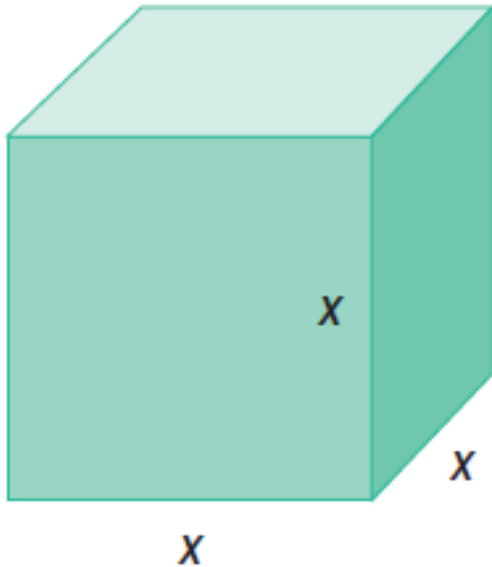


4.3 - Working with Rational Exponents

- GOAL – Investigate powers involving rational exponents and evaluate expressions containing them.



The volume of this cube is $V(x) = x^3$ and the area of its base is $A(x) = x^2$.

Express the side length x as a power of A and V . We want $x = V^n$

$$V = x^3$$

$$V^{1/3} = (x^3)^{1/3}$$

$$V^{1/3} = x^1$$

$$x = V^{1/3}$$

Example #2

- Express the following in radical notation. Then evaluate.

$$\begin{aligned} \text{a) } 49^{-\frac{1}{2}} &= \frac{1}{49^{\frac{1}{2}}} \\ &= \frac{1}{\sqrt{49}} \\ &= \frac{1}{7} \end{aligned}$$

$$\begin{aligned} \text{b) } (-8)^{\frac{1}{3}} &= \sqrt[3]{-8} \\ &= -2 \end{aligned}$$

$$\begin{aligned} \text{c) } 10000^{\frac{1}{4}} &= \sqrt[4]{10000} \\ &= 10 \end{aligned}$$

Example #3

Two Ways to Find Solution:

- Evaluate $27^{\frac{2}{3}}$.

$$= 27^{\frac{1}{3} \times 2}$$

$$= (27^{\frac{1}{3}})^2$$

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

$$= (3)^2$$

$$= 9$$

$$= 27^{2 \times \frac{1}{3}}$$

$$= (27^2)^{\frac{1}{3}}$$

$$= \sqrt[3]{27^2}$$

$$= \sqrt[3]{729}$$

$$= 9$$

Example #4

- Evaluate $(-27)^{4/3}$
- $(-27)^{4/3} = ((-27)^{1/3})^4$
- $= (\sqrt[3]{-27})^4$
- $= (-3)^4$
- $= 81$

Example #5

Simplify, then evaluate: $\frac{8^{\frac{5}{6}}\sqrt{8}}{8^{\frac{5}{3}}}$.

$$\begin{aligned}\frac{8^{\frac{5}{6}}\sqrt{8}}{8^{\frac{5}{3}}} &= \frac{8^{\frac{5}{6}}8^{\frac{1}{2}}}{8^{\frac{5}{3}}} \\ &= \frac{8^{\frac{5}{6}+\frac{1}{2}}}{8^{\frac{5}{3}}}\end{aligned}$$

$$\begin{aligned}&= \frac{8^{\frac{4}{3}}}{8^{\frac{5}{3}}} \\ &= 8^{\frac{4}{3}-\frac{5}{3}} \\ &= 8^{-\frac{1}{3}} \\ &= \frac{1}{8^{\frac{1}{3}}} \\ &= \frac{1}{2}\end{aligned}$$

In Summary...

$$b^{\frac{1}{n}} = \sqrt[n]{b}, \text{ where } b \neq 0.$$

$$b^{\frac{m}{n}} = (\sqrt[n]{b})^m = \sqrt[n]{b^m}, \text{ where } b \neq 0.$$