EXERCISES

Practice and Problem Solving

A **Practice by Example**

Example 1
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Use the quadratic formula to solve each equation. If necessary, round answers to the nearest hundredth.

1. $2x^2 + 5x + 3 = 0$ **2.** $5x^2 + 16x - 84 = 0$ **3.** $4x^2 - 12x + 9 = 0$

4. $3x^2 + 47x = -30$ **5.** $12x^2 - 77x - 20 = 0$ **6.** $3x^2 + 39x + 108 = 0$

7. $3x^2 + 40x - 128 = 0$ **8.** $2x^2 - 9x - 221 = 0$ **9.** $5x^2 - 68x = 192$

Example 2
(page 548)

10. $5x^2 + 13x - 1 = 0$ **11.** $2x^2 - 24x + 33 = 0$ **12.** $7x^2 + 100x - 4 = 0$

13. $8x^2 - 3x - 7 = 0$ **14.** $6x^2 + 5x - 40 = 0$ **15.** $3x^2 - 11x - 2 = 0$

Example 3
(page 549)

For Exercises 16 and 17, use the vertical motion formula $h = -16t^2 + vt + c$.

16. A child tosses a ball upward with a starting velocity of 10 ft/s from a height of 3 ft.
     a. Substitute the values into the vertical motion formula. Let $h = 0$.
     b. Solve. If it is not caught, how long will the ball be in the air? Round to the nearest tenth of a second.

17. A soccer ball is kicked with a starting upward velocity of 50 ft/s from a starting height of 3.5 ft.
     a. Substitute the values into the vertical motion formula. Let $h = 0$.
     b. Solve. If no one touches the ball, how long will the ball be in the air? Round to the nearest tenth of a second.

Example 4
(page 550)

Which method(s) would you choose to solve each equation? Justify your reasoning.

18. $x^2 + 2x - 13 = 0$ **19.** $4x^2 - 81 = 0$ **20.** $9x^2 - 31x = 51$

21. $3x^2 - 5x + 9 = 0$ **22.** $x^2 + 4x - 60 = 0$ **23.** $-4x^2 + 3x + 2 = 0$

Use any method you choose to solve each equation. If necessary, round to the nearest hundredth.

24. $2t^2 = 72$ **25.** $3x^2 + 2x - 4 = 0$ **26.** $5b^2 - 10 = 0$

27. $3x^2 + 4x = 10$ **28.** $m^2 - 4m = -4$ **29.** $13n^2 - 117 = 0$

30. $3s^2 - 4s = 2$ **31.** $5b^2 - 2b - 7 = 0$ **32.** $15x^2 - 12x - 48 = 0$

33. Geometry Suppose you want to make a rectangle like the one shown at the left.
     a. Estimate each dimension of the rectangle to the nearest integer.
     b. Write a quadratic equation and use the quadratic formula to find each dimension to the nearest hundredth.

34. Vertical Motion Suppose you throw a ball upward with a starting velocity of 30 ft/s. The ball is 6 ft high when it leaves your hand. After how many seconds will it hit the ground? Use the vertical motion formula $h = -16t^2 + vt + c$.

35. Writing Compare the way you solve the linear equation $mx + b = 0$ with the way you solve the quadratic equation $ax^2 + bx + c = 0$.

Geometry **Find the base and height of each triangle below. If necessary, round to the nearest hundredth.**

36.

x | 20 ft^2

$x + 2$

37.

Area = 50 cm^2

x

$x + 6$
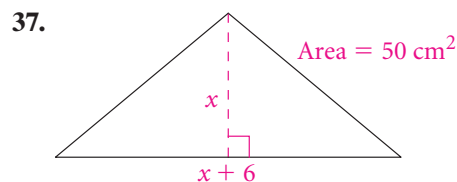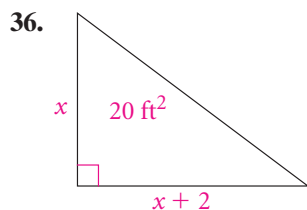
38. Open-Ended Write a problem in which you find the area of a rectangle that you can solve using a quadratic equation. Draw a diagram and solve.

39. Critical Thinking How you can tell from the quadratic formula that a quadratic equation has one solution? Explain.

40. Vertical Motion Refer to the cartoon. Suppose the man's starting upward velocity v is 5 ft/s. Use $0 = -16t^2 + vt + c$, where c is the starting height. Find the number of seconds t before he hits the water.

C **Challenge**

41. Population The function below models the United States population P in millions since 1900, where t is the number of years after 1900.

Real-World Connection

Careers Demographers use mathematics to help describe trends in populations.

$P = 0.0089t^2 + 1.1149t + 78.4491$

a. Use the function to estimate the United States population the year you graduate from high school.

b. Estimate the United States population in 2025.

c. Use the function to predict the year in which the population will reach 300 million.

42. Critical Thinking The two solutions of any quadratic equation are

$\dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $\dfrac{-b - \sqrt{b^2 - 4ac}}{2a}$.

a. Find a formula for the sum of the solutions.

b. One solution of $2x^2 + 3x - 104 = 0$ is -8. Use the formula you found in part (a) to find the second solution.

Reading Comprehension

The Gateway to the West

The Gateway Arch in St. Louis, Missouri, was completed in 1965. The arch spans 630 feet at its base and is 630 feet tall. More than 5100 tons of steel and 38,100 tons of concrete were used in its construction.

43. Use the data in the article above to answer the following questions.

  a. How many pounds of concrete were used in the construction of the Gateway Arch? Write your answer in scientific notation.

  b. How many more tons of concrete than steel were used? Write your answer in scientific notation.

  c. Suppose that a cleaner at the top of the Gateway Arch drops a cleaning brush. Use the vertical motion formula $h = -16t^2 + vt + c$. The starting upward velocity v is 0 and c is the starting height. How many seconds will the brush take to hit the ground?

Multiple Choice

44. The expression $\dfrac{9 \pm \sqrt{(-9)^2 - 4(5)(-7)}}{2(5)}$ gives the solutions to which of the following equations?

  A. $-9x^2 + 5x = -7$ **B.** $5x^2 + 7x = 9$

  C. $5x^2 - 9x = -7$ **D.** $5x^2 - 9x = 7$

45. The graph of $y = 15x^2 - 59x - 112$ crosses the x-axis closest to which of the following x-values?

  F. -1 **G.** 0   **H.** 3   **I.** 6

Short Response

46. Find the solutions to the equation $6x^2 - 40 = 11x$. Round to the nearest tenth.

Mixed Review

Lesson 10-6

Solve each equation by completing the square. If necessary, round to the nearest hundredth.

47. $d^2 - 10d + 13 = 0$ **48.** $z^2 + 3z = -2$ **49.** $3x^2 + 18x - 1 = 0$

Lesson 9-8

Factor by grouping.

50. $2c^2 + 11c + 15$ **51.** $3z^2 + 10z - 8$ **52.** $5n^2 - 33n - 14$

53. $12v^2 + 32v - 35$ **54.** $6x^2 - 13x + 5$ **55.** $15t^2 + 19t + 6$