Check Your Understanding

= Step-by-Step Solutions begin on page R13.

Examples 1–3 Solve each equation by graphing.

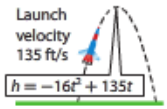
1. $x^2 + 3x - 10 = 0$
2. $2x^2 - 8x = 0$
3. $x^2 + 4x = -4$
4. $x^2 + 12 = -8x$

Example 4 Solve each equation by graphing. If integral roots cannot be found, estimate the roots to the nearest tenth.

5. $-x^2 - 5x + 1 = 0$
6. $-9 = x^2$
7. $x^2 = 25$
8. $x^2 - 8x = -9$

Example 5

9. **SCIENCE FAIR** Ricky built a model rocket. Its flight can be modeled by the equation shown, where h is the height of the rocket in feet after t seconds. About how long was Ricky's rocket in the air?



Practice and Problem Solving

Extra Practice is on page R9.

Examples 1–3 Solve each equation by graphing.

10. $x^2 + 7x + 14 = 0$
11. $x^2 + 2x - 24 = 0$
12. $x^2 - 16x + 64 = 0$
13. $x^2 - 5x + 12 = 0$
14. $x^2 + 14x = -49$
15. $x^2 = 2x - 1$
16. $x^2 - 10x = -16$
17. $-2x^2 - 8x = 13$
18. $2x^2 - 16x = -30$
19. $2x^2 = -24x - 72$
20. $-3x^2 + 2x = 15$
21. $x^2 = -2x + 80$

Example 4 Solve each equation by graphing. If integral roots cannot be found, estimate the roots to the nearest tenth.

22. $x^2 + 2x - 9 = 0$
23. $x^2 - 4x = 20$
24. $x^2 + 3x = 18$
25. $2x^2 - 9x = -8$
26. $3x^2 = -2x + 7$
27. $5x = 25 - x^2$

Example 5

28. **SOFTBALL** The equation $h = -16t^2 + 47t + 3$ models the height h, in feet, of a ball that Sofia hits after t seconds. How long is the ball in the air?

29. **RIDES** The Terror Tower launches riders straight up and returns straight down. The equation $h = -16t^2 + 122t$ models the height h, in feet, of the riders from their starting position after t seconds. How long is it until the riders return to the bottom?

Use factoring to determine how many times the graph of each function intersects the x-axis. Identify each zero.

30. $y = x^2 - 8x + 16$
31. $y = x^2 + 4x + 4$
32. $y = x^2 + 2x - 24$
33. $y = x^2 + 12x + 32$

34. **NUMBER THEORY** Use a quadratic equation to find two numbers that have a sum of 9 and a product of 20.

35. **NUMBER THEORY** Use a quadratic equation to find two numbers that have a sum of 1 and a product of −12.

36. CCSS **MODELING** The height of a golf ball in the air can be modeled by the equation $h = -16t^2 + 76t$, where h is the height in feet of the ball after t seconds.
    a. How long was the ball in the air?
    b. What is the ball's maximum height?
    c. When will the ball reach its maximum height?

37. **SKIING** Stefanie is in a freestyle aerial competition. The equation $h = -16t^2 + 30t + 10$ models Stefanie's height h, in feet, t seconds after leaving the ramp.

a. How long is Stefanie in the air?

b. When will Stefanie reach a height of 15 feet?

c. To earn bonus points in the competition, you must reach a height of 20 feet. Will Stefanie earn bonus points?

38. **MULTIPLE REPRESENTATIONS** In this problem, you will explore how to further interpret the relationship between quadratic functions and graphs.

a. **Graphical** Graph $y = x^2$.

b. **Analytical** Name the vertex and two other points on the graph.

c. **Graphical** Graph $y = x^2 + 2$, $y = x^2 + 4$, and $y = x^2 + 6$ on the same coordinate plane as the previous graph.

d. **Analytical** Name the vertex and two points from each of these graphs that have the same x-coordinates as the first graph.

e. **Analytical** What conclusion can you draw from this?

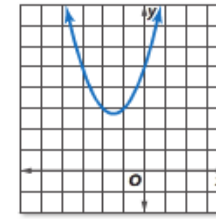
GRAPHING CALCULATOR **Solve each equation by graphing.**

39. $x^3 - 3x^2 - 6x + 8 = 0$

40. $x^3 - 8x^2 + 15x = 0$

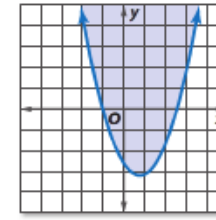
H.O.T. Problems Use Higher-Order Thinking Skills

41. **CCSS CRITIQUE** Iku and Zachary are finding the number of real zeros of the function graphed at the right. Iku says that the function has no real zeros because there are no x-intercepts. Zachary says that the function has one real zero because the graph has a y-intercept. Is either of them correct? Explain your reasoning.



42. **OPEN ENDED** Describe a real-world situation in which a thrown object travels in the air. Write an equation that models the height of the object with respect to time, and determine how long the object travels in the air.

43. **REASONING** The graph shown is that of a *quadratic inequality*. Analyze the graph, and determine whether the y-value of a solution of the inequality is *sometimes*, *always*, or *never* greater than 2. Explain.



44. **CHALLENGE** Write a quadratic equation that has the roots described.

a. one double root

b. one rational (nonintegral) root and one integral root

c. two distinct integral roots that are additive opposites.

45. **CHALLENGE** Find the roots of $x^2 = 2.25$ without using a calculator. Explain your strategy.

46. **WRITING IN MATH** Explain how to approximate the roots of a quadratic equation when the roots are not integers.