Simplifying Radicals

Product Rule for Radicals:
• The product rule for radicals states that the product of two square roots is equal to the square root of the product.

Example 1:

\[ \sqrt{4} \cdot \sqrt{9} = \sqrt{4 \cdot 9} \]

\[ = \sqrt{36} \]

\[ = 6 \]

We can evaluate this way:

\[ \sqrt{4} \cdot \sqrt{9} = 2 \cdot 3 \]

\[ = 6 \]

And we get the same answer.

We will use the product rule for radicals to simplify radical expressions.

Example 2:

Simplify \( \sqrt{8} \).

\[ \sqrt{8} = \sqrt{4 \cdot 2} \]

\[ = \sqrt{4} \cdot \sqrt{2} \]

\[ = 2 \cdot \sqrt{2} \]

\[ = 2\sqrt{2} \]
Example 3:

Simplify $\sqrt{12}$.

$\sqrt{12}$ can be broken down in two ways:

$$\sqrt{12} = \sqrt{6 \cdot 2} \quad \text{OR} \quad \sqrt{12} = \sqrt{4 \cdot 3}$$

Since 4 is a perfect square, we choose to break up $\sqrt{4 \cdot 3}$

$$\sqrt{12} = \sqrt{4 \cdot 3}$$
$$= \sqrt{4} \cdot \sqrt{3}$$
$$= 2\sqrt{3}$$

Example 4:

Simplify $\sqrt{20x^2y^3}$.

We want to write $20x^2y^3$ as a product.

$$\sqrt{20x^2y^3} = \sqrt{4 \cdot 5 \cdot x^2 \cdot y^2 \cdot y}$$
$$= \sqrt{4} \cdot \sqrt{5} \cdot \sqrt{x^2} \cdot \sqrt{y^2} \cdot \sqrt{y}$$
$$= 2 \cdot \sqrt{5} \cdot x \cdot y \cdot \sqrt{y}$$
$$= 2xy\sqrt{5y}$$
Perfect Cubes:

8 is a perfect cube since $2^3 = 8$

Written in math:

$$\sqrt[3]{8} = 2$$

said “the cube root of 8 is 2”.

Example 5:

Evaluate:

a.) $\sqrt[3]{64} =$

b.) $\sqrt[3]{x^3} =$

c.) $\sqrt[3]{x^9} =$

d.) $\sqrt[3]{27x^4} =$
Simplify Radicals

Practice Problems

Simplify:

1. $\sqrt{24}$

2. $\sqrt{32x^2}$

3. $\sqrt{200x^4y^5}$

Evaluate:

4. $\sqrt[3]{125}$

5. $\sqrt[3]{1000x^5y^6}$