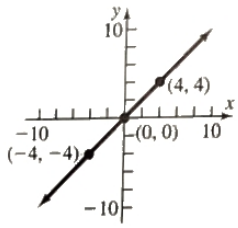
3.4 Concepts and Vocabulary *(page 258)*

4. less **5.** piecewise defined **6.** True **7.** False **8.** False

3.4 Exercises *(page 258)*

9. C **10.** A **11.** E **12.** G **13.** B **14.** D **15.** F **16.** H

17.



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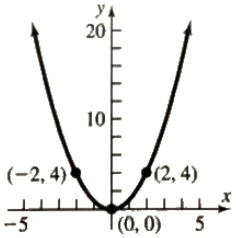

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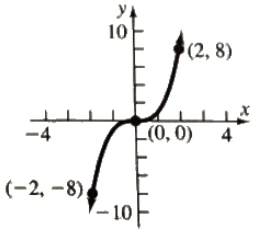

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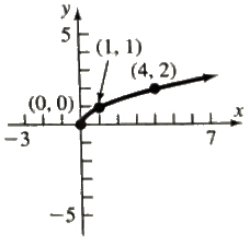

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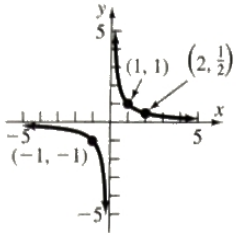

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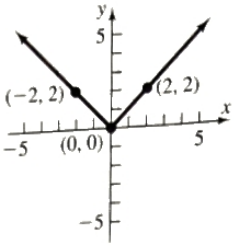

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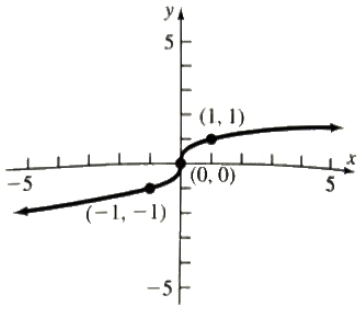

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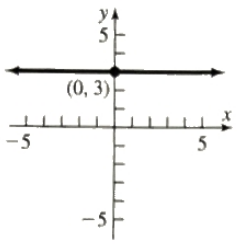


25. (a) 4 (b) 2 (c) 5

26. (a) −1 (b) 2 (c) 5

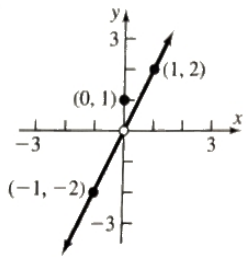
27. (a) 2 (b) 3 (c) −4

28. (a) 0 (b) 0 (c) −1

29. (a) All real numbers

(b) (0, 1)

(c)

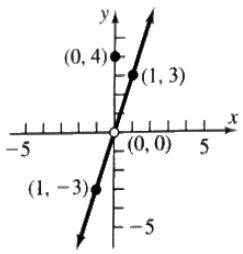


(d) $\{y|y \neq 0\}$; $(-\infty, 0)$ or $(0, \infty)$

30. (a) All real numbers

(b) (0, 4)

(c)

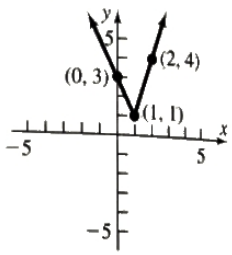


(d) $\{y|y \neq 0\}$; $(-\infty, 0)$ or $(0, \infty)$

31. (a) All real numbers

(b) (0, 3)

(c)

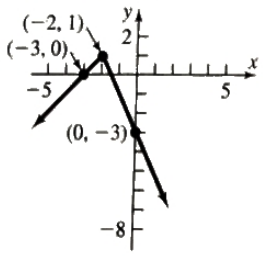


(d) $\{y|y \geq 1\}$; $[1, \infty)$

32. (a) All real numbers

(b) $(-3, 0), \left(-\frac{3}{2}, 0\right), (0, -3)$

(c)

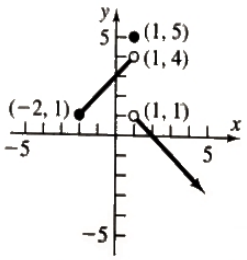


(d) $\{y|y \leq 1\}$; $(-\infty, 1]$

33. (a) $\{x|x \geq -2\}$; $[-2, \infty)$

(b) (0, 3), (2, 0)

(c)

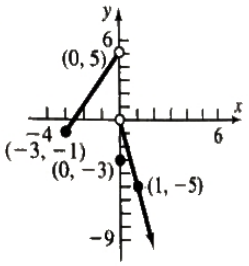


(d) $\{y|y < 4, y = 5\}$; $(-\infty, 4)$ or $\{5\}$

34. (a) $\{x|x \geq -3\}$; $[-3, \infty)$

(b) $\left(-\frac{5}{2}, 0\right), (0, -3)$

(c)

