

Properties of Square Roots

A **radical expression** is an expression that contains a radical. A radical expression involving square roots is in **simplest form** when these three conditions are met.

- No radicands have perfect square factors other than 1.
- No radicands contain fractions.
- No radicals appear in the denominator of a fraction.

You can use the properties below to simplify radical expressions involving square roots.

Product Property of Square Roots	Quotient Property of Square Roots
$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$, where $a, b \geq 0$	$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$, where $a \geq 0$ and $b > 0$

Example 1 Simplify (a) $\sqrt{75}$ and (b) $\sqrt{\frac{13}{25}}$.

a. $\sqrt{75} = \sqrt{25 \cdot 3}$ Factor using the greatest perfect square factor.
 $= \sqrt{25} \cdot \sqrt{3}$ Product Property of Square Roots
 $= 5\sqrt{3}$ Simplify.

b. $\sqrt{\frac{13}{25}} = \frac{\sqrt{13}}{\sqrt{25}}$ Quotient Property of Square Roots
 $= \frac{\sqrt{13}}{5}$ Simplify.

When a radical is in the denominator of a fraction, you can multiply the fraction by an appropriate form of 1 to eliminate the radical from the denominator. This process is called **rationalizing the denominator**.

Example 2 Simplify $\frac{10}{\sqrt{7}}$ by rationalizing the denominator.

$$\frac{10}{\sqrt{7}} = \frac{10}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} \quad \text{Multiply by } \frac{\sqrt{7}}{\sqrt{7}}.$$

$$= \frac{10\sqrt{7}}{\sqrt{49}} \quad \text{Product Property of Square Roots}$$

$$= \frac{10\sqrt{7}}{7} \quad \text{Simplify.}$$

Practice

Check your answers at BigIdeasMath.com.

Simplify the expression.

1. $\sqrt{12}$

2. $-\sqrt{45}$

3. $\sqrt{500}$

4. $\sqrt{112}$

5. $\sqrt{\frac{3}{4}}$

6. $\sqrt{\frac{10}{49}}$

7. $-\sqrt{\frac{8}{25}}$

8. $\sqrt{\frac{48}{81}}$

9. $\frac{3}{\sqrt{5}}$

10. $-\frac{14}{\sqrt{10}}$

11. $\sqrt{\frac{3}{8}}$

12. $\sqrt{\frac{7}{32}}$