9-7 Solving Quadratic Equations by Using Square Roots

Warm Up

Lesson Presentation

Lesson Quiz

9-7 Solving Quadratic Equations by Using Square Roots

Warm Up

Find each square root.

1. $\sqrt{36}$ 6

2. $\sqrt{121}$ 11

3. $-\sqrt{625}$ −25

4. $\sqrt{\frac{4}{25}}$ $\frac{2}{5}$

Solve each equation.

5. $-6x = -60$ $x = 10$

6. $\frac{1}{5}x = 16$ $x = 80$

7. $2x - 40 = 0$ $x = 20$

8. $5x = 3$ $x = \frac{3}{5}$

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SECTION 9A

Ready To Go On? Quiz

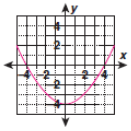
9-1 Identifying Quadratic Functions
Tell whether each function is quadratic.

1. $y + 4x^2 = -5$ — Yes
2. $2x^2 + y = 6 + 2x^2$ — No
3. $(-1, -4); (0, -3); (1, -2); (2, -1)$ — No

Tell whether the graph of each quadratic function opens upward or downward and whether the parabola has a maximum or a minimum.

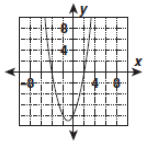
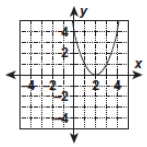
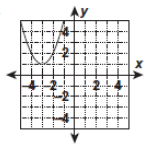
4. $y = -2x^2 - 3x + 7$ — Downward; Maximum
5. $y - 3x^2 = 2x + 5$ — Upward; Minimum
6. $f(x) = 4x - 0.25x^2$ — Downward; Maximum

7. Graph the function $y = \frac{1}{4}x^2 - 4$ and give the domain and range.



D: all real numbers; R: $y \geq -4$

9-2 Characteristics of Quadratic Functions
Find the zeros of each function from its graph. Then find its axis of symmetry.

8.  — 2 and −4; $x = -1$
9.  — 2; $x = 2$
10.  — No zeros; $x = -3$

Find the vertex of each parabola.

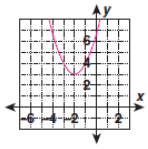
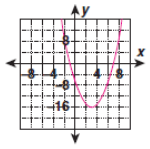
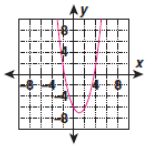
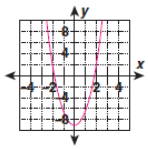
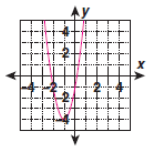
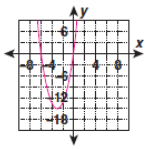
11. $y = x^2 - 4x + 2$ — (2, −2)
12. $y = 4 - 6x - 3x^2$ — (−1, 7)
13. $y = 2x^2 + 8x - 13$ — (−2, −21)

14. The height in feet of an arched bridge can be modeled by $y = -0.05x^2 + 2x$, where x is the distance in feet from the bottom of the arch to the ground. How tall is the bridge? — 20 feet

SECTION 9A

Ready To Go O n? Quiz continued

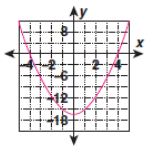
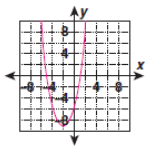
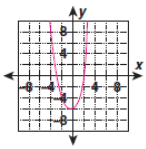
9-3 Graphing Quadratic Functions
Graph each quadratic function.

15. $y = x^2 + 4x + 7$ 
16. $y = x^2 - 6x - 7$ 
17. $y = x^2 - 2x - 6$ 
18. $y = 3x^2 - 9$ 
19. $y = 3x^2 + 6x - 1$ 
20. $y = 2x^2 + 12x + 3$ 

SECTION 9B

Ready To Go On? Quiz

9-5 Solving Quadratic Equations by Graphing
Solve each equation by graphing the related function.

1. $x^2 - 16 = 0$  — −4 and 4
2. $x^2 + 4x - 5 = 0$  — −5 and 1
3. $3x^2 + 3x = 18$  — −3 and 2

4. The height of a rocket fired from a platform 80 feet above the ground can be approximated by $h = -16t^2 + 64t + 80$, where h is the height in feet and t is the time in seconds. Find the time it takes the rocket to reach the ground after it is launched. — 5 seconds

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9-7 Solving Quadratic Equations by Using Square Roots

Objective

Solve quadratic equations by using square roots.

9-7 Solving Quadratic Equations by Using Square Roots

$3(3) = 3^2 = 9 \rightarrow \sqrt{9} = 3 \leftarrow$ *Positive Square root of 9*

$(-3)(-3) = (-3)^2 = 9 \rightarrow -\sqrt{9} = -3 \leftarrow$ *Negative Square root of 9*

When you take the square root of a positive number and the sign of the square root is not indicated, you must find both the positive and negative square root. This is indicated by $\pm\sqrt{\ }$

$\pm\sqrt{9} = \pm 3 \leftarrow$ Positive and negative Square roots of 9

9-7 Solving Quadratic Equations by Using Square Roots

When dealing with quadratic equations that do not have a *b* can be solved by using square roots.

