Lesson-by-Lesson Review

2-1 Relations and Functions

State the domain and range of each relation. Then determine whether the relation is a function. If it is a function, determine if it is *one-to-one, onto, both,* or *neither.* **7–10. See margin.**

7. {(1, 2), (3, 4), (5, 6), (7, 8)}

8. {(−3, 0), (0, 2), (2, 4), (4, 5), (5, 2)}

9. {(−4, 1), (3, 3), (1, 1), (−2, 5), (3, −4)}

10. {(7, −4), (5, −2), (3, 0), (1, 2), (−1, 4)}

Find each value if $f(x) = -3x + 2$.

11. $f(4)$ **−10**

12. $f(-3)$ **11**

13. $f(0)$ **2**

14. $f(y)$ **$-3y + 2$**

15. $f(-a)$ **$3a + 2$**

16. $f(2w)$ **$-6w + 2$**

17. BOWLING A bowling alley charges $2.50 for shoe rental and $3.25 per game bowled. The amount a bowler is charged can be expressed as $y = 2.50 + 3.25x$, when $x \geq 1$, and is an integer. Find the domain and range. Then determine whether the equation is a function. Is the equation discrete or continuous? **See margin.**

Example 1

State the domain and range of the relation {(−4, 3), (−1, 0), (−2, 4), (3, −1), (2, 6)}. Then determine whether the relation is a function. If it is a function, determine if it is *one-to-one, onto, both,* or *neither.*

Domain: {−4, −2, −1, 2, 3}
Range: {−1, 0, 3, 4, 6}

Each element of the domain is paired with one element of the range, so the relation is a function. The function is both because each element of the domain is paired with a unique element of the range and each element of the range is paired with a unique element of the domain.

Example 2

Find $f(-2)$ if $f(x) = 4x - 3$.

$f(-2) = 4(-2) - 3$ Substitute −3 for x.

$= -8 - 3$ Multiply.

$= -11$ Simplify.

Additional Answers

7. D = {1, 3, 5, 7}, R = {2, 4, 6, 8}; a function; both

8. D = {−3, 0, 2, 4, 5}, R = {0, 2, 4, 5}; a function; onto

9. D = {−4, −2, 1, 3}, R = {−4, 1, 3, 5}; not a function

10. D = {−1, 1, 3, 5, 7}, R = {−4, −2, 0, 2, 4}; a function; both

17. D = {1, 2, 3, 4, 5, . . .}, R = {5.75, 9, 12.25, 15.5, 18.75, . . .}; a function; discrete

19. No; the variables have an exponent other than 1.
20. No; x^3 has an exponent other than 1.
23. No; x appears in a denominator.
25. $12x - y = 0$; 12, −1, 0

2-2 Linear Relations and Functions

State whether each function is a linear function. Write *yes* or *no*. Explain.

18. $3x + 4y = 12$ **yes**

19. $x^2 + y^2 = 4$

20. $y = x^3 - 6$

21. $y = 6x - 19$ **yes**

22. $f(x) = -2x + 9$ **yes**

23. $\frac{1}{x} + 3y = -5$

Write each equation in standard form. Identify *A*, *B*, and *C*.

24. $2x + 5y = 10$ **2, 5, 10**

25. $y = 12x$ **$12x - y = 0$; 12, −1, 0**

26. $-4y = 3x - 24$ **$3x + 4y = 24$; 3, 4, 24**

27. $4x = 8y - 12$ **$x - 2y = -3$; 1, −2, −3**

28. TRAVEL The distance the Green family traveled during their family vacation is given by the equation $y = 65x$, where x represents the number of hours spent driving. How far does the Green family travel in 8 hours? **520 miles**

Example 3

State whether $f(x) = 3x^2$ is a linear function. Write *yes* or *no*. Explain.

No, because the expression includes a variable raised to the second power.

Example 4

Write the equation $y = -5x + 8$ in standard form. Identify *A*, *B*, and *C*.

$y = -5x + 8$ Original equation

$5x + y = 8$ Add $5x$ to each side.

$A = 5$, $B = 1$, and $C = 8$

2-3 Rate of Change and Slope

29. RETAIL The table shows the number of DVDs sold each week at the Super Movie Store. Find the average rate of change of the number of DVDs sold from week 2 to week 5. **18**

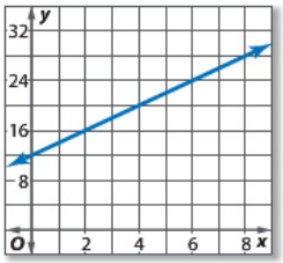
Week	1	2	3	4	5
DVDs Sold	76	58	94	83	112

Find the slope of the line that passes through each pair of points.

