Reteaching 7-1

Roots and Radical Expressions

> **OBJECTIVE:** Simplifying radical expressions   **MATERIALS:** None

- For any real numbers a and b, and any positive integer n,
  if $a^n = b$, then a is an nth root of b.

- For any negative real number a, $\sqrt[n]{a^n} = |a|$ when n is even.

Examples

Simplify $\sqrt[3]{1000x^3y^9}$.

$$\sqrt[3]{1000x^3y^9} = \sqrt[3]{10^3x^3(y^3)^3} \quad \longleftarrow \textbf{Write each factor as a cube.}$$

$$= \sqrt[3]{(10xy^3)^3} \quad \longleftarrow \textbf{Write as the cube of a product.}$$

$$= 10xy^3 \quad \longleftarrow \textbf{Simplify.}$$

Simplify $\sqrt[4]{\dfrac{256g^8}{h^4k^{16}}}$.

$$\sqrt[4]{\frac{256g^8}{h^4k^{16}}} = \sqrt[4]{\frac{4^4(g^2)^4}{h^4(k^4)^4}}$$

$$= \sqrt[4]{\left(\frac{4g^2}{hk^4}\right)^4} = \frac{4g^2}{|h|k^4}$$

The absolute value symbols are needed to ensure the root is positive when h is negative. Note that $4g^2$ and k^4 are never negative.

Exercises

Simplify. Use absolute value symbols when needed.

1. $\sqrt{36x^2}$ **2.** $\sqrt[3]{216y^3}$ **3.** $\sqrt{\dfrac{1}{100x^2}}$

4. $\dfrac{\sqrt{x^{20}}}{\sqrt{y^8}}$ **5.** $\sqrt[3]{\dfrac{(x+3)^3}{(x-4)^6}}$ **6.** $\sqrt[5]{x^{10}y^{15}z^5}$

7. $\sqrt[3]{\dfrac{27z^3}{(z+12)^6}}$ **8.** $\sqrt[4]{2401x^{12}}$ **9.** $\sqrt[3]{\dfrac{1331}{x^3}}$

10. $\sqrt[4]{\dfrac{(y-4)^8}{(z+9)^4}}$ **11.** $\sqrt[3]{\dfrac{a^6b^6}{c^3}}$ **12.** $\sqrt[3]{-x^3y^6}$