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9-7 Solving Quadratic Equations by Using Square Roots

Example 1A: Using Square Roots to Solve $x^2 = a$

$x^2 - 169$

Solve using square roots. Check your answer.

$x^2 = 169$

$x = \pm\sqrt{169}$

$x = \pm 13$

Solve for x by taking the square root of both sides. Use ± to show both square roots.

The solutions are 13 and −13.

Check

$x^2 = 169$	
$(13)^2$	169
169	169 ✓

Substitute 13 and −13 into the original equation.

$x^2 = 169$	
$(-13)^2$	169
169	169 ✓

9-7 Solving Quadratic Equations by Using Square Roots

Example 1B: Using Square Roots to Solve $x^2 = a$

Solve using square roots.

$x^2 = -49$

$x \neq \pm\sqrt{49}$

$x^2 + 49$

There is no real number whose square is negative.

There is no real solution.

9-7 Solving Quadratic Equations by Using Square Roots

Check It Out! Example 1b

Solve using square roots. Check your answer.

$x^2 = 0$

$x = \pm\sqrt{0}$

Solve for x by taking the square root of both sides. Use ± to show both square roots.

$x = 0$

The solution is 0.

Check $x^2 = 0$

$(0)^2$	0
0	0 ✓

Substitute 0 into the original equation.

9-7 Solving Quadratic Equations by Using Square Roots

If a quadratic equation is not written in the form $x^2 = a$, use inverse operations to isolate x^2 before taking the square root of both sides.

9-7 Solving Quadratic Equations by Using Square Roots

Example 2A: Using Square Roots to Solve Quadratic Equations

Solve using square roots.

$x^2 + 7 = 7$

$x^2 + 7 = 7$

$-7 \quad -7$

$x^2 = 0$

$x = \pm\sqrt{0} = 0$

The solution is 0.

Subtract 7 from both sides.

Take the square root of both sides.

9-7 Solving Quadratic Equations by Using Square Roots

Example 2B: Using Square Roots to Solve Quadratic Equations

Solve using square roots.

$16x^2 - 49 = 0$

$16x^2 - 49 = 0$

$+49 \quad +49$

$\frac{16x^2}{16} = \frac{49}{16}$

$x^2 = \frac{49}{16}$

$x = \pm\sqrt{\frac{49}{16}} = \pm\frac{7}{4}$

Add 49 to both sides.

Divide by 16 on both sides.

Take the square root of both sides. Use ± to show both square roots.

9-7 Solving Quadratic Equations by Using Square Roots

Check It Out! Example 2a

Solve by using square roots. Check your answer.

$100x^2 + 49 = 0$

$100x^2 + 49 = 0$
$-49 \quad -49$
$100x^2 = -49$

Subtract 49 from both sides.

$$\frac{100x^2}{100} = \frac{-49}{100}$$

Divide by 100 on both sides.

$$x \neq \pm\sqrt{\frac{49}{100}}$$

There is no real number whose square is negative.

There is no real solution.

9-7 Solving Quadratic Equations by Using Square Roots

When solving quadratic equations by using square roots, you may need to find the square root of a number that is not a perfect square. In this case, the answer is an irrational number. You can approximate the solutions.

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9-7 Solving Quadratic Equations by Using Square Roots

Example 3A: Approximating Solutions

Solve. Round to the nearest hundredth.

$x^2 = 15$

$x = \pm\sqrt{15}$ *Take the square root of both sides.*

$x \approx \pm 3.87$ *Evaluate $\sqrt{15}$ on a calculator.*

The approximate solutions are 3.87 and −3.87.

9-7 Solving Quadratic Equations by Using Square Roots

Check It Out! Example 3a

Solve. Round to the nearest hundredth.

$0 = 90 - x^2$

$-90 \quad -90$

$\frac{-90}{-1} = \frac{-x^2}{-1}$

$\sqrt{90} = \sqrt{x^2}$

$\pm 9.48 = x$

$x^2 + 45 = 0$

$-45 \quad -45$

No solution

$2x^2 - 64 = 0$

$\frac{2x^2}{2} = \frac{64}{2}$

$x^2 = 32$

$x = \sqrt{32}$

$x = \pm 5.66$

9-7 Solving Quadratic Equations by Using Square Roots

Example 4: *Application*

Ms. Pirzada is building a retaining wall along one of the long sides of her rectangular garden. The garden is twice as long as it is wide. It also has an area of 578 square feet. What will be the length of the retaining wall?

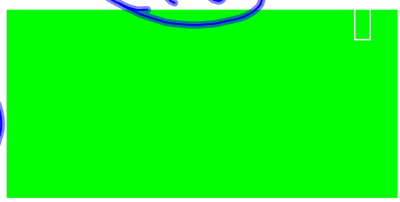
$2w(w) = 578$

$\frac{2w^2}{2} = \frac{578}{2}$

$\sqrt{w^2} = \sqrt{289}$

$w = \pm 17$

$w = 17$



$l = A$

578

$2w = l$

$l = 34$

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