

2.1 EXERCISE SET

Practice Exercises

In Exercises 1–10, determine whether each relation is a function. Give the domain and range for each relation.

1. $\{(1, 2), (3, 4), (5, 5)\}$ function; $\{1, 3, 5\}; \{2, 4, 5\}$
2. $\{(4, 5), (6, 7), (8, 8)\}$ function; $\{4, 6, 8\}; \{5, 7, 8\}$
3. $\{(3, 4), (3, 5), (4, 4), (4, 5)\}$ not a function; $\{3, 4\}; \{4, 5\}$
4. $\{(5, 6), (5, 7), (6, 6), (6, 7)\}$ not a function; $\{5, 6\}; \{6, 7\}$
5. $\{(3, -2), (5, -2), (7, 1), (4, 9)\}$ function; $\{3, 4, 5, 7\}; \{-2, 1, 9\}$
6. $\{(10, 4), (-2, 4), (-1, 1), (5, 6)\}$ function; $\{-2, 1, 5, 10\}; \{1, 4, 6\}$
7. $\{(-3, -3), (-2, -2), (-1, -1), (0, 0)\}$ function*
8. $\{(-7, -7), (-5, -5), (-3, -3), (0, 0)\}$ function*
9. $\{(1, 4), (1, 5), (1, 6)\}$ not a function; $\{1\}; \{4, 5, 6\}$
10. $\{(4, 1), (5, 1), (6, 1)\}$ function; $\{4, 5, 6\}; \{1\}$

In Exercises 11–26, determine whether each equation defines y as a function of x .

- | | |
|----------------------------|-----------------------------|
| 11. $x + y = 16$ yes | 12. $x + y = 25$ yes |
| 13. $x^2 + y = 16$ yes | 14. $x^2 + y = 25$ yes |
| 15. $x^2 + y^2 = 16$ no | 16. $x^2 + y^2 = 25$ no |
| 17. $x = y^2$ no | 18. $4x = y^2$ no |
| 19. $y = \sqrt{x + 4}$ yes | 20. $y = -\sqrt{x + 4}$ yes |
| 21. $x + y^3 = 8$ yes | 22. $x + y^3 = 27$ yes |
| 23. $xy + 2y = 1$ yes | 24. $xy - 5y = 1$ yes |
| 25. $ x - y = 2$ yes | 26. $ x - y = 5$ yes |

In Exercises 27–38, evaluate each function at the given values of the independent variable and simplify.

27. $f(x) = 4x + 5$
 - a. $f(6)$ 29
 - b. $f(x + 1)$ $4x + 9$
 - c. $f(-x)$ *
28. $f(x) = 3x + 7$
 - a. $f(4)$ 19
 - b. $f(x + 1)$ $3x + 10$
 - c. $f(-x)$ *
29. $g(x) = x^2 + 2x + 3$
 - a. $g(-1)$ 2
 - b. $g(x + 5)$ *
 - c. $g(-x)$ *
30. $g(x) = x^2 - 10x - 3$
 - a. $g(-1)$ 8
 - b. $g(x + 2)$ *
 - c. $g(-x)$ *
31. $h(x) = x^4 - x^2 + 1$
 - a. $h(2)$ 13
 - b. $h(-1)$ 1
 - c. $h(-x)$ $x^4 - x^2 + 1$
 - d. $h(3a)$ $81a^4 - 9a^2 + 1$
32. $h(x) = x^3 - x + 1$
 - a. $h(3)$ 25
 - b. $h(-2)$ -5
 - c. $h(-x)$ $-x^3 + x + 1$
 - d. $h(3a)$ $27a^3 - 3a + 1$
33. $f(r) = \sqrt{r + 6} + 3$
 - a. $f(-6)$ 3
 - b. $f(10)$ 7
 - c. $f(x - 6)$ *
34. $f(r) = \sqrt{25 - r} - 6$
 - a. $f(16)$ -3
 - b. $f(-24)$ 1
 - c. $f(25 - 2x)$ *
35. $f(x) = \frac{4x^2 - 1}{x^2}$
 - a. $f(2)$ $\frac{15}{4}$
 - b. $f(-2)$ $\frac{15}{4}$
 - c. $f(-x)$ $\frac{4x^2 - 1}{x^2}$

$$36. f(x) = \frac{4x^3 + 1}{x^3}$$

$$\text{a. } f(2) \frac{33}{8}$$

$$\text{b. } f(-2) \frac{31}{8}$$

$$\text{c. } f(-x) *$$

$$37. f(x) = \frac{x}{|x|}$$

$$\text{a. } f(6) 1$$

$$\text{b. } f(-6) -1$$

$$\text{c. } f(r^2) 1$$

$$38. f(x) = \frac{|x + 3|}{x + 3}$$

$$\text{a. } f(5) 1$$

$$\text{b. } f(-5) -1$$

$$\text{c. } f(-9 - x) *$$

In Exercises 39–50, graph the given functions, f and g , in the same rectangular coordinate system. Select integers for x , starting with -2 and ending with 2. Once you have obtained your graphs, describe how the graph of g is related to the graph of f .

