Simplifying Radicals

LESSON 12.1

OBJECTIVE: IDENTIFY OR ESTIMATE SQUARE ROOTS, DEFINE AND WRITE SQUARE ROOTS IN SIMPLEST RADICAL FORM.

Warm up

Evaluate

1. 14^2
2. $(-5)^2$
3. $\sqrt{81}$
4. $-\sqrt{1}$
5. $y \cdot y$
6. $\sqrt{-49}$

Definition of Square Root

If $\underline{a}$ is a number greater than of equal to zero, $\sqrt{a}$ represents the principal, or positive, square root of $\underline{a}$ and - $\sqrt{a}$ represents the negative square root of $\underline{a}$. The square roots of $\underline{a}$ have the following property:

$$\sqrt{a} \cdot \sqrt{a} = a \qquad (-\sqrt{a})(-\sqrt{a}) = a$$

The symbol $\sqrt{\ }$ is called the radical sign or just radical and the number or expression under the radical is called the radicand.

Objective: To simplify radicals

Know your Perfect Squares

x	x^2	x	x^2	x	x^2
2	4	9	81	16	256
3	9	10	100	17	289
4	16	11	121	18	324
5	25	12	144	19	361
6	36	13	169	20	400
7	49	14	196		
8	64	15	225		

Practice

Evaluate each square root.

1. $\sqrt{100}$ 2. $-\sqrt{225}$ 3. $\sqrt{11}$ 4. $\pm\sqrt{121}$

Radical expressions that are simplified are easier to manipulate algebraically. A square root is in **simplest radical form** when:

1. No factor of the radicand is a perfect square other than 1.
2. The radicand contains no fractions.
3. No radical appears in the denominator of a fraction.

Multiplication Property of Square Roots

For all numbers a and b, where a ≥ 0 and b ≥ 0:

$$\sqrt{ab} = \sqrt{a}\sqrt{b}$$

Example 1: Simplify

a. $\sqrt{216} \quad = \sqrt{36 \cdot 6} \quad = \sqrt{36} \cdot \sqrt{6} \quad = 6\sqrt{6}$

b. $3\sqrt{125} \quad = 3\sqrt{25 \cdot 5} \quad = 3 \cdot 5\sqrt{5} \quad = 15\sqrt{5}$

c. $\sqrt{1920} \quad = \sqrt{64 \cdot 30} \quad = 8\sqrt{30}$

Or

$$= \sqrt{4 \cdot 480} \quad = 2\sqrt{480} = 2\sqrt{4 \cdot 120} = 4\sqrt{120} \quad = 4\sqrt{4 \cdot 30} \quad = 8\sqrt{30}$$

d. $\sqrt{y^6}$

e. $\sqrt{r^6 s^3}$, for s ≥ 0

Practice 1: Simplify

a. $\sqrt{18}$ $= 3\sqrt{2}$

b. $3\sqrt{12}$ $= 6\sqrt{3}$

c. $\sqrt{196}$ $= 14$

d. $\sqrt{960}$ $= 8\sqrt{15}$

e. $\sqrt{72m^2n^5}$

Radical expressions that are simplified are easier to manipulate algebraically. A square root is in **simplest radical form** when:

1. No factor of the radicand is a perfect square other than 1.
2. **The radicand contains no fractions.**
3. **No radical appears in the denominator of a fraction.**

Division Property of Square Roots

For all numbers a and b, where $a \geq 0$ and $b > 0$:

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

Objective: To simplify products and quotients of radicals

Example 2: Simplify

a. $\sqrt{\frac{2}{3}} = \frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{2}}{\sqrt{3}} \gamma \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{6}}{\sqrt{9}} = \frac{\sqrt{6}}{3}$

b. $\frac{\sqrt{18}}{\sqrt{12}} = \frac{\sqrt{9 \cdot 2}}{\sqrt{4 \cdot 3}} = \frac{3\sqrt{2}}{2\sqrt{3}} \gamma \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{6}}{2\sqrt{9}} = \frac{3\sqrt{6}}{2 \cdot 3} = \frac{\sqrt{6}}{2}$

c. $\frac{\sqrt{75}}{2\sqrt{18}} = \frac{\sqrt{25 \cdot 3}}{2\sqrt{9 \cdot 2}} = \frac{5\sqrt{3}}{2 \cdot 3\sqrt{2}} \gamma \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{6}}{6\sqrt{4}} = \frac{5\sqrt{6}}{6 \cdot 2} = \frac{5\sqrt{6}}{12}$

d. $\sqrt{\frac{x^5}{y^2 z^4}}$

Practice 2: Simplify

a. $\sqrt{\frac{5}{7}}$ $= \frac{\sqrt{35}}{7}$

b. $\frac{3\sqrt{20}}{\sqrt{27}}$ $= \frac{2\sqrt{15}}{3}$

c. $\frac{-9\sqrt{3}}{\sqrt{24}}$ $= \frac{-9\sqrt{2}}{4}$

d. $\sqrt{\frac{ab^2}{c}}$

If Time: P581 #6-9, 12-17, 19-22

Homework: P581 #23-42, 46-61