

# 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.

$$\begin{aligned} \frac{10}{\sqrt{7}} &= \frac{10}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} && \text{Multiply by } \frac{\sqrt{7}}{\sqrt{7}}. \\ &= \frac{10\sqrt{7}}{\sqrt{49}} && \text{Product Property of Square Roots} \\ &= \frac{10\sqrt{7}}{7} && \text{Simplify.} \end{aligned}$$

## Practice

Check your answers at [BigIdeasMath.com](http://BigIdeasMath.com).

Simplify the expression.

- $\sqrt{12}$     $2\sqrt{3}$
- $-\sqrt{45}$     $-3\sqrt{5}$
- $\sqrt{500}$     $10\sqrt{5}$
- $\sqrt{112}$     $4\sqrt{7}$
- $\sqrt{\frac{3}{4}}$     $\frac{\sqrt{3}}{2}$
- $\sqrt{\frac{10}{49}}$     $\frac{\sqrt{10}}{7}$
- $-\sqrt{\frac{8}{25}}$     $-\frac{2\sqrt{2}}{5}$
- $\sqrt{\frac{48}{81}}$     $\frac{4\sqrt{3}}{9}$
- $\frac{3}{\sqrt{5}}$     $\frac{3\sqrt{5}}{5}$
- $-\frac{14}{\sqrt{10}}$     $-\frac{7\sqrt{10}}{5}$
- $\sqrt{\frac{3}{8}}$     $\frac{\sqrt{6}}{4}$
- $\sqrt{\frac{7}{32}}$     $\frac{\sqrt{14}}{8}$