

Quadratic Equations and Functions - ANSWERS

Q1 Exercises

1. False

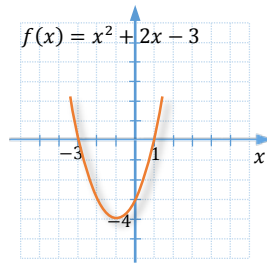
3. True

5. False

7. False

9. a)

x	$f(x)$
1	0
0	-3
-1	-4
-2	-3
-3	0



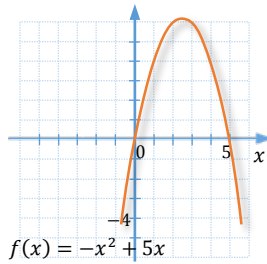
b) $(-3,0), (1,0)$

c) $x \in \{-3,1\}$

The solutions are the first coordinates of the x -intercepts.

11. a)

x	$f(x)$
0	0
1	4
2	6
$\frac{5}{2}$	6.25
3	6
4	4
5	0



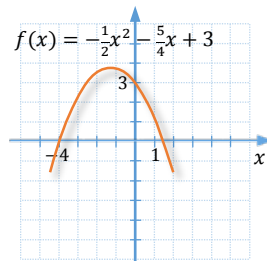
b) $(0,0), (5,0)$

c) $x \in \{0,5\}$

The solutions are the first coordinates of the x -intercepts.

13. a)

x	$f(x)$
-4	0
-2	3.5
-1	3.75
0	3
1	1.25
2	-1.5



b) $(-4,0), (\frac{3}{2},0)$

c) $x \in \{-4, \frac{3}{2}\}$

The solutions are the first coordinates of the x -intercepts.

15. $x \in \{-4\sqrt{2}, 4\sqrt{2}\}$

17. $n \in \{-2\sqrt{6}, 2\sqrt{6}\}$

19. $y \in \{-2\sqrt{10}, 2\sqrt{10}\}$

21. $x \in \{-7,1\}$

23. $t \in \{\frac{-2-2\sqrt{3}}{5}, \frac{-2+2\sqrt{3}}{5}\}$

25. $y \in \{-4 - 2\sqrt{11}, -4 + 2\sqrt{11}\}$

27. $y \in \{\frac{44}{5}, \frac{56}{5}\}$

29. No solution

31. $x \in \{\frac{1-3\sqrt{2}}{2}, \frac{1+3\sqrt{2}}{2}\}$

33. $y \in \{0,3\}$

35. $n = -2$

37. $y \in \{\frac{-7-\sqrt{53}}{2}, \frac{-7+\sqrt{53}}{2}\}$

39. No solution

41. $x \in \{6 - 2\sqrt{5}, 6 + 2\sqrt{5}\}$

43. $x \in \left\{\frac{-1-\sqrt{7}}{3}, \frac{-1+\sqrt{7}}{3}\right\}$

45. $x \in \left\{\frac{4-\sqrt{3}}{3}, \frac{4+\sqrt{3}}{3}\right\}$

47. $x \in \left\{\frac{2-\sqrt{3}}{3}, \frac{2+\sqrt{3}}{3}\right\}$

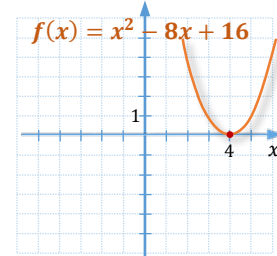
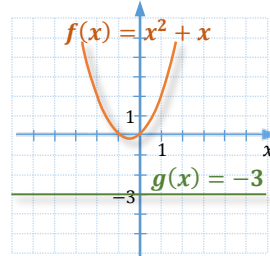
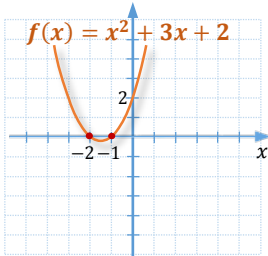
49. $x \in \left\{\frac{1-2\sqrt{19}}{5}, \frac{1+2\sqrt{19}}{5}\right\}$

51. $x \in \{1 - 2\sqrt{2}, 1 + 2\sqrt{2}\}$

53. $x \in \{-2, -1\}$

55. No solution

57. $x = 4$



59. $a = 1 - \sqrt{5} \approx -1.24$, or $a = 1 + \sqrt{5} \approx 3.24$

61. $x = \frac{-5-\sqrt{11}}{2} \approx -4.16$, or $x = \frac{-5+\sqrt{11}}{2} \approx -0.84$

