117. Answers will vary; One possible answer is $f(x) = x + 1$ and $g(x) = x - 1$.   **118.** $\{(4, -2), (1, -1), (1, 1), (4, 2)\}$; no

119. $y = \dfrac{5}{x - 4}$ **120.** $y = \sqrt{x + 1}$
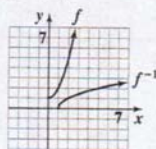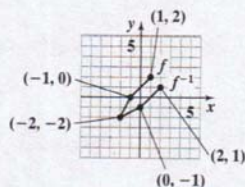
Section 2.7

Check Point Exercises

1. $f(g(x)) = 4\left(\dfrac{x + 7}{4}\right) - 7 = x + 7 - 7 = x$; $g(f(x)) = \dfrac{(4x - 7) + 7}{4} = \dfrac{4x}{4} = x$ **2.** $f^{-1}(x) = \dfrac{x - 7}{2}$ **3.** $f^{-1}(x) = \sqrt[3]{\dfrac{x + 1}{4}}$

4. $f^{-1}(x) = \dfrac{3}{x + 1}$ **5.** (b) and (c)

6.

7. $f^{-1}(x) = \sqrt{x - 1}$

Exercise Set 2.7

1. $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.   **2.** $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.
3. $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.   **4.** $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.
5. $f(g(x)) = \dfrac{5x - 56}{9}$; $g(f(x)) = \dfrac{5x - 4}{9}$; f and g are not inverses.   **6.** $f(g(x)) = \dfrac{3x - 40}{7}$; $g(f(x)) = \dfrac{3x - 4}{7}$; f and g are not inverses.
**7.** $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.   **8.** $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.
9. $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.   **10.** $f(g(x)) = x$; $g(f(x)) = x$; f and g are inverses.   **11.** $f^{-1}(x) = x - 3$

12. $f^{-1}(x) = x - 5$ **13.** $f^{-1}(x) = \dfrac{x}{2}$ **14.** $f^{-1}(x) = \dfrac{x}{4}$ **15.** $f^{-1}(x) = \dfrac{x - 3}{2}$ **16.** $f^{-1}(x) = \dfrac{x + 1}{3}$ **17.** $f^{-1}(x) = \sqrt[3]{x - 2}$

18. $f^{-1}(x) = \sqrt[3]{x + 1}$ **19.** $f^{-1}(x) = \sqrt[3]{x} - 2$ **20.** $f^{-1}(x) = \sqrt[3]{x} + 1$ **21.** $f^{-1}(x) = \dfrac{1}{x}$ **22.** $f^{-1}(x) = \dfrac{2}{x}$ **23.** $f^{-1}(x) = x^2, x \geq 0$

24. $f^{-1}(x) = x^3$ **25.** $f^{-1}(x) = \dfrac{7}{x + 3}$ **26.** $f^{-1}(x) = \dfrac{4}{x - 9}$ **27.** $f^{-1}(x) = \dfrac{3x + 1}{x - 2}; x \neq 2$ **28.** $f^{-1}(x) = \dfrac{-x - 3}{x - 2}; x \neq 2$

29. The function is not one-to-one, so it does not have an inverse function.   **30.** The function is one-to-one, so it does have an inverse function.
31. The function is not one-to-one, so it does not have an inverse function.   **32.** The function is not one-to-one, so it does not have an inverse function.
33. The function is one-to-one, so it does have an inverse function.   **34.** The function is one-to-one, so it does have an inverse function.
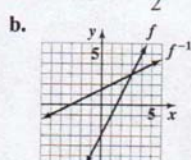
35.

36.

37.

38.

39. a. $f^{-1}(x) = \dfrac{x + 1}{2}$
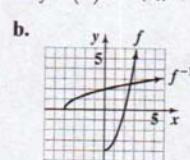
b.
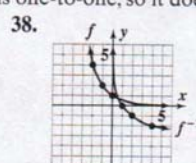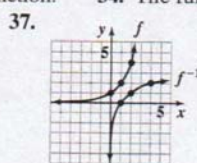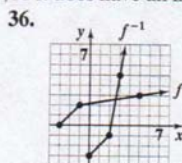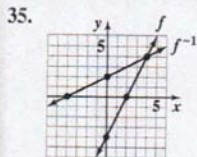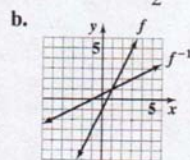
c. domain of f = range of $f^{-1} = (-\infty, \infty)$; range of f = domain of $f^{-1} = (-\infty, \infty)$

