LESSON 4.5

Simplifying Square Roots

CA Standards NS 2.4

Goal: Simplify square root expressions.

Vocabulary

Simplest form of a radical expression

A radical expression is in simplest form when: the expression under the radical sign has no perfect square factors other than 1, and there are no fractions under the radical sign and no radicals appear in the denominator of a fraction.

Product Property of Square Roots

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

Numbers $\sqrt{24} = \sqrt{4} \cdot \sqrt{6} = 2\sqrt{6}$

EXAMPLE 1 Simplifying Radical Expressions

Write the radical expression $\sqrt{125}$ in simplest form.

Solution

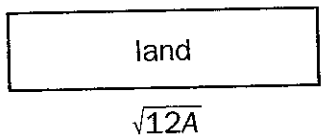
$\sqrt{125} = \sqrt{25} \cdot 5$ Factor out greatest perfect square.

$= \sqrt{25} \cdot \sqrt{5}$ Product property of square roots

$= 5\sqrt{5}$ Simplify.

EXAMPLE 2 Using a Radical Expression in Real Life

The expression $\sqrt{12A}$ gives the length (in feet) of a rectangular plot of land where A is the area (in square feet).



a. Write the expression in simplest form.

b. Use the simplified expression to find the length of a plot of land with an area of 4750 square feet.

Solution

a. $\sqrt{12A} =$ $\sqrt{4 \cdot 3A}$ Factor out greatest perfect square factor.

$=$ $\sqrt{4} \cdot \sqrt{3A}$ Product property of square roots

$=$ $2\sqrt{3A}$ Simplify.

Answer: In simplest form, $\sqrt{12A} =$ $2\sqrt{3A}$

b. $2\sqrt{3A} = 2\sqrt{3(}$ 4750 $)$ Substitute 4750 for A.

$=$ $2\sqrt{14{,}250}$ Multiply.

$\approx$ 239 Approximate using a calculator.

Answer: The length of the plot of land is about 239 feet.

Guided Practice **Complete the following exercises.**

1. Suppose the area in Example 2 is 3000 square feet. What is the length of the plot of land?

EXAMPLE 3 Simplifying a Product of Two Radicals

Simplify the radical expression $\sqrt{3} \cdot \sqrt{15}$.

$\sqrt{3} \cdot \sqrt{15} = \sqrt{45}$ Product property of square roots

$= \sqrt{9 \cdot 5}$ Factor out greatest perfect square factor.

$= \sqrt{9} \cdot \sqrt{5}$ Product property of square roots

$= 3\sqrt{5}$ Simplify.

Quotient Property of Square Roots

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

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

EXAMPLE 4 Simplifying a Radical Expression

$\sqrt{\frac{11}{49}} = \frac{\sqrt{11}}{\sqrt{49}}$ Quotient property of square roots

$= \frac{\sqrt{11}}{7}$ Simplify.

Guided Practice **Simplify the expression.**

Homework

2. $\sqrt{2} \cdot \sqrt{48}$	**3.** $\sqrt{8} \cdot \sqrt{28}$	**4.** $\sqrt{\frac{4}{9}}$