63. $y = \frac{-1-\sqrt{7}}{6} \approx -0.27$, or $y = \frac{-1+\sqrt{7}}{6} \approx 0.61$

65. $x = \frac{17-\sqrt{249}}{10} \approx 0.12$, or $x = \frac{17+\sqrt{249}}{10} \approx 3.28$

67. $x = \frac{5-\sqrt{7}}{6} \approx 0.39$, or $x = \frac{5+\sqrt{7}}{6} \approx 1.27$

69. 2 rational solutions; factoring possible

71. 2 real solutions; use quadratic formula

73. 1 double rational solution; factoring possible

75. $k = 25$

77. No, as the product of a rational and irrational number is irrational. This would contradict the fact that the quadratic equation has integral coefficients.

79. $x = 1 \pm \sqrt{10}$

81. $x = \frac{5 \pm 2\sqrt{6}}{2}$

83. $x \in \{-3, 2\}$

85. No solution

87. $x \in \left\{-\frac{3}{2}, 1\right\}$

89. $x = 5 \pm \sqrt{53}$

Q2 Exercises

1. The solution is incorrect as the question calls for the values of x not a .

3. $x \in \{-\sqrt{5}, -\sqrt{2}, \sqrt{2}, \sqrt{5}\}$

5. $x \in \left\{\frac{1}{4}, 16\right\}$

7. $a \in \{-1, 2\}$

9. $x = 9$

11. $t = 9$

13. $x = 8$

15. $u \in \left\{-\frac{8}{3}, -1\right\}$

17. $x \in \{-1 \pm \sqrt{2}, 3 \pm \sqrt{10}\}$

19. $r = \pm \sqrt{\frac{V}{\pi h}}$

21. $s = \pm \sqrt{\frac{3}{vh}}$

23. $s = \pm \sqrt{\frac{kq_1q_2}{N}}$

25. $H = \pm \sqrt{\frac{703W}{I}}$

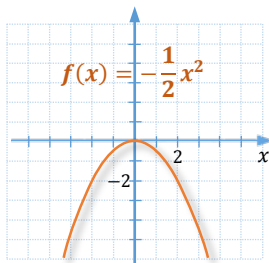
27. $r = \frac{-\pi h \pm \sqrt{\pi^2 h^2 + 2\pi A}}{2\pi}$

29. $a = \pm \frac{bt}{\sqrt{1-t^2}}$ 31. $I = \frac{E \pm \sqrt{E^2 - 4PR}}{2R}$ 33. $v = \frac{c \sqrt{m^2 - m_0^2}}{m}$ 35. $\frac{(r+R)\sqrt{pR}}{R}$
37. a. $r - c$ b. $r + c$ 39. $7 + 2\sqrt{35}$, $10 + 2\sqrt{35}$, and $17 + 2\sqrt{35}$
41. 5 ft by 12 ft 43. 10 ft 3 in 45. 9 in by 13 in 47. $10\sqrt{2}$ m by $5\sqrt{2}$ m
49. 1.5 ft 51. 12 cm 53. 7 cm by 13 cm 55. 60 km/h
57. Skyhawk at 250 km/h; Mooney Bravo at 350 km/h 59. ~ 10.8 km/h
61. 800 km/h and 840 km/h 63. 7 hr 32 min
65. Helen: ~ 16 hr 31 min; Monica: ~ 15 hr 31 min 67. smaller-diameter pipe: 2 hr;
larger-diameter pipe: 3 hr
69. ~ 3.8 sec 71. 4.2%

