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## Solving Radical Equations

Unit 10 Lesson 4

# Solving Radical Equations

**Students will be able to:**

Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

**Key Vocabulary:**

Radical equations

Extraneous solutions

# Solving Radical Equations

A radical equation is an equation that contains a radical expression with a variable in the radicand.

# Solving Radical Equations

## Steps to Solve an Equation Containing One Square Root Term

- 1. Isolate the radical term.
- 2. Square both sides of the equation.
- 3. Solve the resulting equation.
- 4. Check your solution. Watch for extraneous solutions.

# Solving Radical Equations

- A proposed solution that is not a solution of the original equation it is called **an extraneous solution**. Extraneous solutions are false solutions and do not satisfy the original equation.
- Radical equations with square roots often have extraneous solutions because through the process of solving these equations we must square both sides of the equation. However, the process of squaring both sides is not a “reversible” operation.

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

a.  $\sqrt{x - 1} = 2$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**a.** Checking solution:

$$\sqrt{x - 1} = 2$$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

***a.***  $\sqrt{x - 1} = 2$

$$(\sqrt{x - 1})^2 = 2^2$$

$$x - 1 = 4$$

$$x = 5$$



# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

a. Checking solution:  $x = 5$

$$\sqrt{x - 1} = 2$$

$$\sqrt{5 - 1} = 2$$

$$\sqrt{4} = 2$$

$$2 = 2$$

$x = 5$  is a solution

$$\{5\}$$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**b.**  $\sqrt{6x} + 6 = 0$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**b.** Checking solution:

$$\sqrt{6x} + 6 = 0$$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**b.**  $\sqrt{6x} + 6 = 0$

$$\sqrt{6x} = -6$$

$$(\sqrt{6x})^2 = (-6)^2$$

$$6x = 36$$

$$x = 6$$

## Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**b.** Checking solution:  $x = 6$

$$\sqrt{6x} + 6 = 0$$

$$\sqrt{6 * 6} + 6 = 0$$

$$\sqrt{36} = -6$$

$$6 \neq -6$$

$x = 6$  is an extraneous solution

$\emptyset$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

*c.*  $2\sqrt{x - 6} - 3 = 5$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

*c.* Checking solution:

$$2\sqrt{x - 6} - 3 = 5$$

## Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

$$c. \ 2\sqrt{x-6} - 3 = 5$$

$$2\sqrt{x-6} = 8$$

$$(2\sqrt{x-6})^2 = 8^2$$

$$4(x-6) = 64$$

$$4x - 24 = 64$$

$$4x = 88$$

$$x = 22$$



# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

c. Checking solution:  $x = 22$

$$2\sqrt{x - 6} - 3 = 5$$

$$2\sqrt{22 - 6} - 3 = 5$$

$$2\sqrt{16} - 3 = 5$$

$$8 - 3 = 5$$

$$5 = 5$$

$x = 22$  is a solution  
 $\{22\}$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

d.  $\sqrt{6x + 1} - x = -1$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**d.** Checking solution:

$$\sqrt{6x + 1} - x = -1$$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

**d.**  $\sqrt{6x + 1} - x = -1$

$$\sqrt{6x + 1} = x - 1$$

$$(\sqrt{6x + 1})^2 = (x - 1)^2$$

$$6x + 1 = x^2 - 2x + 1$$

$$8x - x^2 = 0$$

$$x(8 - x) = 0$$

$$x_1 = 0 \quad x_2 = 8$$

# Solving Radical Equations

**Sample Problem 1:** Solve the following equation.

d. Checking solution:

$$x_1 = 0$$

$$\sqrt{6x + 1} - x = -1$$

$$\sqrt{6 * 0 + 1} - 0 = -1$$

$$\sqrt{1} \neq -1$$

$$x_1 = 0$$

is an extraneous solution

$$x_2 = 8$$

$$\sqrt{6x + 1} - x = -1$$

$$\sqrt{49} - 8 = -1$$

$$7 = 7$$

$$x_2 = 8$$

is a solution

**{8}**

# Solving Radical Equations

- **Steps to Solve an Equation Containing Two Square Root Terms**
  - 1. Isolate one of the radical terms
  - 2. Square both sides of the equation.
  - 3. Isolate the remaining radical term.
  - 4. Square both sides of the equation.
  - 5. Solve the resulting equation.
  - 6. Check your solution. Watch for extraneous (false) solutions.

# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

*a.*  $\sqrt{5x + 3} = \sqrt{3x + 7}$

# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

a. Checking solution:

$$\sqrt{5x + 3} = \sqrt{3x + 7}$$



# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

$$a. \sqrt{5x + 3} = \sqrt{3x + 7}$$

$$(\sqrt{5x + 3})^2 = (\sqrt{3x + 7})^2$$

$$5x + 3 = 3x + 7$$

$$x = 2$$

## Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

a. Checking solution:  $x = 2$

$$\sqrt{5x + 3} = \sqrt{3x + 7}$$

$$\sqrt{5 * 2 + 3} = \sqrt{3 * 2 + 7}$$

$$\sqrt{10 + 3} = \sqrt{6 + 7}$$

$$\sqrt{13} = \sqrt{13}$$

$x = 2$  is a solution of this equation

**{2}**

# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

**b.**  $\sqrt{2x - 3} - \sqrt{x + 2} = 0$

# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

**b.** Checking solution:

$$\sqrt{2x - 3} - \sqrt{x + 2} = 0$$

# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

**b.**  $\sqrt{2x - 3} - \sqrt{x + 2} = 0$

$$\sqrt{2x - 3} = \sqrt{x + 2}$$

$$(\sqrt{2x - 3})^2 = (\sqrt{x + 2})^2$$

$$2x - 3 = x + 2$$

$$2x - x = 3 + 2$$

$$x = 5$$

# Solving Radical Equations

**Sample Problem 2:** Solve the following equation.

**b.** Checking solution:  $x = 5$

$$\sqrt{2x - 3} - \sqrt{x + 2} = 0$$

$$\sqrt{2 * 5 - 3} - \sqrt{5 + 2} = 0$$

$$\sqrt{7} - \sqrt{7} = 0$$

$$\sqrt{7} = \sqrt{7}$$

$x = 5$  is a solution of this equation  $\{5\}$