30. (2, 5), (6, −3) **−2**

31. (8, 2), (2, 8) **−1**

32. Determine the rate of change of the graph. **2**



Example 5

Find the slope of the line that passes through each pair of points.

a. (−2, 9), (1, 4)

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Slope Formula

$= \frac{4 - 9}{1 - (-2)}$ $(x_1, y_1) = (-2, 9), (x_2, y_2) = (1, 4)$

$= -\frac{5}{3}$ Simplify.

b. (−3, 6), (4, 6)

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Slope Formula

$= \frac{6 - 6}{4 - (-3)}$ $(x_1, y_1) = (-3, 6), (x_2, y_2) = (4, 6)$

$= \frac{0}{7}$ or 0 Simplify.

2-4 Writing Linear Equations

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

33. slope -2, passes through $(-3, -5)$ $y = -2x - 11$

34. slope $\frac{2}{3}$, passes through $(4, -1)$ $y = \frac{2}{3}x - \frac{11}{3}$

35. passes through $(-2, 4)$ and $(0, 8)$ $y = 2x + 8$

36. passes through $(3, 5)$ and $(-1, 5)$ $y = 5$

Write an equation of the line passing through each pair of points. **37, 38. See margin.**

37. (6, 1), (4, 9)

38. $(-4, 2)$, (6, 8)

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

39. through (1, 2), parallel to $y = 4x - 3$ $y = 4x - 2$

40. through $(-3, 5)$, perpendicular to $y = \frac{2}{3}x - 8$

41. **PETS** Drew paid a $250 fee when he adopted a puppy. The average monthly cost of feeding and caring for the puppy is $32. Write an equation that represents the total cost of adopting and caring for the puppy for x months.

Example 6

Write an equation of the line through $(-2, 5)$ and $(0, -9)$.

Find the slope of the line.

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Slope Formula

$= \frac{-9 - 5}{0 - (-2)}$ $(x_1, y_1) = (-2, 5)$, $(x_2, y_2) = (0, -9)$

$= \frac{-14}{2}$ or -7 Simplify.

Write an equation.

$y - y_1 = m(x - x_1)$ Point-slope form

$y - 5 = -7(x - (-2))$ Substitute.

$y - 5 = -7(x + 2)$ Simplify.

$y - 5 = -7x - 14$ Distributive Property

$y = -7x - 9$ Add 5 to each side.

The equation is $y = -7x - 9$.

40. $y = -\frac{3}{2}x + \frac{1}{2}$ **41.** $y = 32x + 250$

2-5 Scatter Plots and Lines of Regression

Make a scatter plot and a line of fit and describe the correlation for each set of data. Then, use two ordered pairs to write a prediction equation.

42. **HEATING** The table shows the monthly heating cost for a large home. **See margin.**

Month	Sep	Oct	Nov	Dec	Jan	Feb
Bill ($)	72	114	164	198	224	185

43. **AMUSEMENT PARK** The table shows the annual attendance in thousands at an amusement park during the last 5 years. **See margin.**

Year	1	2	3	4	5
People (thousands)	44	42	39	31	24

Example 7

SCHOOL ENROLLMENT The table shows the number of students each year at a school.

Year	'07	'08	'09	'10	'11	'12
Students	125	116	142	154	146	175

Use (2007, 125) and (2012, 175) to find a prediction equation.

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Slope Formula

$= \frac{175 - 125}{2012 - 2007}$ Substitution

$= \frac{50}{5}$ or 10 Simplify.

$y - y_1 = m(x - x_1)$ Point-slope form

$y - 125 = 10(x - 2007)$ Substitution

$y - 125 = 10x - 20{,}070$ Distributive Property

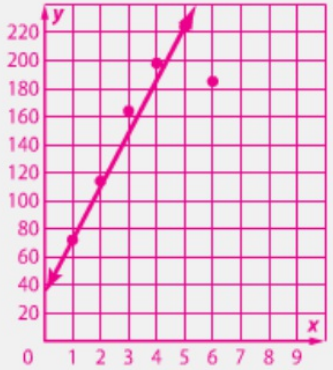
$y = 10x - 20{,}195$ Add 125 to each side.

