GUIDED PRACTICE

Vocabulary Check ✓

1. Complete this statement: For the complex number $3 - 7i$, the real part is ? and the imaginary part is ?.

Concept Check ✓

2. **ERROR ANALYSIS** A student thinks that the complex conjugate of $-5 + 2i$ is $5 - 2i$. Explain the student's mistake, and give the correct complex conjugate of $-5 + 2i$.

3. Geometrically, what does the absolute value of a complex number represent?

Skill Check ✓

Solve the equation.

4. $x^2 = -9$
5. $2x^2 + 3 = -13$
6. $(x - 1)^2 = -7$

Write the expression as a complex number in standard form.

7. $(1 + 5i) + (6 - 2i)$
8. $(4 + 3i) - (-2 + 4i)$
9. $(1 - i)(7 + 2i)$
10. $\dfrac{3 - 4i}{1 + i}$

Find the absolute value of the complex number.

11. $1 + i$
12. $3i$
13. $-2 + 3i$
14. $5 - 5i$

15. Plot the numbers in Exercises 11–14 in the same complex plane.

16. **FRACTAL GEOMETRY** Tell whether $c = 1 - i$ belongs to the Mandelbrot set. Use absolute value to justify your answer.

PRACTICE AND APPLICATIONS

STUDENT HELP

Extra Practice to help you master skills is on p. 946.

SOLVING QUADRATIC EQUATIONS **Solve the equation.**

17. $x^2 = -4$
18. $x^2 = -11$
19. $3x^2 = -81$
20. $2x^2 + 9 = -41$
21. $5x^2 + 18 = 3$
22. $-x^2 - 4 = 14$
23. $8r^2 + 7 = 5r^2 + 4$
24. $3s^2 - 1 = 7s^2$
25. $(t - 2)^2 = -16$
26. $-6(u + 5)^2 = 120$
27. $-\frac{1}{8}(v + 3)^2 = 7$
28. $9(w - 4)^2 + 1 = 0$

PLOTTING COMPLEX NUMBERS **Plot the numbers in the same complex plane.**

29. $4 + 2i$
30. $-1 + i$
31. $-4i$
32. 3
33. $-2 - i$
34. $1 + 5i$
35. $6 - 3i$
36. $-5 + 4i$

STUDENT HELP

HOMEWORK HELP

Example 1: Exs. 17–28
Example 2: Exs. 29–36
Example 3: Exs. 37–46
Example 4: Exs. 47–55
Example 5: Exs. 56–63
Example 6: Exs. 64–71
Example 7: Exs. 72–79

ADDING AND SUBTRACTING **Write the expression as a complex number in standard form.**

37. $(2 + 3i) + (7 + i)$
38. $(6 + 2i) + (5 - i)$
39. $(-4 + 7i) + (-4 - 7i)$
40. $(-1 - i) + (9 - 3i)$
41. $(8 + 5i) - (1 + 2i)$
42. $(2 - 6i) - (-10 + 4i)$
43. $(-0.4 + 0.9i) - (-0.6 + i)$
44. $(25 + 15i) - (25 - 6i)$
45. $-i + (8 - 2i) - (5 - 9i)$
46. $(30 - i) - (18 + 6i) + 30i$

MULTIPLYING Write the expression as a complex number in standard form.

47. $i(3 + i)$ **48.** $4i(6 - i)$ **49.** $-10i(4 + 7i)$

50. $(5 + i)(8 + i)$ **51.** $(-1 + 2i)(11 - i)$ **52.** $(2 - 9i)(9 - 6i)$

53. $(7 + 5i)(7 - 5i)$ **54.** $(3 + 10i)^2$ **55.** $(15 - 8i)^2$

DIVIDING Write the expression as a complex number in standard form.

56. $\frac{8}{1 + i}$ **57.** $\frac{2i}{1 - i}$ **58.** $\frac{-5 - 3i}{4i}$ **59.** $\frac{3 + i}{3 - i}$

60. $\frac{2 + 5i}{5 + 2i}$ **61.** $\frac{-7 + 6i}{9 - 4i}$ **62.** $\frac{\sqrt{10}}{\sqrt{10} - i}$ **63.** $\frac{6 - i\sqrt{2}}{6 + i\sqrt{2}}$

ABSOLUTE VALUE Find the absolute value of the complex number.

64. $3 - 4i$ **65.** $5 + 12i$ **66.** $-2 - i$ **67.** $-7 + i$

68. $2 + 5i$ **69.** $4 - 8i$ **70.** $-9 + 6i$ **71.** $\sqrt{11} + i\sqrt{5}$

MANDELBROT SET Tell whether the complex number c belongs to the Mandelbrot set. Use absolute value to justify your answer.

72. $c = 1$ **73.** $c = -1$ **74.** $c = -i$ **75.** $c = -1 - i$

76. $c = 2$ **77.** $c = -1 + i$ **78.** $c = -0.5$ **79.** $c = 0.5i$

STUDENT HELP

Skills Review
For help with disproving statements by counterexample, see p. 927.

LOGICAL REASONING In Exercises 80–85, tell whether the statement is *true* or *false*. If the statement is false, give a counterexample.

80. Every complex number is an imaginary number.

81. Every irrational number is a complex number.

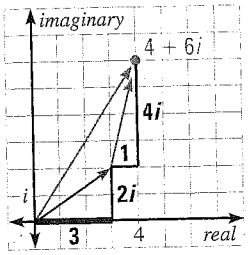
82. All real numbers lie on a single line in the complex plane.

83. The sum of two imaginary numbers is always an imaginary number.

84. Every real number equals its complex conjugate.

85. The absolute values of a complex number and its complex conjugate are always equal.

86. VISUAL THINKING The graph shows how you can geometrically add two complex numbers (in this case, $3 + 2i$ and $1 + 4i$) to find their sum (in this case, $4 + 6i$). Find each of the following sums by drawing a graph.



a. $(2 + i) + (3 + 5i)$

b. $(-1 + 6i) + (7 - 4i)$

COMPARING REAL AND COMPLEX NUMBERS Tell whether the property is true for (a) the set of real numbers and (b) the set of complex numbers.

87. If r, s, and t are numbers in the set, then $(r + s) + t = r + (s + t)$.

88. If r is a number in the set and $|r| = k$, then $r = k$ or $r = -k$.

89. If r and s are numbers in the set, then $r - s = s - r$.

90. If r, s, and t are numbers in the set, then $r(s + t) = rs + rt$.

91. If r and s are numbers in the set, then $|r + s| = |r| + |s|$.