

Algebra 1

Lesson 11.2A

Simplify Radical Expressions

Warm-Up

(a) Solve $x^2 + 4x - 7 = 0$ by completing the square.

(b) Solve $x^2 + 4x - 7 = 0$ by the quadratic formula.

SIMPLEST FORM of a radical expression

- ① No perfect square factors in the radicand (other than 1)
- ② No fractions in the radicand
- ③ No radicals allowed in the denominator
*MUST rationalize the denominator

Example 1. Using the Product Property of Radicals

Simplify.

(a) $\sqrt{32}$

$$\begin{aligned} &\sqrt{8 \cdot 4} \\ &\sqrt{8} \cdot \sqrt{4} \\ &2\sqrt{8} \\ &2\sqrt{4 \cdot 2} \\ &4\sqrt{2} \end{aligned}$$

(b) $\sqrt{48} = \sqrt{16 \cdot 3}$

$$\sqrt{16} \cdot \sqrt{3}$$

$$4\sqrt{3}$$

(c) $\sqrt{24}$

$$\sqrt{4} \cdot \sqrt{6}$$

$$2\sqrt{6}$$

(d) $\sqrt{90}$

$$\sqrt{9} \cdot \sqrt{10}$$

$$3\sqrt{10}$$

Example 2. Use the Product Property of Radicals with Variables

(a) $\sqrt{25x^2}$

$$\sqrt{25} \cdot \sqrt{x^2}$$

$$5x$$

(b) $\sqrt{9x^3}$

$$\sqrt{9} \cdot \sqrt{x^3}$$

$$\sqrt{9} \cdot \sqrt{x^2 \cdot x}$$

$$\sqrt{9} \cdot \sqrt{x^2} \cdot \sqrt{x}$$

$$3x\sqrt{x}$$

(c) $\sqrt{27x}$

$$\sqrt{27} \cdot \sqrt{x}$$

$$\sqrt{9} \cdot \sqrt{3} \cdot \sqrt{x}$$

$$3\sqrt{3x}$$

(d) $\sqrt{20n^2}$

$$\sqrt{20} \cdot \sqrt{n^2}$$

$$\sqrt{4} \cdot \sqrt{5} \cdot \sqrt{n^2}$$

$$2n\sqrt{5}$$

Try It!

(a) $\sqrt{50}$

$$\sqrt{25} \sqrt{2}$$

$$5\sqrt{2}$$

(b) $\sqrt{12}$

$$\sqrt{4} \sqrt{3}$$

$$2\sqrt{3}$$

(c) $\sqrt{18b^3}$

$$\sqrt{9} \sqrt{2} \sqrt{b^2} \sqrt{b}$$

$$3b\sqrt{2b}$$

(d) $\sqrt{54y}$

$$\sqrt{9} \sqrt{6} \sqrt{y}$$

$$3\sqrt{6y}$$

Example 3. Multiply Radicals
Simplify.

(a) $\sqrt{6} \cdot \sqrt{6}$

$$\sqrt{36}$$

$$6$$

(b) $\sqrt{3} \cdot \sqrt{12}$

$$\sqrt{36}$$

$$6$$

(c) $3\sqrt{b} \cdot \sqrt{2b^3}$

$$3\sqrt{2b^4}$$

$$3\sqrt{2} \sqrt{b^4}$$

$$3b^2\sqrt{2}$$

(d) $2\sqrt{mn^2} \cdot \sqrt{5m^2}$

$$2\sqrt{m^2 mn^2 5m^2}$$

$$2mn\sqrt{5m}$$

Example 4. Use the Quotient Property of Radicals
Simplify.

(a) $\frac{\sqrt{25}}{\sqrt{49}}$

$$\frac{\sqrt{25}}{\sqrt{49}} = \frac{5}{7}$$

(b) $\frac{\sqrt{13}}{\sqrt{100}}$

$$\frac{\sqrt{13}}{\sqrt{100}} = \frac{\sqrt{13}}{10}$$

(c) $\frac{\sqrt{7}}{\sqrt{x^2}}$

$$\frac{\sqrt{7}}{\sqrt{x^2}} = \frac{\sqrt{7}}{x}$$

(d) $\frac{\sqrt{11}}{\sqrt{d^4}}$

$$\frac{\sqrt{11}}{\sqrt{d^4}} = \frac{\sqrt{11}}{d^2}$$

Try It!
Simplify.

(a) $4\sqrt{5} \cdot \sqrt{10}$

$$4\sqrt{50}$$

$$4\sqrt{25 \cdot 2}$$

$$20\sqrt{2}$$

(b) $\sqrt{6x} \cdot \sqrt{8x}$

$$\sqrt{48x^2}$$

$$\sqrt{16x^2} \sqrt{3}$$

$$4x\sqrt{3}$$

(c) $\frac{\sqrt{14}}{\sqrt{9}}$

$$\frac{\sqrt{14}}{\sqrt{9}}$$

$$\frac{\sqrt{14}}{3}$$

(d) $\frac{\sqrt{x}}{\sqrt{81}}$

$$\frac{\sqrt{x}}{\sqrt{81}}$$

$$\frac{\sqrt{x}}{9}$$

KEY CONCEPT

For Your Notebook

Product Property of Radicals

Words The square root of a product equals the product of the square roots of the factors.

Algebra $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$
where $a \geq 0$ and $b \geq 0$

Example $\sqrt{4x} = \sqrt{4} \cdot \sqrt{x} = 2\sqrt{x}$

KEY CONCEPT

For Your Notebook

Quotient Property of Radicals

Words The square root of a quotient equals the quotient of the square roots of the numerator and denominator.

Algebra $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ where $a \geq 0$ and $b > 0$

Example $\sqrt{\frac{16}{25}} = \frac{\sqrt{16}}{\sqrt{25}} = \frac{4}{5}$

Homework

New: Pg. 723 #3-23

Review:

Solve using the Quadratic Formula.

1. $2x^2 + 7x - 3 = 0$

2. $5x^2 - 7x = -1$