Additional Answers

37. $y = 4x + 25$

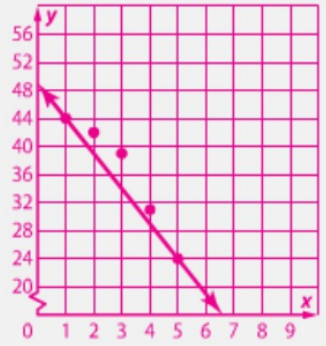
38. $y = \frac{3}{5}x + \frac{22}{5}$

42.



Sample answer: using (1, 72) and (5, 224): $y = 38x + 34$

43.



Sample answer using (1, 44) and (5, 24): $y = -5x + 49$

2-6 Special Functions

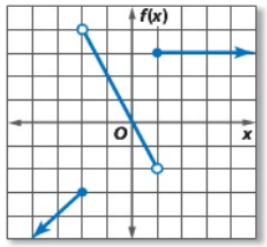
Graph each function. Identify the domain and range.

44–46. See margin.

44. $f(x) = \begin{cases} -2x \text{ if } x \le -1 \\ x + 1 \text{ if } -1 < x < 3 \\ x \text{ if } x \ge 3 \end{cases}$

45. $f(x) = \begin{cases} -3 \text{ if } x < -1 \\ 4x - 3 \text{ if } -1 \le x \le 3 \\ x \text{ if } x > 3 \end{cases}$

46. Write the piecewise-defined function shown in the graph.



47, 48. See margin.

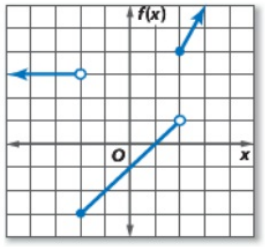
Graph each function. Identify the domain and range.

47. $f(x) = [\![x]\!] + 2$

48. $f(x) = [\![x + 3]\!]$

Example 8

Write the piecewise-defined function shown in the graph.



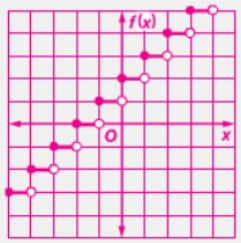
The left portion of the graph is the graph of $f(x) = 3$. There is a circle at $(-2, 3)$, so the linear function is defined for $x < -2$.

The center portion of the graph is the graph of $f(x) = x - 1$. There is a dot at $(-2, -3)$ and a circle at $(2, 1)$, so the linear function is defined for $-2 \le x < 2$.

The right portion of the graph is the graph of $f(x) = 2x$. There is a dot at $(2, 4)$, so the linear function is defined for $x \ge 2$.

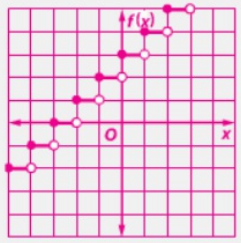
$$f(x) = \begin{cases} 3 \text{ if } x < -2 \\ x - 1 \text{ if } -2 \le x < 2 \\ 2x \text{ if } x \ge 2 \end{cases}$$

47.



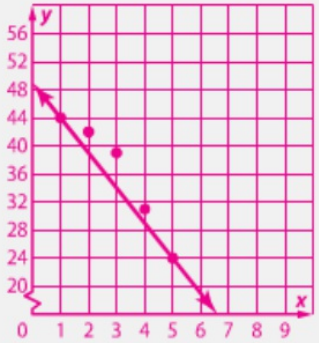
D = {all real numbers};
R = {all integers}

48.



D = {all real numbers};
R = {all integers}

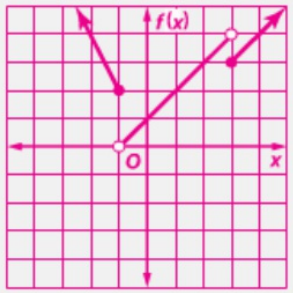
43.



Sample answer using (1, 44) and (5, 24):
$y = -5x + 49$

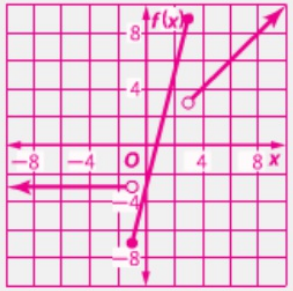
Additional Answers

44.



D = {all real numbers};
R = {f(x) | f(x) > 0}

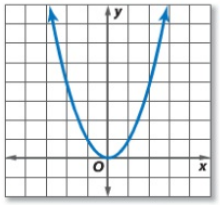
45.



