Chapter 4

Getting Started, pp. 192–194

1. **a)** (iv) **b)** (iii) **c)** (v) **d)** (ii) **e)** (i) **f)** (vi)

2. **a)** $(x + 10)(x - 3)$; $x = -10$ or $x = 3$
b) $(x + 5)(x + 3)$; $x = -5$ or $x = -3$
c) $(x + 2)(x - 3)$; $x = -2$ or $x = 3$
d) $(x - 2)(x - 3)$; $x = 2$ or $x = 3$

3. **a)** $(x + 3)^2$ **b)** $(x - 4)^2$ **c)** $(3x + 1)^2$ **d)** $(2x - 3)^2$

4. **a)** $-15x^2 + 7x + 8$ **b)** $2x^2 + 6$ **c)** $12x^2 - x - 35$ **d)** $4x^2 - 1$

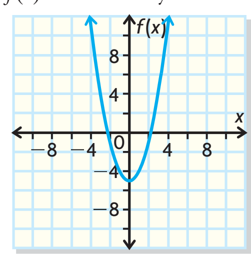
5. **a)** $(x - 5)(x + 8)$ **b)** $(2x + 3)(3x - 2)$ **c)** $(9x - 7)(9x + 7)$ **d)** $(3x + 1)^2$

6. **a)** 9 **b)** $10x$ **c)** $28x$ **d)** 16

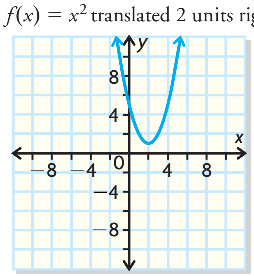
7. **a)** $f(x) = (x - 9)(x + 2)$ **b)** $g(x) = -(x - 8)(2x - 1)$ **c)** $h(x) = (2x - 5)(2x + 5)$ **d)** $y = (3x - 1)(2x + 5)$

8. **a)** vertex: $(-3, -4)$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \geq -4\}$
b) vertex: $\left(\frac{5}{4}, -\frac{121}{8}\right)$; domain: $\{x \in \mathbf{R}\}$; range: $\left\{y \in \mathbf{R} \mid y \geq -\frac{121}{8}\right\}$
c) vertex: $\left(-\frac{7}{12}, \frac{121}{24}\right)$; $\{x \in \mathbf{R}\}$; range: $\left\{y \in \mathbf{R} \mid y \leq \frac{121}{24}\right\}$
d) vertex: $\left(\frac{3}{2}, \frac{147}{4}\right)$; $\{x \in \mathbf{R}\}$; range: $\left\{y \in \mathbf{R} \mid y \leq \frac{147}{4}\right\}$

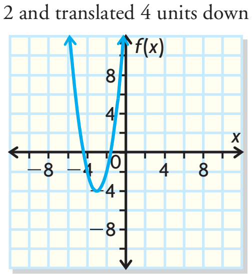
9. **a)** $f(x) = x^2$ vertically shifted down 5 units



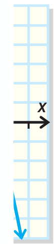
b) $f(x) = x^2$ translated 2 units right and 1 unit up



c) $f(x) = x^2$ translated 3 units left, stretched vertically by a factor of 2 and translated 4 units down



d) ıits right, compressed vertically by a factor is and translated 2 units up



10. 0.5

11.

Essential characteristics:
A polynomial equation containing one variable with highest degree 2.

Non-essential characteristics:
Does not have to = 0.
Can have fractional or decimal coefficients.
Can have variables on both sides of the = sign.
Does not have a solution.

Quadratic Equation

Examples:
$x^2 - 9 = 0$
$x^2 + 4x - 21 = 0$
$(3x - 1)(2x + 5) = 0$

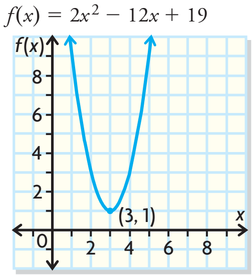
Non-examples:
$x^2 + x^2 = 0$
$x^2 + \frac{1}{x} = 0$

Lesson 4.1, pp. 203–205

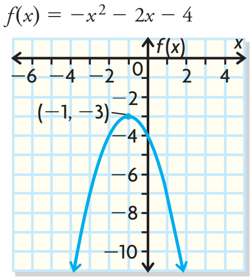
1. **a)** $(3, -5)$; min **b)** $(5, -1)$; max **c)** $(-1, 6)$; max **d)** $(-5, -3)$; min

2. **a)** $x = 3$, domain: $\{x \geq \mathbf{R}\}$; range: $\{y \geq \mathbf{R} \mid y \geq -5\}$
b) $x = 5$, $\{x \geq \mathbf{R}\}$; range: $\{y \geq \mathbf{R} \mid y < -1\}$
c) $x = -1$, $\{x \geq \mathbf{R}\}$; range: $\{y \geq \mathbf{R} \mid y < 6\}$
d) $x = -5$, $\{x \geq \mathbf{R}\}$; range: $\{y \geq \mathbf{R} \mid y \geq -3\}$

3. **a)** $f(x) = 2x^2 - 12x + 19$



b) $f(x) = -x^2 - 2x - 4$

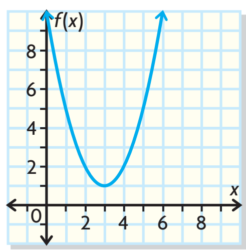


4.

