P.280: 6-38 even

Index (Root) → $\sqrt[n]{a}$ ← Radical symbol

↑ Radicand

GUIDED NOTES – Lesson 6.3

Rational Exponents and nth Roots

OBJECTIVE: I can simplify and convert radical expressions and nth roots.

Remember that a cube represents three factors of a value. For example, $2^3 = 8$. ***Cubes and cube roots are INVERSE operations***.

Since $2^3 = 8$, $\sqrt[3]{8} = 2$

$4^3 = 64$, so $\sqrt[3]{64} = 4$

$8^3 = 512$, so 8 = $\sqrt[3]{512}$

Suppose the volume of a cube is $V = x^3$ where *x* represents the side length. If the volume is 125 cubic inches, what is the side length?

$125 = x^3$

$\sqrt[3]{125} = x$

$x = 5$ inches

nth roots can be written as rational exponents. A RATIONAL exponent is one that can be written as a fraction. In general,

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

$\sqrt[3]{64}$ can be written as $64^{1/3}$

$\sqrt[3]{27}$ can be written as $27^{1/3}$

$\sqrt[4]{625} = \sqrt[4]{5\cdot5\cdot5\cdot5}$

25 25

5 5 5 5

$\sqrt[4]{5^4}$

→ 5

$\sqrt[3]{343} = \sqrt[3]{7\cdot7\cdot7}$

7 49

7 7

$\sqrt[3]{7^3} = 7$

$\sqrt[5]{64} = \sqrt[5]{2\cdot2\cdot2\cdot2\cdot2\cdot2}$

8 8

4 2 2 4

2 2 2 2

$\sqrt[5]{2^5}$

$= 2$

Sometimes fractional exponents are used to represent power of numbers or variables. The numerator of the fraction (m) represents the power, the denominator (n) represents the root. The exponent in the denominator must always be positive.

exponent

Root Root

$$\boxed{a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m}$$

Root exponent exponent

PRACTICE: Write the expression in radical form:

A) $x^{\frac{2}{5}} = \left(\sqrt[5]{x}\right)^2$

B) $a^{\frac{7}{4}}$ $\left(\sqrt[4]{x}\right)^7$

EXAMPLES: Evaluate each exponential.

a. $25^{3/2} = 125$

$\left(\sqrt[2]{25}\right)^3$

$(5)^3$

b. $27^{2/3} = 9$

$\left(\sqrt[3]{27}\right)^2$

$(3)^2$

c. $-16^{3/2} = -64$

$-\left(\sqrt[2]{16}\right)^3$

$-(4)^3$

d. $(-64)^{2/3} = 16$

$\left(\sqrt[3]{-64}\right)^2$

$(-4)^2$

e. $\left(\frac{64}{25}\right)^{\frac{3}{2}} = 125/512$

$\left(\frac{25}{64}\right)^{3/2}$

$\left(\sqrt{25/64}\right)^3$

$(5/8)^3$