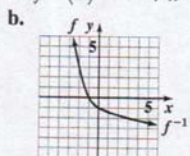**40. a.** $f^{-1}(x) = \dfrac{x + 3}{2}$

b.

c. domain of f = range of $f^{-1} = (-\infty, \infty)$; range of f = domain of $f^{-1} = (-\infty, \infty)$
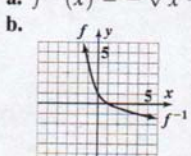
41. a. $f^{-1}(x) = \sqrt{x + 4}$

b.

c. domain of f = range of $f^{-1} = [0, \infty)$; range of f = domain of $f^{-1} = [-4, \infty)$
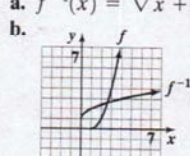
42. a. $f^{-1}(x) = -\sqrt{x + 1}$

b.

c. domain of f = range of $f^{-1} = (-\infty, 0]$; range of f = domain of $f^{-1} = [-1, \infty)$
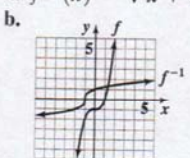
43. a. $f^{-1}(x) = -\sqrt{x} + 1$

b.

c. domain of f = range of $f^{-1} = (-\infty, 1]$; range of f = domain of $f^{-1} = [0, \infty)$
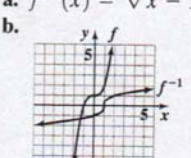
44. a. $f^{-1}(x) = \sqrt{x} + 1$

b.

c. domain of f = range of $f^{-1} = [1, \infty)$; range of f = domain of $f^{-1} = [0, \infty)$

45. a. $f^{-1}(x) = \sqrt[3]{x} + 1$
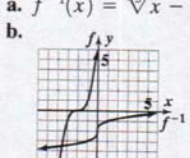
b.

c. domain of f = range of $f^{-1} = (-\infty, \infty)$; range of f = domain of $f^{-1} = (-\infty, \infty)$

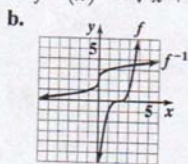**46. a.** $f^{-1}(x) = \sqrt[3]{x} - 1$

b.

c. domain of f = range of $f^{-1} = (-\infty, \infty)$; range of f = domain of $f^{-1} = (-\infty, \infty)$

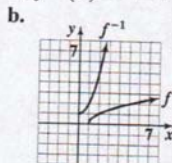**47. a.** $f^{-1}(x) = \sqrt[3]{x} - 2$

b.

c. domain of f = range of $f^{-1} = (-\infty, \infty)$; range of f = domain of $f^{-1} = (-\infty, \infty)$
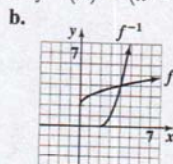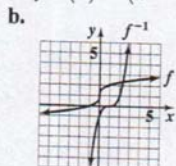
48. a. $f^{-1}(x) = \sqrt[3]{x} + 2$
b.

49. a. $f^{-1}(x) = x^2 + 1, x \geq 0$
b.

50. a. $f^{-1}(x) = (x-2)^2, x \geq 2$
b.

c. domain of f = range of $f^{-1} = (-\infty, \infty)$;
range of f = domain of $f^{-1} = (-\infty, \infty)$

c. domain of f = range of $f^{-1} = [1, \infty)$;
range of f = domain of $f^{-1} = [0, \infty)$

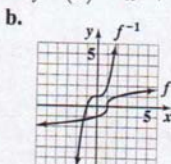**c.** domain of f = range of $f^{-1} = [0, \infty)$;
range of f = domain of $f^{-1} = [2, \infty)$

51. a. $f^{-1}(x) = (x-1)^3$
b.

52. a. $f^{-1}(x) = x^3 + 1$
b.

53. 5   **54.** -1
55. 1   **56.** 2
57. 2   **58.** -1
59. -7 **60.** -21
61. 3   **62.** 2
63. 11   **64.** 25

c. domain of f = range of $f^{-1} = (-\infty, \infty)$;
range of f = domain of $f^{-1} = (-\infty, \infty)$

