

Take note **Property** Combining Radical Expressions: Products

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, then $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$.

Problem 1 Multiplying Radical Expressions

Got It? Can you simplify the product of the radical expressions? Explain.

a. $\sqrt[4]{7} \cdot \sqrt[5]{7}$

b. $\sqrt[5]{-5} \cdot \sqrt[5]{-2}$

A Practice Multiply, if possible. Then simplify.

1. $\sqrt[3]{4} \cdot \sqrt[3]{16}$

2. $\sqrt[3]{-12} \cdot \sqrt[3]{-18}$

If the radicand of $\sqrt[n]{a}$ has a perfect n th power among its factors, you can *reduce* the radical. If you reduce a radical as much as possible, the radical is in **simplest form**. For example, consider $\sqrt{24}$ and $\sqrt[3]{24}$.

$\sqrt{24} = \sqrt{4 \cdot 6} = \sqrt{2^2 \cdot 6} = \sqrt{2^2} \cdot \sqrt{6} = 2\sqrt{6}$ $2\sqrt{6}$ is in simplest form.

$\sqrt[3]{24} = \sqrt[3]{8 \cdot 3} = \sqrt[3]{2^3 \cdot 3} = \sqrt[3]{2^3} \cdot \sqrt[3]{3} = 2\sqrt[3]{3}$ $2\sqrt[3]{3}$ is in simplest form.

Problem 2 Simplifying a Radical Expression

Got It? What is the simplest form of $\sqrt[3]{128x^7}$?

A Practice Simplify.

3. $\sqrt[3]{81x^3}$

4. $\sqrt[4]{64x^3y^6}$

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Problem 3 Simplifying a Product

Got It? What is the simplest form of $\sqrt{45x^5y^3} \cdot \sqrt{35xy^4}$?

A Practice Multiply and simplify.

5. $-\sqrt[3]{2x^2y^2} \cdot 2\sqrt[3]{15x^5y}$

6. $3\sqrt[4]{18a^9} \cdot \sqrt[4]{6ab^2}$

Take note

Property Combining Radical Expressions: Quotients

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers and $b \neq 0$, then $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$.

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Problem 4 Dividing Radical Expressions

Got It? a. What is the simplest form of $\frac{\sqrt{50x^6}}{\sqrt{2x^4}}$?

A Practice Divide and simplify.

7. $\frac{\sqrt{48x^3}}{\sqrt{3xy^2}}$

8. $\frac{\sqrt{20ab}}{\sqrt{45a^2b^3}}$

Another way to simplify a radical expression is to **rationalize the denominator**. You rewrite the expression so that there are no radicals in any denominator and no denominator in any radical.

Multiply by 1.

$$\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \left(\frac{\sqrt{2}}{\sqrt{2}} \right) = \frac{\sqrt{2}}{2}$$

The product of $\sqrt{2}$ and itself is a rational number, 2.

Problem 5 Rationalizing the Denominator

Got It? a. What is the simplest form of $\frac{\sqrt[3]{7x}}{\sqrt[3]{5y^2}}$?

A Practice Rationalize the denominator of each expression.

9. $\frac{\sqrt{3xy^2}}{\sqrt{5xy^3}}$

10. $\frac{\sqrt[3]{12ab^3c^2}}{\sqrt[3]{10a^3bc}}$