$$39. f(x) = x, g(x) = x + 3 *$$

$$40. f(x) = x, g(x) = x - 4 *$$

$$41. f(x) = -2x, g(x) = -2x - 1 *$$

$$42. f(x) = -2x, g(x) = -2x + 3 *$$

$$43. f(x) = x^2, g(x) = x^2 + 1 *$$

$$44. f(x) = x^2, g(x) = x^2 - 2 *$$

$$45. f(x) = |x|, g(x) = |x| - 2 *$$

$$46. f(x) = |x|, g(x) = |x| + 1 *$$

$$47. f(x) = x^3, g(x) = x^3 + 2 *$$

$$48. f(x) = x^3, g(x) = x^3 - 1 *$$

$$49. f(x) = 3, g(x) = 5 *$$

$$50. f(x) = -1, g(x) = 4 *$$

In Exercises 51–54, graph the given square root functions, f and g , in the same rectangular coordinate system. Use the integer values of x given to the right of each function to obtain ordered pairs. Because only nonnegative numbers have square roots that are real numbers, be sure that each graph appears only for values of x that cause the expression under the radical sign to be greater than or equal to zero. Once you have obtained your graphs, describe how the graph of g is related to the graph of f .

$$51. f(x) = \sqrt{x} \quad (x = 0, 1, 4, 9) \text{ and}$$

$$g(x) = \sqrt{x} - 1 \quad (x = 0, 1, 4, 9) *$$

$$52. f(x) = \sqrt{x} \quad (x = 0, 1, 4, 9) \text{ and}$$

$$g(x) = \sqrt{x} + 2 \quad (x = 0, 1, 4, 9) *$$

$$53. f(x) = \sqrt{x} \quad (x = 0, 1, 4, 9) \text{ and}$$

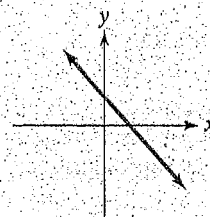
$$g(x) = \sqrt{x} - 1 \quad (x = 1, 2, 5, 10) *$$

$$54. f(x) = \sqrt{x} \quad (x = 0, 1, 4, 9) \text{ and}$$

$$g(x) = \sqrt{x + 2} \quad (x = -2, -1, 2, 7) *$$

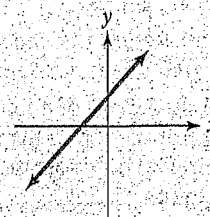
In Exercises 55–64, use the vertical line test to identify graphs in which y is a function of x .

55.



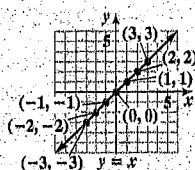
function

56.

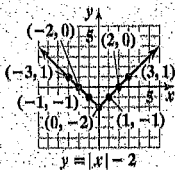


function

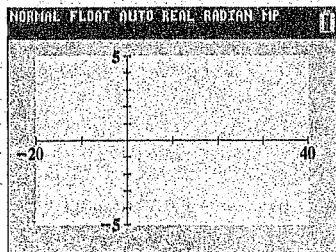
3.



4.



5.



9. (20, 8); 8% of college students anticipated a starting salary of \$20 thousand. 22. $\{x|x \text{ is a real number}\}$; identity 30. all real numbers except -1 and 1 ; identity

46. $g = \frac{T}{r + vt}$ 63. $\left\{\frac{4 - 3\sqrt{2}}{3}, \frac{4 + 3\sqrt{2}}{3}\right\}$

69. $\{1 + 3i\sqrt{2}, 1 - 3i\sqrt{2}\}$ 71. 2 complex imaginary solutions

72. 2 unequal real solutions that are rational

74. $\left\{-2, \frac{10}{3}\right\}$ 75. $\left\{\frac{7 + \sqrt{37}}{6}, \frac{7 - \sqrt{37}}{6}\right\}$

78. $\left\{\frac{1}{6} + i\frac{\sqrt{23}}{6}, \frac{1}{6} - i\frac{\sqrt{23}}{6}\right\}$ 80. $\{-2 - 2i, -2 + 2i\}$

