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 also 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:

\[
\sqrt{12} = \sqrt{16 \cdot 2} \quad \text{or} \quad \sqrt{12} = \sqrt{4 \cdot 3}
\]

Since 4 is a perfect square, we choose to break up \( \sqrt{12} \) as \( \sqrt{4 \cdot 3} \)

\[
\sqrt{12} = \sqrt{4 \cdot 3} = \sqrt{4} \cdot \sqrt{3} = 2 \sqrt{3}
\]

Example 4: Simplify \( \sqrt{20x^2y^3} \)

We want to write \( 20x^2y^3 \) as a product.

\[
\sqrt{20x^2y^3} = \sqrt{4 \cdot 5 \cdot x^2 \cdot y^2 \cdot y} = \sqrt{4} \cdot \sqrt{5} \cdot \sqrt{x^2} \cdot \sqrt{y^2} \cdot \sqrt{y} = 2 \sqrt{5} \cdot x \cdot y \cdot \sqrt{y} = 2xy \sqrt{5y}
\]
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: Simplify

A) $\sqrt[3]{64} =$

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

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

D) $\sqrt[3]{27x^4} =$

E) $\sqrt{32x^3y^5z^{10}}$

f) $\sqrt[3]{32x^3y^5z^{10}}$
### Simplifying Radicals Practice Problems

#### Simplify:

1. \( \sqrt{24} \)

2. \( \sqrt{32} x^3 \)

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

#### Evaluate:

4. \( \sqrt[3]{125} \)

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