### Section 3.1

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<tr>
<td>1</td>
<td>yes</td>
<td>3</td>
<td>yes</td>
<td>5</td>
<td>no</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>no</td>
<td>13</td>
<td>yes</td>
<td>15</td>
<td>yes</td>
<td>17</td>
</tr>
<tr>
<td>21</td>
<td>no</td>
<td>23</td>
<td>yes</td>
<td>25</td>
<td>no</td>
<td>27</td>
</tr>
<tr>
<td>29</td>
<td>Domain {0,1,2,3,4} Range {1,4,5,6,8}</td>
<td>31</td>
<td>Domain {-5, -3, 1} Range {-4, 0, 12}</td>
<td></td>
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</tr>
<tr>
<td>33</td>
<td>Domain {-5,1} Range {-4,12}</td>
<td>35</td>
<td>domain {-1, 2} range {-4,2}</td>
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<tr>
<td>37</td>
<td>domain (-\infty, \infty) range (-\infty, 1)</td>
<td>39</td>
<td>domain (-\infty, 0) range [0, \infty)</td>
<td></td>
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<tr>
<td>41</td>
<td>domain (-\infty, \infty) range [1, \infty)</td>
<td>43</td>
<td>domain (-\infty, 2) U (2, \infty) range (-\infty, 0) U (0, \infty)</td>
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<tr>
<td>45</td>
<td>domain (-\infty, -1) U (-1, \infty) range (-\infty, 1 \frac{1}{2}) U (1 \frac{1}{2}, \infty)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>47</td>
<td>domain [3, \infty)</td>
<td>49</td>
<td>domain [-5, \infty)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>domain (-\infty, 7) U (7, \infty)</td>
<td></td>
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<tr>
<td>53</td>
<td>domain (-\infty, 2) U (2,3) U (3, \infty)</td>
<td>55</td>
<td>domain (5, \infty)</td>
<td></td>
<td></td>
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<tr>
<td>57</td>
<td>domain (-\infty, 6)</td>
<td></td>
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<tr>
<td>59</td>
<td>domain (-\infty, 3)</td>
<td>61</td>
<td>domain (-\infty, \infty)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>domain (-\infty, \infty)</td>
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</tbody>
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### Section 3.2

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<tbody>
<tr>
<td>1</td>
<td>f(3) = 13</td>
<td>3</td>
<td>g(1) = 12</td>
<td>5</td>
<td>h(2) = 4</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>f(b+1) = 3b+7</td>
<td>13</td>
<td>g(2a) = 2(2a+3)(a+1)</td>
<td>15</td>
<td>g(x-2) = x(x-1)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>k(a) = \frac{2}{a+3}</td>
<td>19</td>
<td>(f+g)(x) = (2x+3)(x+2)</td>
<td>21</td>
<td>\left(\frac{f}{g}\right)(x) = \frac{1}{x+1}</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>(g/f)(x) = x+1</td>
<td>25</td>
<td>(g \circ f)(x) = 2(4x + 9)(x + 2)</td>
<td>27</td>
<td>(f-g)(x) = -x(2x+3)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>(g-f)(x) = -2x(x-3)</td>
<td>31</td>
<td>(g)(x) = 2x^3 - 11x^2 + 12x + 9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>(f \circ g)(x) = (2x - 5)(x - 6)</td>
<td>35</td>
<td>(g\cdot f)(x) = 2(x+1)(x-3)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>37</td>
<td>(h+k)(3) = 17</td>
<td>39</td>
<td>(h/k)(5) = 36/5</td>
<td>41</td>
<td>(h-k)(7) = 55</td>
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<tr>
<td>43</td>
<td>(h \circ k)(4) = 16</td>
<td>45</td>
<td>(k \circ h)(3) = 27</td>
<td>47</td>
<td>(k \circ h)(1) = 3</td>
<td></td>
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<tr>
<td>49</td>
<td>(s\cdot t)(3) = -21</td>
<td>51</td>
<td>(t\cdot s)(6) = 68</td>
<td>53</td>
<td>(s \circ t)(0) = 11</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>(s \circ t)(-2) = 63</td>
<td>57</td>
<td>(t \circ s)(-6) = -1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>9</td>
<td>63</td>
<td>2x + h</td>
<td>65</td>
<td>2x + h + 5</td>
<td>67</td>
</tr>
</tbody>
</table>
Section 3.3