Q3 Exercises

1. a.-III; b.-I; c.-IV; d.-II

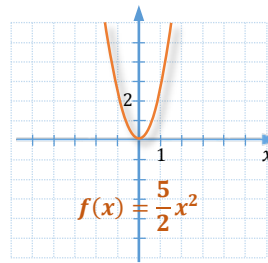
5. wider; opens down



Range = $(-\infty, 0]$

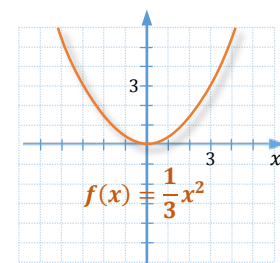
3. a.-II; b.-III; c.-I; d.-IV

7. narrower; opens up



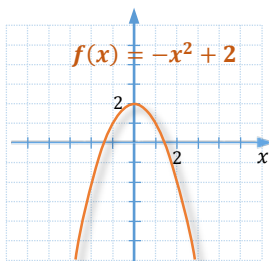
Range = $[0, \infty)$

9. narrower; opens up



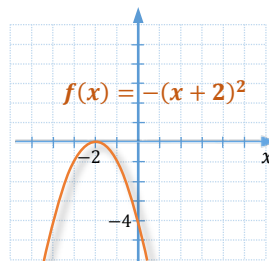
Range = $[0, \infty)$

11. S_x ; shift 2 units up



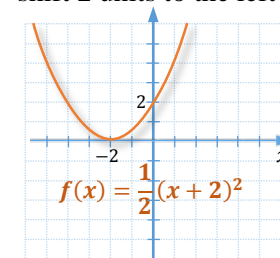
Domain = \mathbb{R}
Range = $(-\infty, 2]$
Axis of symmetry: $x = 0$

13. S_x ; shift 2 units to the left



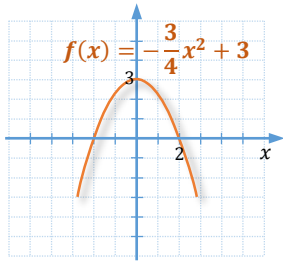
Domain = \mathbb{R}
Range = $(-\infty, 0]$
Axis of symmetry: $x = -2$

15. vertical dilation by $\frac{1}{2}$;
shift 2 units to the left



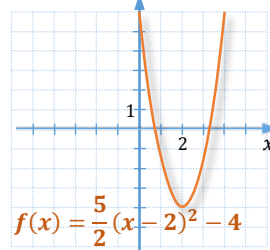
Domain = \mathbb{R}
Range = $[0, \infty)$
Axis of symmetry: $x = -2$

17. vertex = $(0, 3)$
 shape of $\frac{3}{4}x^2$; opens down
 x-int.: $(-2, 0), (2, 0)$
 y-int.: $(0, 3)$



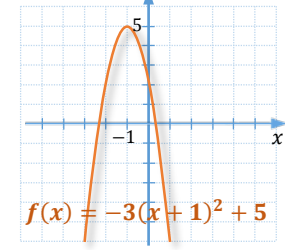
S_x ; vertical dilation by $\frac{3}{4}$;
 shift 3 units up

19. vertex = $(2, -4)$
 shape of $\frac{5}{2}x^2$; opens up
 x-int.: $(\frac{10-2\sqrt{10}}{5}, 0), (\frac{10+2\sqrt{10}}{5}, 0)$
 y-int.: $(0, 6)$



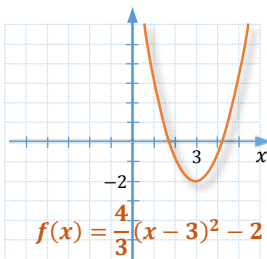
vertical dilation by $\frac{5}{2}$;
 shift 2 units to the right;
 shift 4 units down

21. vertex = $(-1, 5)$
 shape of $3x^2$; opens down
 x-int.: $(\frac{-3-\sqrt{15}}{3}, 0), (\frac{-3+\sqrt{15}}{3}, 0)$
 y-int.: $(0, 2)$



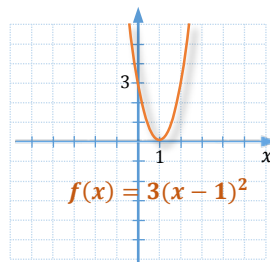
S_x ; vertical dilation by 3;
 shift 1 unit to the left;
 shift 5 units up

23. vertex = $(3, -2)$
 shape of $\frac{4}{3}x^2$; opens up
 x-int.: $(-2, 0), (2, 0)$
 y-int.: $(0, 3)$



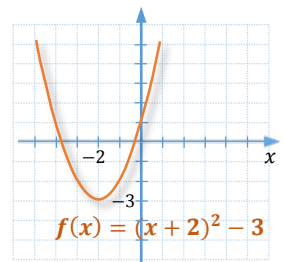
vertical dilation by $\frac{4}{3}$;
 shift 3 units to the right;
 shift 2 units down

25. vertex = $(1, 0)$



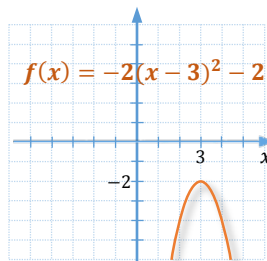
Minimum value = 0;
 Range = $[0, \infty)$

27. vertex = $(-2, -3)$



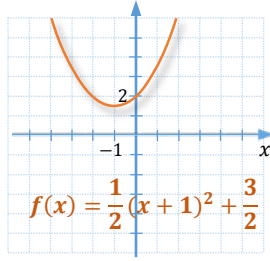
Minimum value = -3;
 Range = $[-3, \infty)$