c. domain of f = range of $f^{-1} = (-\infty, \infty)$;
range of f = domain of $f^{-1} = (-\infty, \infty)$
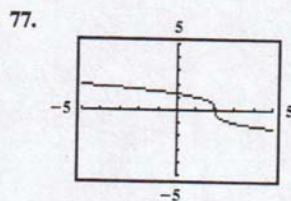
65. a. $\{(17, 9.7), (22, 8.7), (30, 8.4), (40, 8.3), (50, 8.2), (60, 8.3)\}$ **b.** $\{(9.7, 17), (8.7, 22), (8.4, 30), (8.3, 40), (8.2, 50), (8.3, 60)\}$; no; The inverse of f is not a function.   **66. a.** $\{(17, 9.3), (22, 9.1), (30, 8.8), (40, 8.5), (50, 8.4), (60, 8.5)\}$ **b.** $\{(9.3, 17), (9.1, 22), (8.8, 30), (8.5, 40), (8.4, 50), (8.5, 60)\}$; no; The inverse of g is not a function.   **67. a.** f is a one-to-one function.   **b.** $f^{-1}(0.25)$ is the number of people in a room for a 25% probability of two people sharing a birthday. $f^{-1}(0.5)$ is the number of people in a room for a 50% probability of two people sharing a birthday. $f^{-1}(0.7)$ is the number of people in a room for a 70% probability of two people sharing a birthday.   **68. a.** No; the horizontal line $y = 3$ intersects the graph in more than one point.   **b.** 12 P.M. and 7 P.M.; $(12, 3)$ and $(19, 3)$ **c.** No, the graph does not represent a one-to-one function; the points $(12, 3)$ and $(19, 3)$ have the same second coordinate but different first coordinates.
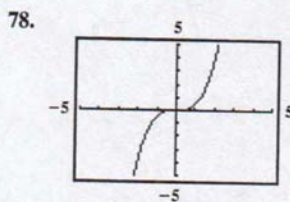
69. $f(g(x)) = \dfrac{9}{5}\left[\dfrac{5}{9}(x - 32)\right] + 32 = x$ and $g(f(x)) = \dfrac{5}{9}\left[\left(\dfrac{9}{5}x + 32\right) - 32\right] = x$
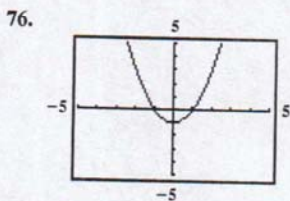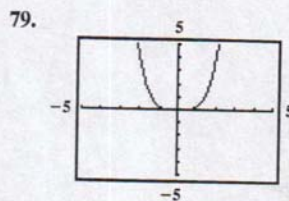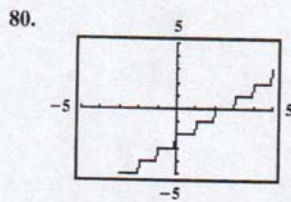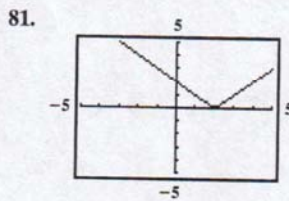
76.

not one-to-one

77.

one-to-one

78.

one-to-one

79.

not one-to-one

80.

not one-to-one

81.

not one-to-one

82.

one-to-one

83.

not one-to-one

84.

f and g are inverses.

85.

f and g are inverses.

86.
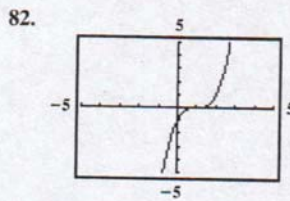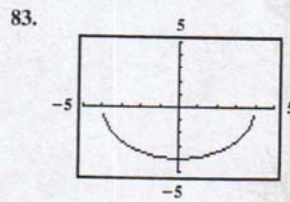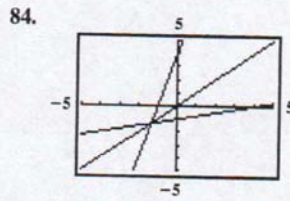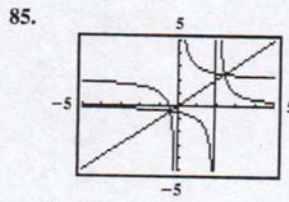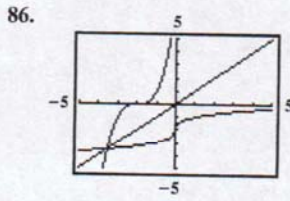
f and g are inverses.

87. makes sense   **88.** makes sense   **89.** makes sense   **90.** makes sense   **91.** false   **92.** false   **93.** false   **94.** true

95. $(f \circ g)^{-1}(x) = \dfrac{x - 15}{3}$; $(g^{-1} \circ f^{-1})(x) = \dfrac{x}{3} - 5 = \dfrac{x - 15}{3}$ **96.** $(f \circ f)(x) = x$, so f is its own inverse.

97. No; The space craft was at the same height, $s(t)$, for two different values of t-once during the ascent and once again during the descent.   **98.** 7

100. $3\sqrt{5}$ **101.**

102. $\{3 \pm \sqrt{13}\}$