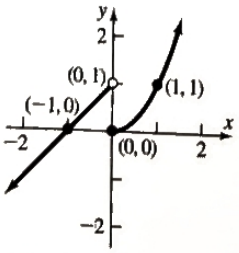


(d) $\{y|y < 5\}$; $(-\infty, 5)$

35. (a) All real numbers

(b) (−1, 0), (0, 0)

(c)

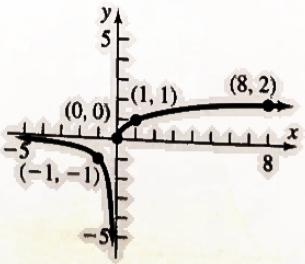


(d) All real numbers

36. (a) All real numbers

(b) (0, 0)

(c)

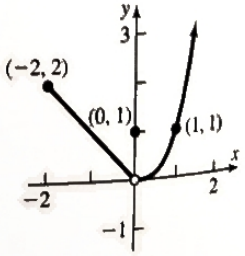


(d) All real numbers

37. (a) $\{x|x \geq -2\}$; $[-2, \infty)$

(b) (0, 1)

(c)

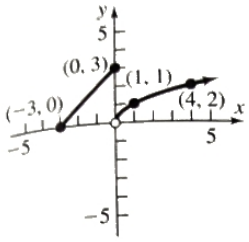


(d) $\{y|y > 0\}$; $(0, \infty)$

38. **(a)** $\{x|x \geq -3\}; [-3, \infty)$

(b) $(-3, 0), (0, 3)$

(c)

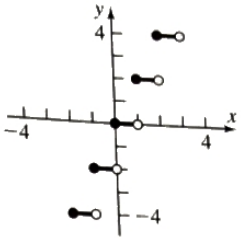


(d) $\{y|y \geq 0\}; [0, \infty)$

39. **(a)** All real numbers

(b) $(x, 0)$ for $0 \leq x < 1$

(c)

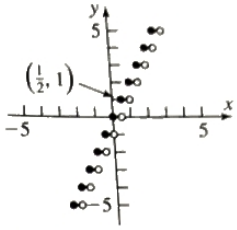


(d) Set of even integers

40. **(a)** All real numbers

(b) $(x, 0)$ for $0 \leq x < \frac{1}{2}$

(c)



(d) Set of integers

41. $f(x) = \begin{cases} -x & \text{if } -1 \leq x \leq 0 \\ \frac{1}{2}x & \text{if } 0 < x \leq 2 \end{cases}$ (Other answers are possible.)

42. $f(x) = \begin{cases} x & \text{if } -1 \leq x \leq 0 \\ 1 & \text{if } 0 < x \leq 2 \end{cases}$ (Other answers are possible.)

43. $f(x) = \begin{cases} -x & \text{if } x \leq 0 \\ -x + 2 & \text{if } 0 < x \leq 2 \end{cases}$ (Other answers are possible.)

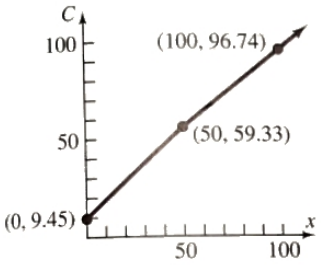
44. $f(x) = \begin{cases} 2x + 2 & \text{if } -1 \leq x \leq 0 \\ x & \text{if } x > 0 \end{cases}$ (Other answers are possible.)

45. **(a)** \$39.99 **(b)** \$43.74 **(c)** \$40.24 **46.** **(a)** \$1.29 **(b)** \$0.37 **(c)** \$3.13

47. **(a)** \$59.33 **(b)** \$396.04

(c) $C = \begin{cases} 0.99755x + 9.45 & \text{if } 0 \leq x \leq 50 \\ 0.74825x + 21.915 & \text{if } x > 50 \end{cases}$

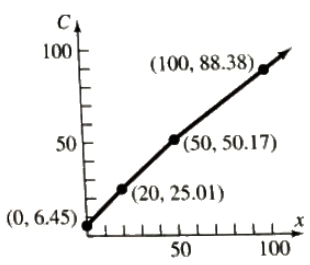
(d)



48. **(a)** \$41.78 **(b)** \$166.32

(c) $C = \begin{cases} 0.928x + 6.45 & \text{if } 0 \leq x \leq 20 \\ 0.8385x + 8.24 & \text{if } 20 < x \leq 50 \\ 0.7642x + 11.955 & \text{if } x > 50 \end{cases}$

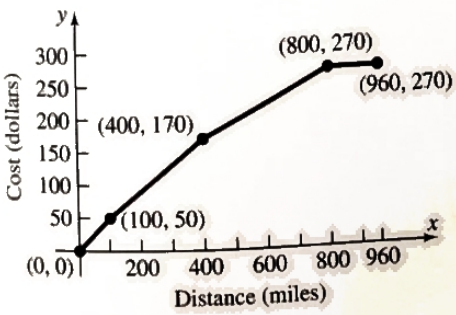
(d)