1a) x-intercept (1,0) (5,0)  
1b) y-intercept (0,5)  
1c) x = 0, 6  
1d) f(5) = 0  
1e) domain (−∞, ∞)  
1f) range [−4, ∞)  
3a) x-intercept (−4,0) (2,0)  
3b) y-intercept (0,8)  
3c) x = -4,2  
3d) h(0) = 8  
3e) domain [−5,2]  
3f) range [−7,9]  
5a) [−1,7]  
5b) (−∞, −1] ∪ [7, ∞)  
7a) (−∞, −6] ∪ [2, ∞)  
7b) [−6,2]  
9a) [−1,3] ∪ [5, ∞)  
9b) (−∞, −1] ∪ [3,5]  
11a) (−∞, −1] ∪ [3,6]  
11b) [−1,3] ∪ [6, ∞)  
13a) (−∞, −3) ∪ (1, ∞)  
13b) (−3,1)  
13c) a local maximum occurs at x = -3  
13d) the local maximum value is 31  
13e) a local minimum occurs at x = 1  
13f) the local minimum value is -1  
15a) (−1,2)  
15b) (−∞, −1] ∪ (2, ∞)  
15c) a local maximum occurs at x = 2  
15d) the local maximum value is 4.667  
15e) a local minimum occurs at x = -1  
15f) the local minimum value is -4.333  
17a) (−2, −1) ∪ (0, ∞)  
17b) (−∞, −2) ∪ (−1,0)  
17c) a local maximum occurs at x = -1  
17d) the local maximum value is 2  
17e) local minimums occur at x = -2 and x = 0  
17f) in both cases the local minimum value is 1  
19a) (−2, ∞)  
19b) (−∞, −2)  
19c) no local maximum  
19d) no local maximum value  
19e) a local minimum occurs at x = -2  
19f) the local minimum value is 3  
21a) (−∞, −1)  
21b) (−1, ∞)  
21c) a local maximum occurs at x = -1  
21d) the local maximum value is 4  
21e) there is no local minimum  
21f) no local minimum value  
23a) never increases  
23b) (−∞, ∞)  
23c) no local maximum  
23d) no local maximum value  
23e) there is no local minimum  
23f) no local minimum value  
25a) the average rate of change from 1 to 3 is (-2)
Section 3.3

25b) the average rate of change from 4 to 5 is 3

27a) the average rate of change from -3 to -2 is 34

27b) the average rate of change from 4 to 6 is 46

29a) increasing from 0 to 1.85 hours. This is the time where the blood alcohol content is rising. Decreasing from 1.85 hours to 5 hours. This is the time where the blood alcohol content is falling.

29b) the maximum blood concentration was .091 and it occurred 1.85 hours after drinking the alcohol.

Section 3.4

1a) f(-5) = -15  
1b) f(0) = 1  
1c) f(2) = 5  
3a) g(-1) = -1  
3b) g(2) = 2  
3c) g(0) = 0  
5a) k(-10) = 100  
5b) k(11) = 131  
5c) k(0) = 0

7) The point (0,0) should also be displayed with an open circle. I couldn’t figure out how to make my graph have both closed and open circles.
Section 3.4

9) The points (-1,-6) and (2,4) should be included and have open circles.

11) The points (1,3) and (-1,-1) should be included and have open circles.
Section 3.4

13a) \( t(x) = \begin{cases} 
.15x, & \text{if } x \leq 23,350 \\
3502.50 + .28(x - 23,350), & \text{if } 23350 \leq x \leq 56550 \\
12798.50 + .31(x - 56550), & \text{if } 56550 < x \leq 117950 
\end{cases} \)

13b) tax will be $5910.50

15a) \( f(x) = \begin{cases} 
7.80x, & \text{if } x \leq 35 \\
273 + 11.70(x - 35), & \text{if } 35 < x \leq 45 \\
390 + 15.60(x - 45), & \text{if } x > 45 
\end{cases} \)

