxed{2 \cdot 2 \cdot 2 \cdot 2}} = 2 \cdot 2 = 4$$

$$\text{c. } \sqrt[4]{625} = 5$$

Problem 2: Write in radical form.

$$a. x^{\frac{3}{5}} = \sqrt[5]{x^3}$$

$$b. z^{\frac{4}{7}} = \sqrt[7]{z^4}$$

$$c. (8a)^{\frac{2}{3}} = \sqrt[3]{(8a)^2} = \sqrt[3]{8^2 a^2}$$

$$= \sqrt[3]{64a^2} = \sqrt[3]{\boxed{2 \cdot 2 \cdot 2} \boxed{2 \cdot 2 \cdot 2} a \cdot a}$$

$$\begin{array}{c} 8 \quad 8 \\ \textcircled{2} \textcircled{4} \textcircled{2} \quad \textcircled{2} \textcircled{4} \textcircled{2} \\ \textcircled{2} \textcircled{2} \quad \textcircled{2} \textcircled{2} \end{array} \quad \begin{array}{c} 2 \cdot 2 \sqrt{a \cdot a} \\ 4 \sqrt[3]{a^2} \end{array}$$

$$d. (98d)^{\frac{1}{2}} = \sqrt{98d} = \sqrt{2 \cdot \boxed{7 \cdot 7} d}$$

$$\begin{array}{c} \textcircled{2} \textcircled{49} \\ \textcircled{7} \textcircled{7} \end{array} \quad 7\sqrt{2d}$$

Problem 3: Write in exponential form.

$$a. \sqrt[7]{y^4} \quad y^{\frac{4}{7}}$$

$$b. \sqrt[5]{32b^3} = (32b^3)^{\frac{1}{5}} = 32^{\frac{1}{5}} b^{\frac{3}{5}}$$

$$(2 \cdot 2 \cdot 2 \cdot 2 \cdot 2)^{\frac{1}{5}} b^{\frac{3}{5}} \quad \begin{array}{c} \textcircled{2} \textcircled{16} \\ \textcircled{2} \textcircled{8} \\ \textcircled{2} \textcircled{4} \\ \textcircled{2} \textcircled{2} \end{array}$$

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

$$\sqrt[5]{\boxed{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} b b b} = 2 \sqrt[5]{b^3} = 2b^{\frac{3}{5}}$$

$$2d. (24c)^{\frac{2}{3}} = \sqrt[3]{(24c)^2} = \sqrt[3]{24^2 c^2}$$

$$= \sqrt[3]{24 \cdot 24 c^2} = \sqrt[3]{\boxed{2 \cdot 2 \cdot 2} \boxed{2 \cdot 2 \cdot 2} \cdot 3 \cdot 3 c c}$$

$$\begin{array}{c} 6 \quad 4 \\ \textcircled{2} \textcircled{3} \textcircled{2} \textcircled{2} \textcircled{2} \textcircled{3} \textcircled{2} \\ \textcircled{2} \textcircled{2} \end{array} \quad \begin{array}{c} 3 \\ 2 \cdot 2 \sqrt{3 \cdot 3 \cdot c c} \\ 4 \sqrt[3]{9c^2} \end{array}$$

Problem 4: Use the formula

$R = 73.3 \sqrt[4]{M^3}$  to find the metabolic rate of a dog with a body mass of 35 kg.

$$R = 73.3 \sqrt[4]{35^3}$$

approx. 1055 Cal per day

$$3 \ 5 \ y^x \ 3 \ = \quad 2nd \ y^x \ 4 \ =$$

$$x \ 7 \ 3 \ . \ 3 \ =$$