140. The solution set of $ax^2 + bx + c = 0$ is $\left\{\frac{-b + \sqrt{b^2 - 4ac}}{2a}, \frac{-b - \sqrt{b^2 - 4ac}}{2a}\right\}$.

The solution set of $cx^2 + bx + a = 0$ is $\left\{\frac{-b + \sqrt{b^2 - 4ca}}{2c}, \frac{-b - \sqrt{b^2 - 4ca}}{2c}\right\}$

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a} \cdot \frac{-b - \sqrt{b^2 - 4ca}}{2c} = \frac{b^2 - (b^2 - 4ac)}{4ac} = \frac{b^2 - b^2 + 4ac}{4ac} = \frac{4ac}{4ac} = 1$$

$$\frac{-b - \sqrt{b^2 - 4ac}}{2a} \cdot \frac{-b + \sqrt{b^2 - 4ca}}{2c} = \frac{b^2 - (b^2 - 4ac)}{4ac} = \frac{b^2 - b^2 + 4ac}{4ac} = \frac{4ac}{4ac} = 1$$

Since the product of each solution of $ax^2 + bx + c = 0$ with a corresponding solution of $cx^2 + bx + a = 0$ is 1, the solutions of the two equations are reciprocals.

141. (b)

A.6 Assess Your Understanding *(page 1007)*

1. F **2.** 5 **3.** F **4.** real; imaginary; imaginary unit **5.** $\{-2i, 2i\}$ **6.** F **7.** T **8.** F

9. $8 + 5i$ **10.** $-4 + 7i$ **11.** $-7 + 6i$ **12.** 6 **13.** $-6 - 11i$ **14.** $-10 + 6i$ **15.** $6 - 18i$ **16.** $-8 - 32i$ **17.** $6 + 4i$ **18.** $-12 - 9i$

19. $10 - 5i$ **20.** $13 + i$ **21.** 37 **22.** -10 **23.** $\frac{6}{5} + \frac{8}{5}i$ **24.** $\frac{5}{13} + \frac{12}{13}i$ **25.** $1 - 2i$ **26.** $\frac{1}{2} + i$ **27.** $\frac{5}{2} - \frac{7}{2}i$ **28.** $-\frac{1}{2} + \frac{5}{2}i$

29. $-\frac{1}{2} + \frac{\sqrt{3}}{2}i$ **30.** $\frac{1}{2} - \frac{\sqrt{3}}{2}i$ **31.** $2i$ **32.** $-2i$ **33.** $-i$ **34.** -1 **35.** i **36.** i **37.** -6 **38.** $4 - i$ **39.** $-10i$ **40.** $3 - 4i$

41. $-2 + 2i$ **42.** 82 **43.** 0 **44.** 0 **45.** 0 **46.** 0 **47.** $2i$ **48.** $3i$ **49.** $5i$ **50.** $8i$ **51.** $5i$ **52.** $5i$ **53.** $\{-2i, 2i\}$ **54.** $\{-2, 2\}$

55. $\{-4, 4\}$ **56.** $\{-5i, 5i\}$ **57.** $\{3 - 2i, 3 + 2i\}$ **58.** $\{-2 - 2i, -2 + 2i\}$ **59.** $\{3 - i, 3 + i\}$ **60.** $\{1 - 2i, 1 + 2i\}$

61. $\left\{\frac{1}{4} - \frac{1}{4}i, \frac{1}{4} + \frac{1}{4}i\right\}$ **62.** $\left\{-\frac{3}{10} - \frac{1}{10}i, -\frac{3}{10} + \frac{1}{10}i\right\}$ **63.** $\left\{\frac{1}{5} - \frac{2}{5}i, \frac{1}{5} + \frac{2}{5}i\right\}$ **64.** $\left\{\frac{3}{13} - \frac{2}{13}i, \frac{3}{13} + \frac{2}{13}i\right\}$

65. $\left\{-\frac{1}{2} - \frac{\sqrt{3}}{2}i, -\frac{1}{2} + \frac{\sqrt{3}}{2}i\right\}$ **66.** $\left\{\frac{1}{2} - \frac{\sqrt{3}}{2}i, \frac{1}{2} + \frac{\sqrt{3}}{2}i\right\}$ **67.** $\{2, -1 - \sqrt{3}i, -1 + \sqrt{3}i\}$ **68.** $\left\{-3, \frac{3}{2} - \frac{3\sqrt{3}}{2}i, \frac{3}{2} + \frac{3\sqrt{3}}{2}i\right\}$