15b) $468 will be earned if 50 hours are worked
Section 3.5 Answers

1a)

1b) \( f(x-3) = |x - 3| \)

1c) Graph of \( f(x-3) = |x - 3| \) drawn in blue

1d) Same shape, but shifted 3 units to the right.
Section 3.5 Answers

1e) \( f(x+2) = |x + 2| \)

1f) graph of \( f(x+2) = |x + 2| \) shown in blue

1g) Shifted 2 units to the left

3a)  

3b) \( f(x-2) = (x - 2)^2 \)

3c)  

Graph of \( f(x-2) = (x - 2)^2 \) shown in blue

3d) Shifted 2 units to the right.
Section 3.5 Answers

3e) \( f(x + 1) = (x + 1)^2 \)

3f)

Graph of \( f(x + 1) = (x + 1)^2 \) shown in blue

3g) Same shape as \( f(x) = x^2 \) but shifted one unit to the left

5a) \( f(x) = \sqrt{x + 2} \)
Section 3.5 Answers

5b) \( f(x - 3) = \sqrt{x - 3} + 2 = \sqrt{x - 1} \)

5c) Graph of \( f(x - 3) \) shown in blue

5d) Same shape as \( f(x) \) but shifted 3 units to the right.

5e) \( f(x+1) = \sqrt{x + 1} + 2 \)

5f) Graph of \( f(x + 1) \) shown in blue

5g) Same shape as \( f(x) \) but shifted one unit to the left.
Section 3.5 Answers

7a) 

7b) \( f(x) - 3 = |x + 3| - 3 \)

7c) graph of \( f(x) - 3 \) shown in blue

7d) Same shape as \( f(x) \) but shifted 3 units to the down.

7e) \( f(x) + 2 = |x + 3| + 2 \)

7f) graph of \( f(x) + 2 \) shown in blue

7g) Same shape as \( f(x) \) shifted 2 units up.
Section 3.5 Answers

9a)

9b) \( f(x) - 2 = (x - 3)^2 - 2 \)

9c) graph of \( f(x) - 2 \) shown in blue

9d) Same shape as \( f(x) \) but shifted down 2 units

9e) Find \( f(x) + 1 = (x - 3)^2 + 1 \)

9f)

9g) Same shape as \( f(x) \) but shifted one unit up.
Section 3.5 Answers

11a)

11b) \( f(x) - 3 = \sqrt{x - 4} - 3 \)

11c) Graph of \( f(x) - 3 \) shown in blue

11d) Same shape as \( f(x) \) but shifted down 3 units

11e) \( f(x) + 1 = \sqrt{x - 4} + 1 \)

11f) Graph of \( f(x) + 1 \) shown in blue.

11g) Same shape as \( f(x) \) but shifted up 1 unit.
Section 3.5 Answers

13a)

13b) \( f(-x) = | -x + 2 | \)

13c) graph of \( f(-x) \) shown in blue.

13d) Same shape as \( f(x) \) but reflected over y-axis.

13e) \(-f(x) = -| x + 2 |\)

13f) graph of \(-f(x)\) shown in blue

13g) Same shape as \( f(x) \) but reflected over x-axis.
Section 3.5 Answers

15a)  

15b) \( f(-x) = (-x - 1)^2 \)

15c) Graph of \( f(-x) \) shown in blue

15d) Same shape as \( f(x) \) but reflected over the y-axis

15e) \( -f(x) = -(x - 1)^2 \)
Section 3.5 Answers

15f) Graph of \( -f(x) \) shown in blue

15g) Same shape as \( f(x) \) but reflected over x-axis.

17a)

17b) \( f(2x) = |2x| \)
Section 3.5 Answers

17c) Graph of $f(2x)$ shown in blue

17d) Same shape as the graph of $f(x)$ but stretched, it would be equally correct to say the same shape of $f(x)$ but narrower.