49. For schedule X: $f(x) = \begin{cases} 0.10x & \text{if } 0 < x \leq 7000 \\ 700.00 + 0.15(x - 7000) & \text{if } 7000 < x \leq 28{,}400 \\ 3910 + 0.25(x - 28{,}400) & \text{if } 28{,}400 < x \leq 68{,}800 \\ 14{,}010 + 0.28(x - 68{,}800) & \text{if } 68{,}800 < x \leq 143{,}500 \\ 34{,}926 + 0.33(x - 143{,}500) & \text{if } 143{,}500 < x \leq 311{,}950 \\ 90{,}514.50 + 0.35(x - 311{,}950) & \text{if } x > 311{,}950 \end{cases}$

50. For schedule Y-1: $f(x) = \begin{cases} 0.10x & \text{if } 0 < x \leq 14{,}000 \\ 1400 + 0.15(x - 14{,}000) & \text{if } 14{,}000 < x \leq 56{,}800 \\ 7820 + 0.25(x - 56{,}800) & \text{if } 56{,}800 < x \leq 114{,}650 \\ 22{,}282.50 + 0.28(x - 114{,}650) & \text{if } 114{,}650 < x \leq 174{,}700 \\ 39{,}096.50 + 0.33(x - 174{,}700) & \text{if } 174{,}700 < x \leq 311{,}950 \\ 84{,}389 + 0.35(x - 311{,}950) & \text{if } x > 311{,}950 \end{cases}$

51. **(a)**



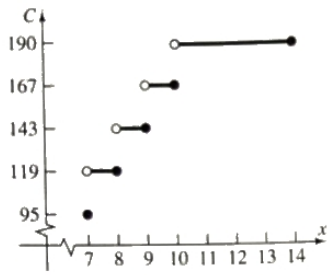
(b) $C = 50 + 0.4(x - 100)$

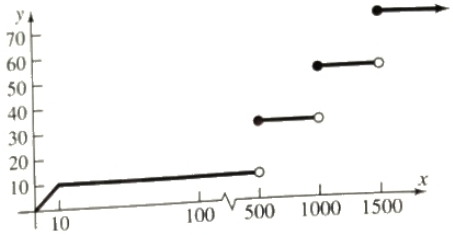
(c) $C = 170 + 0.25(x - 400)$

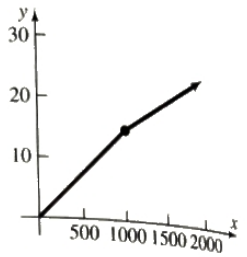
52. $C = \begin{cases} 95 \text{ if } x = 7 \\ 119 \text{ if } 7 < x \le 8 \\ 143 \text{ if } 8 < x \le 9 \\ 167 \text{ if } 9 < x \le 10 \\ 190 \text{ if } 10 < x \le 14 \end{cases}$

53. $f(x) = \begin{cases} x \text{ if } 0 \le x < 10 \\ 10 \text{ if } 10 \le x < 500 \\ 30 \text{ if } 500 \le x < 1000 \\ 50 \text{ if } 1000 \le x < 1500 \\ 70 \text{ if } 1500 \le x \end{cases}$

54. $g(x) = \begin{cases} 0.015x & \text{if } 0 \le x \le 1000 \\ 5 + 0.01x & \text{if } x > 1000 \end{cases}$







55. **(a)** 10°C **(b)** 4°C **(c)** −3°C **(d)** −4°C **(e)** The wind chill is equal to the air temperature. **(f)** At wind speed greater than 20 m/sec, the wind chill factor depends only on the air temperature. **56.** **(a)** −10°C **(b)** −21°C **(c)** −34°C **(d)** −36°C **57.** Each graph is that of $y = x^2$, but shifted vertically. If $y = x^2 + k, k > 0$, the shift is up k units; if $y = x^2 - k, k > 0$, the shift is down k units. **58.** Each graph is that of $y = x^2$, but shifted horizontally. If $y = (x - k)^2, k > 0$, the shift is right k units; if $y = (x + k)^2$, $k > 0$, the shift is left k units. **59.** Each graph is that of $y = |x|$, but either compressed or stretched. If $y = k|x|$ and $k > 1$, the graph is stretched vertically; if $y = k|x|, 0 < k < 1$, the graph is compressed vertically. **60.** The graph of $y = -f(x)$ is the reflection about the x-axis of the graph of $y = f(x)$. **61.** The graph of $y = f(-x)$ is the reflection about the y-axis of the graph of $y = f(x)$. **62.** Yes. The graph of $y = (x - 1)^3 + 2$ is the graph of $y = x^3$ shifted right 1 unit and up 2 units. **63.** They are all ∪-shaped and open upward. All three go through the points $(-1, 1)$, $(0, 0)$ and $(1, 1)$. As the exponent increases, the steepness of the curve increases (except near $x = 0$). **64.** They all have the same general shape. All three go through the points $(-1, -1)$, $(0, 0)$, and $(1, 1)$. As the exponent increases, the steepness of the curve increases (except near $x = 0$).