29. vertex = $(3, -2)$



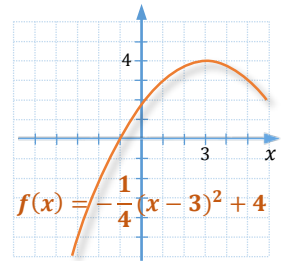
Maximum value = -2;
 Range = $(-\infty, -2]$

31. vertex = $(-1, \frac{3}{2})$



Minimum value = $\frac{3}{2}$;
 Range = $[\frac{3}{2}, \infty)$

33. vertex = $(3, 4)$



Maximum value = 4;
 Range = $(-\infty, 4]$

35. $f(x) = (x + 3)^2 - 4$

37. $f(x) = 2(x - 1)^2 - 5$

39. $f(x) = -3(x + 2)^2 + 6$

Q4 Exercises

1. $f(x) = (x + 3)^2 + 1; V(-3,1)$

3. $f(x) = \left(x + \frac{1}{2}\right)^2 - \frac{13}{4}; V\left(-\frac{1}{2}, -\frac{13}{4}\right)$

5. $f(x) = -\left(x - \frac{7}{2}\right)^2 + \frac{61}{4}; V\left(\frac{7}{2}, \frac{61}{4}\right)$

7. $f(x) = -3(x - 1)^2 + 15; V(1,15)$

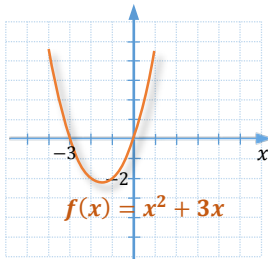
9. $f(x) = \frac{1}{2}(x + 3)^2 - \frac{11}{2}; V\left(-3, -\frac{11}{2}\right)$

11. $V\left(\frac{3}{2}, -\frac{11}{4}\right)$

13. $V(1,8)$

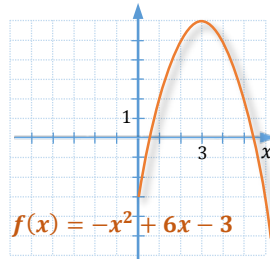
15. $V(-1,-23)$

17. $V\left(-\frac{3}{2}, -\frac{9}{4}\right)$; opens up
shape of x^2



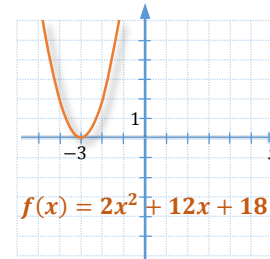
$D = \mathbb{R}; \text{Range} = \left[-\frac{9}{4}, \infty\right)$

19. $V(3,6)$; opens down
shape of x^2



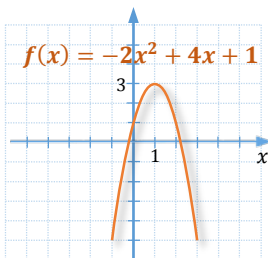
$D = \mathbb{R}; \text{Range} = (-\infty, 6]$

21. $V(-3,0)$; opens up
shape of $2x^2$



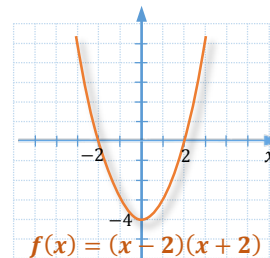
$D = \mathbb{R}; \text{Range} = [0, \infty)$

23. $V(1,3)$; opens down
shape of $2x^2$



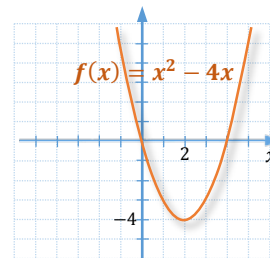
$D = \mathbb{R}; \text{Range} = (-\infty, 3]$

25. zeros: $-2, 2$; $V(0, -4)$;
opens up; shape of x^2



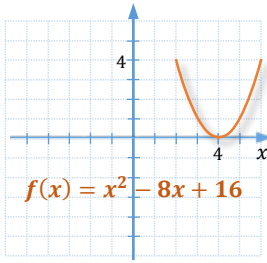
Minimum value = -4
Minimum occurs at $x = 0$