69. $\{-2, 2, -2i, 2i\}$ **70.** $\{-1, 1 - i, i\}$ **71.** $\{-3i, -2i, 2i, 3i\}$ **72.** $\{-1, 1, -2i, 2i\}$

73. Two complex solutions that are conjugates of each other **74.** Two unequal real solutions **75.** Two unequal real solutions

76. Two complex solutions that are conjugates of each other **77.** A repeated real solution **78.** A repeated real solution

79. $2 - 3i$ **80.** $4 + i$ **81.** 6 **82.** $6i$ **83.** 25 **84.** $-5 + 7i$

85. $z + \bar{z} = a + bi + a - bi = 2a + (b - b)i = 2a$

$z - \bar{z} = a + bi - a - bi = 0 + (b + b)i = 2bi$

86. $z = a + bi, \bar{z} = a - bi, \bar{\bar{z}} = \overline{(a - bi)} = a + bi = z$

87. $\overline{z + w} = \overline{(a + bi) + (c + di)} = \overline{(a + c) + (b + d)i} = (a + c) - (b + d)i$

$\bar{z} + \bar{w} = (a - bi) + (c - di) = (a + c) + (-b - d)i = (a + c) - (b + d)i$

88. $\overline{z \cdot w} = \overline{(a + bi)(c + di)} = \overline{(ac - bd) + (ad + bc)i} = (ac - bd) - (ad + bc)i$

$\bar{z} \cdot \bar{w} = (a - bi)(c - di) = [ac - (-b)(-d)] + [a(-d) + (-b)(c)]i = (ac - bd) + (-ad - bc)i = (ac - bd) - (ad + bc)i$

A.7 Assess Your Understanding *(page 1016)*

1. mathematical modeling **2.** interest **3.** uniform motion **4.** T **5.** T **6.** $100 - x$

7. $A = \pi r^2$; r = radius, A = area **8.** $C = 2\pi r$; r = radius, C = circumference **9.** $A = s^2$; A = area, s = length of a side

10. $P = 4s$; s = length of a side, P = perimeter **11.** $F = ma$; F = force, m = mass, a = acceleration

12. $P = \frac{F}{A}$; P = pressure, F = force, A = area **13.** $W = Fd$; W = work, F = force, d = distance

14. $K = \frac{1}{2}mv^2$; K = kinetic energy, m = mass, v = velocity **15.** $C = 150x$; C = total variable cost, x = number of dishwashers

16. $R = 250x$; R = total revenue, x = number of dishwashers **17.** \$11,500 will be invested in bonds and \$8500 in CDs.

18. Sean will receive \$6500 and George \$3500. **19.** Brooke needs a score of 85. **20.** For a B, Mike needs 78; for an A, he needs 93.

21. The length is 19 ft; the width is 11 ft. **22.** The length is 14 m; the width is 7 m. **23.** Invest \$31,250 in bonds and \$18,750 in CDs.

24. Invest \$43,750 in bonds and \$6250 in CDs. **25.** \$11,600 was loaned out at 8%. **26.** She can lend \$333,333.33 at 16%.

27. Mix 75 lb of Earl Grey tea with 25 lb of Orange Pekoe tea. **28.** 49 lb of coffee I should be mixed with 51 lb of coffee II.

29. Mix 40 lb of cashews with the peanuts. **30.** Each box should contain 20 caramels and 10 cremes. **31.** The speed of the current is 2.286 mi/hr.

32. The speed of the boat is 9 mi/hr. **33.** The Metra commuter averages 30 mi/hr; the Amtrak averages 80 mi/hr. **34.** The average speed of the slower car is 60 mi/hr; the average speed of the faster car is 70 mi/hr. Each traveled 210 mi. **35.** Working together, it takes 12 min.

36. April would take 15 hr. **37.** The dimensions should be 4 ft by 4 ft. **38.** The dimensions should be 6 ft by 3 ft.