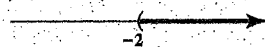
87. $\left\{-3, \frac{1}{2}, 3\right\}$ 89. $\{8\}$ 92. $\{-2, -1, 1, 2\}$

96. $\left\{-1, -\frac{2\sqrt{6}}{9}, \frac{2\sqrt{6}}{9}, 1\right\}$ 99. $\{-3, -2, 3\}$ 101. $\{-3, -\sqrt{2}, \sqrt{2}\}$

104. $\{x|-3 \leq x < 5\}$



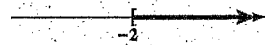
105. $\{x|x > -2\}$



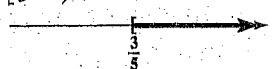
106. $\{x|x \leq 0\}$



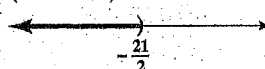
111. $[-2, \infty)$



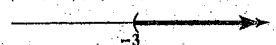
112. $\left[\frac{3}{5}, \infty\right)$



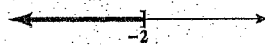
113. $\left(-\infty, -\frac{21}{2}\right)$



114. $(-3, \infty)$



115. $(-\infty, -2]$



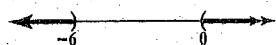
117. $(2, 3]$



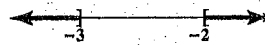
118. $[-9, 6]$



119. $(-\infty, -6) \cup (0, \infty)$



120. $(-\infty, -3] \cup [-2, \infty)$

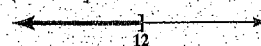


121. $(-\infty, -5] \cup [1, \infty)$

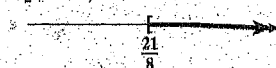


Chapter 1 Test

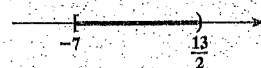
20. $(-\infty, 12]$



21. $\left[\frac{21}{8}, \infty\right)$



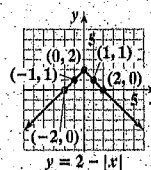
22. $\left[-7, \frac{13}{2}\right)$



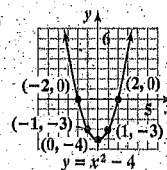
23. $\left(-\infty, -\frac{5}{3}\right] \cup \left[\frac{1}{3}, \infty\right)$



30.



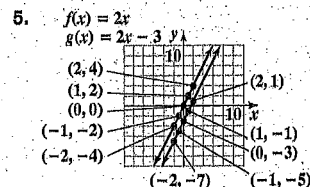
31.



Chapter 2

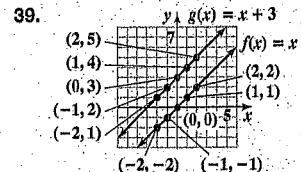
Section 2.1

Check Point Exercises

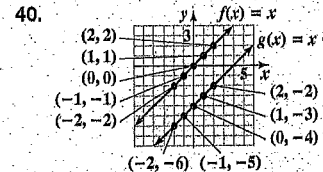


2.1 Exercise Set

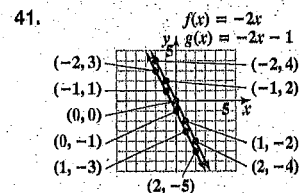
7. function; $\{-3, -2, -1, 0\}$; $\{-3, -2, -1, 0\}$ 8. function;
 $\{-7, -5, -3, 0\}$; $\{-7, -5, -3, 0\}$ 27. c. $-4x + 5$ 28. c. $-3x +$
29. b. $x^2 + 12x + 38$ c. $x^2 - 2x + 3$ 30. b. $x^2 - 6x - 19$
c. $x^2 + 10x - 3$ 33. c. $\sqrt{x} + 3$ 34. c. $\sqrt{2x} - 6$
36. c. $\frac{-4x^3 + 1}{-x^3}$ or $\frac{4x^3 - 1}{x^3}$ 38. c. $\begin{cases} 1, & \text{if } x < -6 \\ -1, & \text{if } x \geq -6 \end{cases}$



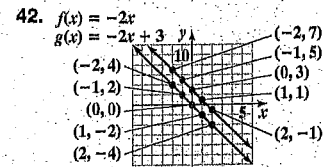
The graph of g is the graph of f shifted up by 3 units.



The graph of g is the graph of f shifted down by 4 units.



The graph of g is the graph of f shifted down by 1 unit.



The graph of g is the graph of f shifted up by 3 units.