27. zeros: $0, 4$; $V(2, -4)$;
opens up; shape of x^2



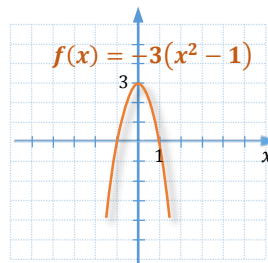
Minimum value = -4
Minimum occurs at $x = 2$

29. zero: 4; $V(4,0)$;
opens up; shape of x^2



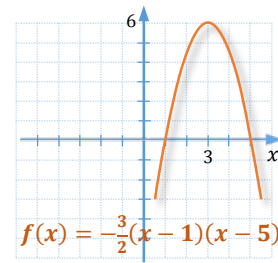
Minimum value = 0
Minimum occurs at $x = 4$

31. zero: $-1, 1$; $V(0,3)$;
opens down; shape of $3x^2$



Maximum value = 3
Maximum occurs at $x = 0$

33. zeros: 1, 5; $V(3,6)$;
opens down; shape of $\frac{3}{2}x^2$



Maximum value = 6
Maximum occurs at $x = 3$

35. $f(x) = x(5x - 2)$

37. $f(x) = \frac{3}{4}(x - 1)(x - 4)$

39. $x(3x - 1) = 0$

41. $(x - 2)^2 = 0$

43. By observing the second coordinate of the vertex in combination with the opening. For example, the second coordinate “+ve” with opening up means no x -intercepts while the second coordinate “+ve” with opening down indicates 2 x -intercepts.

45. true

47. true

49. true

51. 30.625 m; 5 sec

53. 20; \$150

55. 16, 16

57. 4 m by 8 m

59. a. $P(n) = 60 - 2n$ b. $R(n) = (60 - 2n)n$ c. 15 d. 450\$

Q5 Exercises

1. false

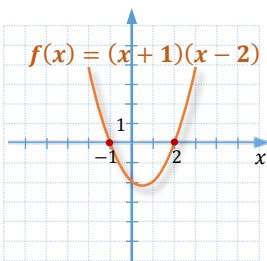
3. false

5. true

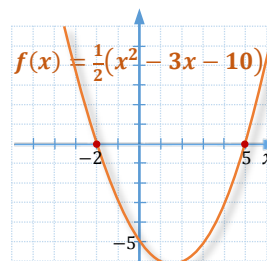
7. a. $[-1,3]$ b. $(-\infty, -1) \cup (3, \infty)$

9. a. $(-\infty, -1] \cup \{3\}$ b. $(-1,3) \cup (3, \infty)$

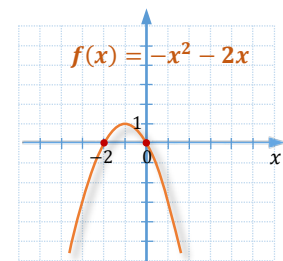
11. $x \in (-1,2)$



13. $x \in [-2,5]$



15. $x \in (-\infty, -2) \cup (0, \infty)$



A40

17. $x \in (-4, 5)$

23. $x = 2$

29. $x \in \left[0, \frac{1}{2}\right] \cup [2, \infty)$

35. $y \in (-5, -2)$

41. $y \in \left(-\infty, -\frac{5}{2}\right) \cup \left[-\frac{3}{2}, \infty\right)$

47. $x \in (-\sqrt{5}, \sqrt{5})$

53. $x \in (-\infty, -5) \cup (-5, -2) \cup (4, \infty)$

57. $x = \frac{1}{2}$

63. $[9 \text{ m}, 12 \text{ m}]$

19. $x \in (-\infty, -3] \cup [4, \infty)$

25. $x \in (-\infty, -5) \cup (4, \infty)$

31. $x \in (-\infty, -1) \cup (0, \infty)$

37. $x \in \left(-\infty, -\frac{7}{2}\right] \cup (-2, \infty)$

43. $x \in \left[0, \frac{1}{2}\right) \cup \left[\frac{5}{2}, \infty\right)$

49. $x \in (-2, 3)$

59. $x = 0$

65. $R \in (0, 20)$

21. $x \in \left(-2, -\frac{1}{2}\right)$

27. $x \in (-\infty, -3] \cup [2, 5]$

33. $x \in \left(-3, \frac{1}{2}\right]$

39. $t \in \left(-\infty, -\frac{15}{2}\right] \cup (-3, \infty)$

45. $x \in (-\infty, -1) \cup \left(-1, \frac{3}{2}\right]$

51. $x \in (-\infty, -1] \cup [3, 4)$

55. \mathbb{R}

61. $(0 \text{ sec}, 2.47 \text{ sec})$