

11-9 Solving Radical EquationsWarm UpLesson PresentationLesson Quiz

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations**Warm Up****Solve each equation.**

1. $3x + 5 = 17$

2. $4x + 1 = 2x - 3$

3. $\frac{x}{7} = 5$

4. $(x + 7)(x - 4) = 0$

5. $x^2 - 11x + 30 = 0$

6. $x^2 = 2x + 15$

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations

Homework Answers p. 843

27. $3\sqrt{10}$

47. $\frac{\sqrt{3x}}{x}$

71. 269.5 ft^2

31. $6d\sqrt{7}$

51. $3\sqrt{2}$

75. $\textcircled{\text{B}}$

35. $2\sqrt{3} - 2\sqrt{5}$

61. $2\sqrt{y}$

76. $\textcircled{\text{H}}$

39. $75 + 19\sqrt{15}$

63. $134\sqrt{3} + 96$

77. $\textcircled{\text{D}}$

43. $67 + 16\sqrt{3}$

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations

Objective

Solve radical equations.

Vocabulary

radical equation
extraneous solution

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations

A **radical equation** is an equation that contains a variable within a radical. In this course, you will only study radical equations that contain square roots.

Recall that you use inverse operations to solve equations. For nonnegative numbers, squaring and taking the square root are inverse operations. When an equation contains a variable within a square root, square both sides of the equation to solve.

11-9 Solving Radical Equations

Example 1A: Solving Simple Radical Equations

Solve the equation. Check your answer.

$$\begin{aligned}\sqrt{x} &= 5 \\ (\sqrt{x})^2 &= (5)^2 \\ x &= 25\end{aligned}$$

$$\begin{aligned}10 &= \sqrt{2x} \\ (10)^2 &= (\sqrt{2x})^2 \\ 100 &= 2x \\ 50 &= x\end{aligned}$$

11-9 Solving Radical Equations

Check It Out! Example

Solve the equation. Check your answer.

$$\sqrt{x} = 13$$

$$x = 169$$

$$\sqrt{9x} = 9$$

$$\frac{9x}{9} = \frac{81}{9}$$

$$x = 9$$

11-9 Solving Radical Equations

Some square-root equations do not have the square root isolated. To solve these equations, you may **have to isolate the square root** before squaring both sides. You can do this by using one or more inverse operations.

$$\sqrt{x} - 4 = 5$$

$$\sqrt{x} = 9$$

$$(\sqrt{x})^2 = (9)^2$$

$$x = 81$$

11-9 Solving Radical Equations

Example 2B: Solving Simple Radical Equations

Solve the equation. Check your answer.

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

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

$$x + 3 = 49$$

$$x = 46$$

Square both sides.

Subtract 3 from both sides.

Check $\sqrt{x + 3} = 49$

$\sqrt{46 + 3}$	7
$\sqrt{49}$	7
7	7 ✓

11-9 Solving Radical Equations

Example 2C: Solving Simple Radical Equations

Solve the equation. Check your answer.

$$\sqrt{5x + 1} + 6 = 10$$

$$\sqrt{5x + 1} = 4$$

$$(\sqrt{5x + 1})^2 = (4)^2$$

$$5x + 1 = 16$$

$$5x = 15$$

$$x = 3$$

Subtract 6 from both sides.

Square both sides.

Subtract 1 from both sides.

Divide both sides by 5.

$\sqrt{5x+1}$
 $\sqrt{16+6}$
 $4+6$

11-9 Solving Radical Equations

Check It Out! Example 2a

Solve the equation. Check your answer.

$$\sqrt{x-5} = 7^2$$

$$\begin{array}{r} x-5 = 49 \\ +5 \quad +5 \\ \hline x = 54 \end{array}$$

$$\frac{\sqrt{x-1}}{-2 \cdot 2} = -10 \cdot 2$$

$$\sqrt{x-1} = 20^2$$

$$x-1 = 400, \quad x = 401$$

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

$$\begin{array}{r} +5 \quad +5 \\ \hline \sqrt{x} = 4^2 \end{array}$$

$$x = 16$$

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations

$$\frac{2\sqrt{3x+4}}{7} = 4$$

$$\frac{2\sqrt{3x+4}}{2} = \frac{28}{2}$$

$$\sqrt{3x+4} = 14^2$$

$$\begin{array}{r} 3x+4 = 196 \\ -4 \quad -4 \end{array}$$

$$\frac{3x}{3} = \frac{192}{3}$$

$$x = 64$$

$$\frac{2\sqrt{192+4}}{7} = 4$$

$$\frac{2\sqrt{196}}{7} = 4 \quad \frac{2(14)}{7} = 4$$

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations

Example 4A: Solving Radical Equations with Square Roots on Both Sides

Solve the equation. Check your answer.

$$\sqrt{2x - 1} = \sqrt{x + 7}$$

$$(\sqrt{2x - 1})^2 = (\sqrt{x + 7})^2 \quad \text{Square both sides.}$$

$$2x - 1 = x + 7$$

$$x = 8$$

Add 1 to both sides and subtract x from both sides.

