13-1 Exercises

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GUIDED PRACTICE

1. **Vocabulary** The number 7 is the __?__ part of the complex number $\sqrt{5} + 7i$. (*real* or *imaginary*)

SEE EXAMPLE 1

Express each number in terms of i.

2. $5\sqrt{-100}$ 3. $\frac{1}{2}\sqrt{-16}$ 4. $-\sqrt{-32}$ 5. $\sqrt{-144}$

SEE EXAMPLE 2

Solve each equation.

6. $x^2 = -9$ 7. $2x^2 + 72 = 0$ 8. $4x^2 = -16$ 9. $x^2 + 121 = 0$

SEE EXAMPLE 3

Find the values of x and y that make each equation true.

10. $-2x + 6i = (-24y)i - 14$ 11. $-4 + (y)i = -12x - i + 8$

SEE EXAMPLE 4

Find the zeros of each function.

12. $f(x) = x^2 - 12x + 45$ 13. $g(x) = x^2 + 6x + 34$

SEE EXAMPLE 5

Find each complex conjugate.

14. $-9i$ 15. $\sqrt{5} + 5i$ 16. $8i - 3$ 17. $6 + i\sqrt{2}$

PRACTICE AND PROBLEM SOLVING

Independent Practice

For Exercises	See Example
18–21	1
22–25	2
26–27	3
28–31	4
32–35	5

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Express each number in terms of i.

18. $8\sqrt{-4}$ 19. $-\frac{1}{3}\sqrt{-90}$ 20. $6\sqrt{-12}$ 21. $\sqrt{-50}$

Solve each equation.

22. $x^2 + 49 = 0$ 23. $5x^2 = -80$ 24. $3x^2 + 27 = 0$ 25. $\frac{1}{2}x^2 = -32$

Find the values of x and y that make each equation true.

26. $9x + (y)i - 5 = -12i + 4$ 27. $5(x - 1) + (3y)i = -15i - 20$

Find the zeros of each function.

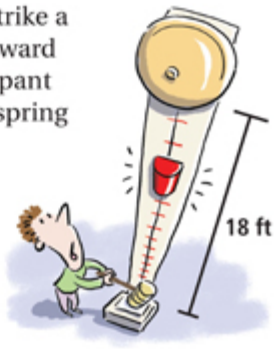
28. $f(x) = x^2 + 2x + 3$ 29. $g(x) = 4x^2 - 3x + 1$

30. $f(x) = x^2 + 4x + 8$ 31. $g(x) = 3x^2 - 6x + 10$

Find each complex conjugate.

32. i 33. $-\frac{\sqrt{3}}{2} - 2i$ 34. $-2.5i + 1$ 35. $\frac{i}{10} - 1$

HOT 36. **What if...?** A carnival game asks participants to strike a spring with a hammer. The spring shoots a puck upward toward a bell. If the puck strikes the bell, the participant wins a prize. Suppose that a participant strikes the spring and shoots the puck according to the model $d(t) = 16t^2 - 32t + 18$, where d is the distance in feet between the puck and the bell and t is the time in seconds since the puck was struck. Is it possible for the participant to win a prize? Explain your answer.



Given each solution to a quadratic equation, find the other solution.

37. $1 + 14i$ **38.** $\frac{5}{7}i$ **39.** $4i - 2\sqrt{5}$

40. $-12 - i$ **41.** $9 - i\sqrt{2}$ **42.** $-\frac{17i}{3}$

Find the values of c and d that make each equation true.

43. $2ci + 1 = -d + 6 - ci$ **44.** $c + 3ci = 4 + di$ **45.** $c^2 + 4i = d + di$

Solve each equation.

46. $8x^2 = -8$ **47.** $\frac{1}{3}x^2 = -27$ **48.** $2x^2 + 12.5 = 0$

49. $\frac{1}{2}x^2 + 72 = 0$ **50.** $x^2 = -30$ **51.** $2x^2 + 16 = 0$

52. $x^2 - 4x + 8 = 0$ **53.** $x^2 + 10x + 29 = 0$ **54.** $x^2 - 12x + 44 = 0$

55. $x^2 + 2x = -5$ **56.** $x^2 + 18 = -6x$ **57.** $-149 = x^2 - 24x$

Tell whether each statement is always, sometimes, or never true. If sometimes true, give examples to support your answer.

58. A real number is an imaginary number.

59. An imaginary number is a complex number.

60. A rational number is a complex number.

61. A complex number is an imaginary number.

62. An integer is a complex number.

63. Quadratic equations have no real solutions.

64. Quadratic equations have roots that are real and complex.

65. Roots of quadratic equations are conjugate pairs.

Find the zeros of each function.

66. $f(x) = x^2 - 10x + 26$ **67.** $g(x) = x^2 + 2x + 17$ **68.** $h(x) = x^2 - 10x + 50$

69. $f(x) = x^2 + 16x + 73$ **70.** $g(x) = x^2 - 10x + 37$ **71.** $h(x) = x^2 - 16x + 68$

72. **Critical Thinking** Can you determine the zeros of $f(x) = x^2 + 64$ by using a graph? Explain why or why not.

73. **Critical Thinking** What is the complex conjugate of a real number?

HOT **74.** **Write About It** Explain the procedures you can use to solve for nonreal complex roots.

LINK

Math History

The Swiss mathematician Leonhard Euler (1707–1783) was the first to use the notation i to represent $\sqrt{-1}$. He also introduced the notation $f(x)$ to represent the value of a function f at x.

Real-World Connections

75. A player throws a ball straight up toward the roof of an indoor baseball stadium. The height h in feet of the ball after t seconds can be modeled by the function $h(t) = -16t^2 + 112t$.

a. The height of the roof is 208 ft. Solve the equation $208 = -16t^2 + 112t$.

b. Based on your answer to part **a**, does the ball hit the roof? Explain your answer.

c. Based on the function model, what is the maximum height that the ball will reach?