

## Lesson 11-1

### Example 1 Simplify Square Roots Simplify.

a.  $\sqrt{32}$

$$\begin{aligned}\sqrt{32} &= \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} \\ &= \sqrt{2^2} \cdot \sqrt{2^2} \cdot \sqrt{2} \\ &= 2 \cdot 2 \cdot \sqrt{2} \\ &= 4\sqrt{2}\end{aligned}$$

Prime factorization of 32

Product Property of Square Roots

Simplify.

Simplify.

b.  $\sqrt{124}$

$$\begin{aligned}\sqrt{124} &= \sqrt{2 \cdot 2 \cdot 31} \\ &= \sqrt{2^2} \cdot \sqrt{31} \\ &= 2\sqrt{31}\end{aligned}$$

Prime factorization of 124

Product Property of Square Roots

Simplify.

### Example 2 Multiply Square Roots

Find  $\sqrt{5} \cdot \sqrt{18}$ .

$$\begin{aligned}\sqrt{5} \cdot \sqrt{18} &= \sqrt{5} \cdot \sqrt{2} \cdot \sqrt{9} \\ &= \sqrt{5 \cdot 2} \cdot \sqrt{3^2} \\ &= \sqrt{10} \cdot 3 \\ &= 3\sqrt{10}\end{aligned}$$

Product Property of Square Roots

Product Property

Simplify.

Simplify.

### Example 3 Simplify a square Root with Variables

Simplify  $\sqrt{27a^5bc^2}$ .

$$\begin{aligned}\sqrt{27a^5bc^2} &= \sqrt{3^3a^5bc^2} \\ &= \sqrt{3^2} \cdot \sqrt{3} \cdot \sqrt{a^4} \cdot \sqrt{a} \cdot \sqrt{b} \cdot \sqrt{c^2} \\ &= 3 \cdot \sqrt{3} \cdot a^2 \cdot \sqrt{a} \cdot \sqrt{b} \cdot |c| \\ &= 3a^2 |c| \sqrt{3ab}\end{aligned}$$

Prime factorization

Product Property

Simplify.

The absolute value of  $c$  ensures a nonnegative result.

#### Example 4 Rationalizing the Denominator

Simplify.

a.  $\frac{\sqrt{6}}{\sqrt{5}}$

$$\begin{aligned}\frac{\sqrt{6}}{\sqrt{5}} &= \frac{\sqrt{6}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} \\ &= \frac{\sqrt{30}}{5}\end{aligned}$$

Multiply by  $\frac{\sqrt{5}}{\sqrt{5}}$  to rationalize the denominator.

Product Property of Square Roots

b.  $\frac{5}{\sqrt{108}}$

$$\begin{aligned}\frac{5}{\sqrt{108}} &= \frac{5}{\sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3}} \\ &= \frac{5}{2 \cdot 3 \cdot \sqrt{3}} \\ &= \frac{5}{6\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} \\ &= \frac{5\sqrt{3}}{18}\end{aligned}$$

Prime factorization

Simplify.

Multiply by  $\frac{\sqrt{3}}{\sqrt{3}}$ .

Product Property of Square Roots

#### Example 5 Use Conjugates to Rationalize a Denominator

Simplify  $\frac{5}{2\sqrt{2}+3}$ .

$$\begin{aligned}\frac{5}{2\sqrt{2}+3} &= \frac{5}{2\sqrt{2}+3} \cdot \frac{2\sqrt{2}-3}{2\sqrt{2}-3} \\ &= \frac{5(2\sqrt{2}-3)}{(2\sqrt{2})^2-3^2} \\ &= \frac{10\sqrt{2}-15}{8-9} \\ &= \frac{10\sqrt{2}-15}{-1} \\ &= -1(10\sqrt{2}-15) \\ &= 15-10\sqrt{2}\end{aligned}$$

$$\frac{2\sqrt{2}-3}{2\sqrt{2}-3} = 1$$

$$(a-b)(a+b) = a^2 - b^2$$

$$(2\sqrt{2})^2 = 8$$

Simplify.