Check $\sqrt{2x - 1} = \sqrt{x + 7}$

$$\begin{array}{l|l} \sqrt{2(8) - 1} & \sqrt{(8) + 7} \\ \hline \sqrt{15} & \sqrt{15} \quad \checkmark \end{array}$$

11-9 Solving Radical Equations

Example 4B: Solving Radical Equations with Square Roots on Both Sides

Solve the equation. Check your answer.

$$\sqrt{5x - 4} - \sqrt{6} = 0$$

$$\sqrt{5x - 4} = \sqrt{6}$$

Add $\sqrt{6}$ to both sides.

$$(\sqrt{5x - 4})^2 = (\sqrt{6})^2$$

Square both sides.

$$5x - 4 = 6$$

Add 4 to both sides.

$$5x = 10$$

Divide both sides by 2.

$$x = 2$$

11-9 Solving Radical Equations

Check It Out! Example 4a

Solve the equation. Check your answer.

$$\sqrt{3x+2} = \sqrt{x+6}$$

$$(\sqrt{3x+2})^2 = (\sqrt{x+6})^2$$

Square both sides.

$$3x + 2 = x + 6$$

Subtract x from both sides and subtract 2 from both sides.

$$2x = 4$$

$$x = 2$$

Divide both sides by 2.

11-9 Solving Radical Equations

Squaring both sides of an equation may result in an **extraneous solution**—a number that is not a solution of the original equation.

Suppose your original equation is $x = 3$.

$$x = 3$$

Square both sides. Now you have a new equation.

$$x^2 = 9$$

Solve this new equation for x by taking the square root of both sides.

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

$$x = 3 \text{ or } x = -3$$

11-9 Solving Radical Equations

Now there are two solutions. One ($x = 3$) is the original equation. The other ($x = -3$) is extraneous—it is not a solution of the original equation. Because of extraneous solutions, it is important to check your answers.

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations**Example 5A: Extraneous Solutions**

Solve $12 + \sqrt{6x} = 6$. Check your answer.

$$12 + \sqrt{6x} = 6$$

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

Subtract 12 from each sides.

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

Square both sides

$$6x = 36$$

Divide both sides by 6.

$$x = 6$$

Holt Algebra 1

Copyright © by Holt, Rinehart and Winston. All Rights Reserved.

11-9 Solving Radical Equations

Example 5A Continued

Solve $12 + \sqrt{6x} = 6$. Check your answer.

Check $12 + \sqrt{6x} = 6$

$12 + \sqrt{6(6)}$	6
$12 + \sqrt{36}$	6
18	$6 \quad \times$

Substitute 6 for x in the equation.

6 does not check. There is no solution.

11-9 Solving Radical Equations

Example 5B: Extraneous Solutions

Solve $x = \sqrt{2x + 3}$. Check your answer.

$$(x)^2 = (\sqrt{2x + 3})^2 \quad \text{Square both sides}$$

$$x^2 = 2x + 3$$

$$x^2 - 2x - 3 = 0 \quad \text{Write in standard form.}$$

$$(x - 3)(x + 1) = 0 \quad \text{Factor.}$$

$$x - 3 = 0 \text{ or } x + 1 = 0 \quad \text{Zero-Product Property}$$

$$x = 3 \text{ or } x = -1 \quad \text{Solve for } x.$$

11-9 Solving Radical Equations

$x=3$ $x=-1$ **Example 5B Continued**

Solve $x = \sqrt{2x + 3}$. Check your answer.

Check

$x = \sqrt{2x + 3}$	
-1	$\sqrt{2(-1) + 3}$
-1	$\sqrt{1}$
-1	$1 \times$
$x = \sqrt{2x + 3}$	
3	$\sqrt{2(3) + 3}$
3	$\sqrt{9}$
3	$3 \checkmark$

Substitute -1 for x in the equation.

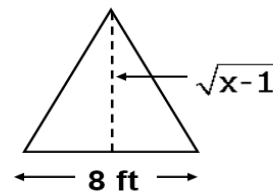
Substitute 3 for x in the equation.

-1 does not check; it is extraneous. The only solution is 3.

11-9 Solving Radical Equations

Example 6: Geometry Application

A triangle has an area of 36 square feet, its base is 8 feet, and its height is $\sqrt{x-1}$ feet. What is the value of x? What is the height of the triangle?



$$A = \frac{1}{2}bh$$

Use the formula for area of a triangle.

$$36 = \frac{1}{2}(8)(\sqrt{x-1})$$

Substitute 8 for b, 36 for A and $\sqrt{x-1}$ for h.

$$36 = 4(\sqrt{x-1})$$

Simplify.

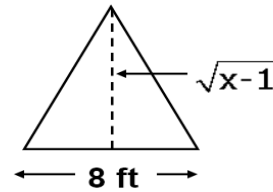
$$\frac{36}{4} = \frac{4(\sqrt{x-1})}{4}$$

Divide both sides by 4.

11-9 Solving Radical Equations

Example 6 Continued

A triangle has an area of 36 square feet, its base is 8 feet, and its height is $\sqrt{x-1}$ feet. What is the value of x ? What is the height of the triangle?



$$9 = \sqrt{x-1}$$

$$(9)^2 = (\sqrt{x-1})^2 \quad \text{Square both sides.}$$

$$81 = x - 1$$

$$82 = x$$

$$\frac{1}{2}(8)(9) = 36$$

$$4(9) = 36$$

11-9 Solving Radical Equations

Lesson Quiz: Part I

Solve each equation. Check your answer.

1. $\frac{2\sqrt{x}}{3} = 4$

2. $\sqrt{5x} = 15$

3. $\sqrt{5x} + 8 = 3$
 $\sqrt{5x} = -5$

4. $\sqrt{4x+5} - 2 = 5$

5. $\sqrt{3x+1} - \sqrt{2x+5} = 0$

6. $x = \sqrt{2x+8}$

$$x = \sqrt{2x + 8} \quad \sqrt{2x + 8} - x = 0$$

$$x^2 = 2x + 8$$

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

$$(x - 4)(x + 2) = 0$$

$$x = 4 \quad x = -2$$

Apr 25-8:19 AM

11-9 Solving Radical Equations

Homework

p. 850 1st Column, & 40

Test 11.4, 11.6-11.9