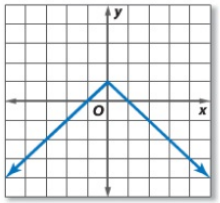
D = {all real numbers};
R = {f(x) | f(x) ≥ −7}

46. $f(x) = \begin{cases} x - 1 \text{ if } x \le -2 \\ -2x \text{ if } -2 < x < 1 \\ 3 \text{ if } x \ge 1 \end{cases}$

Identify the type of function represented by each graph.

49. 

quadratic

50. 

absolute value

51. Describe the translation in $y = x^2 - 3$.

52. Describe the reflection in $y = -x^2$.

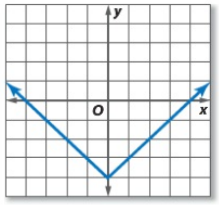
53. **CONSTRUCTION** A large arch is being constructed at the entrance of a new city hall building. The shape of the arch resembles the graph of the function $f(x) = -0.025x^2 + 3.64x - 0.038$. Describe the shape of the arch. parabola

51. $y = x^2$ shifted down 3 units

52. $y = x^2$ reflected over the x-axis

Example 9

Identify the type of function represented by the graph.



The graph is in the shape of a V. The graph represents an absolute value function.

Example 10

Describe the translation in $y = |x + 6|$.

The graph of $y = |x + 6|$ is a translation of the graph of $y = |x|$ shifted left 6 units.

2-8 Graphing Linear and Absolute Value Inequalities

Graph each inequality. 54–61. See margin.

54. $x - 3y < 6$
55. $y \geq 2x + 1$
56. $2x + 4y \leq 12$
57. $y < -3x - 5$
58. $y > |2x|$
59. $y \geq |2x - 2|$
60. $y + 3 < |x + 1|$
61. $2y \leq |x - 3|$

62. **BOOKS** Spencer has saved $96 for a trip to his favorite bookstore. Each paperback book costs $8 and each hardback book costs $12. Write and graph an inequality that shows the number of paperback books and hardback books Spencer can purchase.

$8x + 12y \leq 96$; See Chapter 2 Answer Appendix for graph.

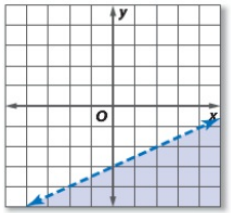
Example 11

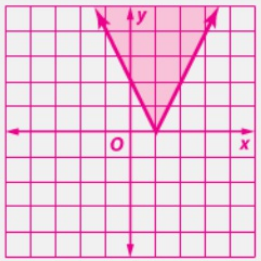
Graph $x - 2y > 6$.

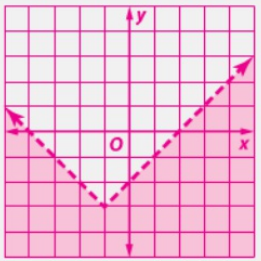
Since the inequality symbol is $>$, the graph of the boundary line should be dashed. Graph $x - 2y = 6$.

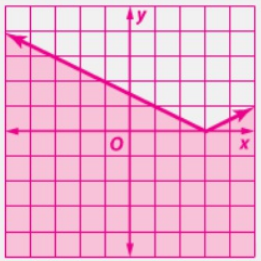
Test $x - 2y > 6$ at (0, 0).

$x - 2y > 6$
$0 - 2(0) \stackrel{?}{>} 6$
$0 > 6$ ✗

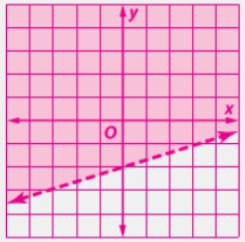


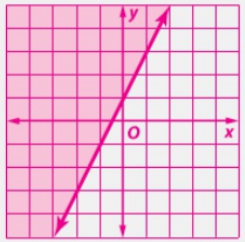
59. 

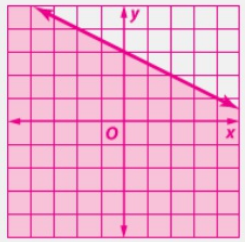
60. 

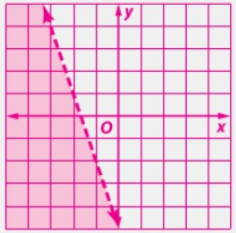
61. 

Additional Answers

54. 

55. 

56. 

57. 

58.