17e) $f\left(\frac{1}{2}x\right) = \left|\frac{1}{2}x\right|$

17f) graph of $f\left(\frac{1}{2}x\right) = \left|\frac{1}{2}x\right|$ shown in blue

17g) Same shape as $f(x)$ but compressed, it would also be correct to say same shape as $f(x)$ but wider.
Section 3.5 Answers

19a) 

19b) \( f(4x) = (4x)^2 \)

19c) Graph of \( f(4x) \) in blue

19d) Same shape as the graph of \( f(x) \) but stretched, it would be equally correct to say the same shape of \( f(x) \) but narrower.
Section 3.5 Answers

19e) \( f \left( \frac{1}{4} x \right) = \left( \frac{1}{4} x \right)^2 \)

19f) Graph of \( f \left( \frac{1}{4} x \right) = \left( \frac{1}{4} x \right)^2 \) drawn in blue

19g) Same shape as f(x) but compressed, it would also be correct to say same shape as f(x) but wider.

21a)

21b) \( 3f(x) = 3|x| \)
Section 3.5 Answers

21c) Graph of $3f(x) = 3|x|$ drawn in blue

21d) Same shape as the graph of $f(x)$ but stretched, it would be equally correct to say the same shape of $f(x)$ but narrower.

21e) $\frac{1}{3}f(x) = \frac{1}{3}|x|$

21f) Graph of $\frac{1}{3}f(x) = \frac{1}{3}|x|$ drawn in blue

21g) Same shape as $f(x)$ but compressed, it would also be correct to say same shape as $f(x)$ but wider.
Section 3.5 Answers

23a) 

23b) \(3f(x) = 3x^2\)

23c) Graph of \(3f(x)\) drawn in blue

23d) Same shape as the graph of \(f(x)\) but stretched, it would be equally correct to say the same shape of \(f(x)\) but narrower.

23fe) \(\frac{1}{3} f(x) = \frac{1}{3} x^2\)

23f) Graph of \(\frac{1}{3} f(x) = \frac{1}{3} x^2\) drawn in blue
Section 3.5 Answers

23g) Same shape as \( f(x) \) but compressed, it would also be correct to say same shape as \( f(x) \) but wider.

25) \( f(x+2) = (x+2)^2 \)

27) \( f(x - 5) = (x - 5)^2 \)

29) \( -f(x) = -x^2 \)

31) \( f(x) + 2 = x^2 + 2 \)

33) \( f(x) - 4 = x^2 - 4 \)

35) \( f(x - 2) - 3 = (x - 2)^2 - 3 \)

37) \( f(x + 2) - 3 = (x + 2)^2 - 3 \)

39) \( f(x - 2) + 3 = (x - 2)^2 + 3 \)

41) \( f(x + 2) + 3 = (x + 2)^2 + 3 \)

43) \( -f(x) + 2 = -x^2 + 2 \)

45) \( -f(x) - 2 = -x^2 - 2 \)

47) \( -f(x - 3) = -(x - 3)^2 \)

49) \( -f(x + 2) = -(x+2)^2 \)
Section 3.5 Answers

51a) graph of \( f(x - 2) \) is drawn in blue shifted 2 units to the right.

51b) graph of \( f(x + 1) \) is drawn in blue shifted left 1 unit.

51c) graph of \( f(x) - 2 \) is drawn in blue shifted down 2 units.
Section 3.5 Answers

51d) graph of $f(x) + 1$ is drawn in blue.
Shifted up 1 unit

51e) Graph of $f(x-2) + 1$ is drawn in blue
Shifted right 2 and up 1
Section 3.5 Answers

51f) Graph of $f(x + 1) - 2$ is drawn in blue
Shifted left 1 and down 2

51g) Graph of $f(-x)$ is drawn in blue
Reflected over y-axis

51h) Graph of $-f(x)$ is drawn in blue
Reflected over x-axis
Section 3.5 Answers

53a) $f(x - 1)$ drawn in blue

Shifted right 1

53b) $f(x + 2)$ drawn in blue

Shifted left 2

53c) $f(x) - 1$ drawn in blue

Shifted down 1
Section 3.5 Answers

53d) \( f(x) + 2 \) drawn in blue
Shifted up 2

53e) \( f(x-1) + 2 \) drawn in blue
Shifted right 1 and up 2

53f) \( f(x + 2) – 1 \) drawn in blue
Shifted left 2 and down 1
Section 3.5 Answers

53g) $f(-x)$ drawn in blue
The graph is already symmetric to the y-axis so the graph looks the same as when it started. Original graph is in red, $f(-x)$ is in blue.

Reflected over y-axis

53h) $-f(x)$ drawn in blue

Reflected over x-axis
Section 3.5 Answers

55a) $f(x - 2)$ drawn in blue
Shifted right 2

55b) $f(x + 2)$ drawn in blue
Shifted left 2
Section 3.5 Answers

55c) \( f(x) - 3 \) drawn in blue

Shifted down 3

55d) \( f(x) + 3 \) drawn in blue

Shifted up 3
Section 3.5 Answers

55e) \( f(x-2) + 3 \) drawn in blue
Shifted right 2 and up 3

55f) \( f(x+2) - 3 \) drawn in blue
Shifted left 2 and down 3
Section 3.5 Answers

55g) \( f(-x) \) drawn in blue

Reflected over \( y \)-axis

55h) \(-f(x)\) drawn in blue

Reflected over \( x \)-axis
Section 3.6

1a) L = 400-W
1b) A = (400-W)W
1c) W = 200 meters
1d) L = 200 meters
1e) max area 40,000 square meters

3a) L = 1400 – 2W
3b) A = (1400 – 2W)W
3c) width = 350 meters
3d) length = 700 meters
3e) maximum area that can be enclosed 245,000 square meters

5a) $L = \frac{20000}{W}$
5b) $C = 5L + 6.40W$
5c) W = 125 feet
5d) L = 160 feet
5e) lowest cost = $1,600

7a) $L = \frac{25600}{W}$
7b) $C = 1.50 \left(\frac{25600}{W}\right) + 6.00W$
7c) W = 80 meters
7d) L = 320 meters
7e) Cost = $960

9a) see solutions manual for diagram
9b) $V = x(10-2x)^2$
9c) $x = 1.65$ inches

11a) see solutions manual for diagram
11b) $V = x(20-2x)^2$
11c) 3.33 inches
Chapter 3 review

1) y is a function of x 
2) y is not a function of x 
3) y is not a function of x

4) domain {3,4,5,7} Range {-1,2,6}

5) Domain [0,5] range [-5,4]

6) Domain (-\infty, 0] Range (-\infty, 2]

7) Domain (-\infty,-7) U (-7,1) U (1, \infty)

8) domain [-5, \infty)

7) domain (-\infty, 0] range (-\infty, 2]

9) domain (-\infty, \infty)

10) (f-g)(x) = x^2 - 4x + 3 it would be better to write (f-g)(x) = (x-1)(x-3)

11) (f \circ g)(x) = 49x^2 - 77x + 24

12) (f+g)(5) = 64

13) (g \circ f)(4) = 161

14) \frac{f(x+h)-f(x)}{h} = 2x + h + 5

15) (-4, 0) and (0,0)

16) (0,0)

17) x = -2 
18) h(-4) = 0 or y = 0 
19) [-4, \infty)

20) [-4, \infty) 
21a) (-\infty, -3) U (-1, \infty) 
21b) (-3, -1)

21c) x = -3 
21d) y = -8 
21e) x = -1

21f) y = -12

22a) (-\infty, 3) 
22b) (3, \infty) 
22c) x = 3

22d) y = 4 
22e) none 
22f) none

23) average rate of change = 69

24) has been deleted
25a)

25b) \(4f(x) = 4x^2\)

25c)

25d) Graph is stretched, you may also say graph is narrower.

26) \(f(x+4) = (x+4)^2\)  
27) \(f(x-4) = (x-4)^2\)

28) \(f(x-5) + 3 = (x-5)^2 + 3\) (there seems to be two problem 28's, this is the answer to the first #28)

28) \(f(x+2) - 3 = (x+2)^2 - 3\) (This is the answer to second problem 28)

29) \(-f(x) = -x^2\)  
30) \(f(-x) = (-x)^2\)

31a) \(L = 2000 - 2W\)  
31b) \(A = (2000-2W)W\) or \(-2W^2 + 2000W\)

31c) width = 500 feet  
31d) length = 1000 feet

31e) maximum area = 500,000 square feet