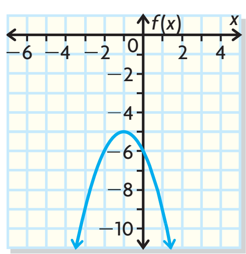
	Function	Vertex	Axis of Symmetry	Opens Up/Down	Range
a)	$f(x) = (x - 3)^2 + 1$	(3, 1)	$x = 3$	up	$y \geq 1$
b)	$f(x) = -(x + 1)^2 - 5$	$(-1, -5)$	$x = -1$	down	$y \leq -5$
c)	$y = 4(x + 2)^2 - 3$	$(-2, -3)$	$x = -2$	up	$y \geq -3$
d)	$y = -3(x + 5)^2 + 2$	$(-5, 2)$	$x = -5$	down	$y \leq 2$
e)	$f(x) = -2(x - 4)^2 + 1$	(4, 1)	$x = 4$	down	$y \leq 1$
f)	$y = \frac{1}{2}(x - 4)^2 + 3$	(4, 3)	$x = 4$	up	$y \geq 3$

Sketches (from table above)

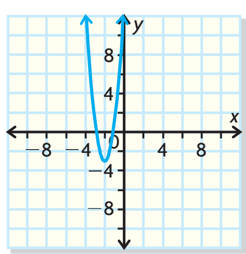
a)



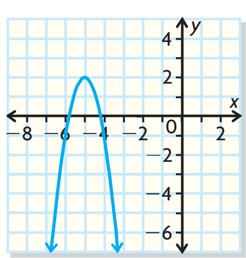
b)



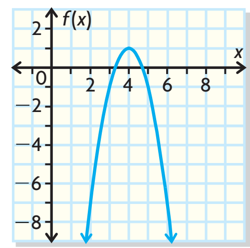
c)



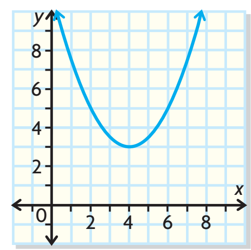
d)



e)



f)



5. **a)** $x = -8, 14$
b) $x = -12, 2$
c) $x = 1$
d) $x = -6.873$ or -0.873
e) $x = 0.192$ or 7.808
f) no zeros

6. $f(x) = (x - 7)^2 - 25$; vertex form: vertex $(7, -25)$; axis: $x = 7$; direction of opening: up
$f(x) = x^2 - 14x + 24$; standard form: y intercept is 24; direction of opening: up
$f(x) = (x - 12)(x - 2)$; factored form: zeros: $x = 12$ and $x = 2$; direction of opening: up

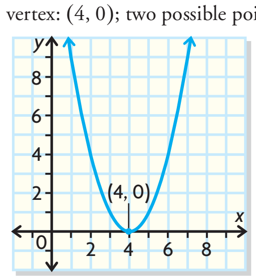
7. **a)** after 0.3 s; maximum since $a < 0$ so the parabola opens down
b) 110 m
c) 109.55 m

8. **a)** $y = -3(x + 4)^2 + 8, y = -3x^2 - 24x - 40$
b) $y = -(x - 3)^2 + 5, y = -x^2 + 6x - 4$
c) $f(x) = 4(x - 1)^2 - 7, y = 4x^2 - 8x - 3$
d) $y = (x + 6)^2 - 5, y = x^2 + 12x + 31$

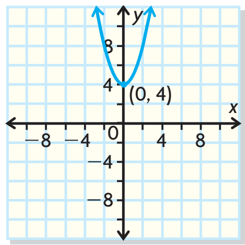
9. **a)** $f(x) = (x + 3)^2 - 4$
b) $f(x) = (x - 2)^2 + 1$
c) $f(x) = -(x - 4)^2 - 2$
d) $f(x) = -(x + 1)^2 + 4$

10. **a)** 23 m **b)** 2 s **c)** 1 s or 3 s

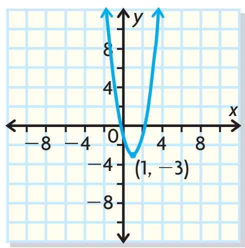
11. **a)** vertex: (4, 0); two possible points (3, 1), (5, 1)



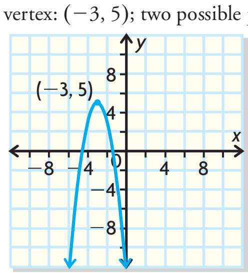
b) vertex: (0, 4); two possible points: (2, 8), (−2, 8)



c) vertex: (1, −3); two possible points: (−1, 5), (3, 5)



d) vertex: (−3, 5); two possible points: (−2, 3), (−4, 3)



12. $y = 2(x + 1)^2 - 8$

13. Expand and simplify. For example,

$$\begin{aligned} f(x) &= (x + 2)^2 - 4 \\ &= x^2 + 4x + 4 - 4 \\ &= x^2 + 4x \end{aligned}$$

14. **a)** y-intercept, opens upward or downward
b) vertex, opens upward or downward, max/min

15. $y = -0.88(x - 1996)^2 + 8.6$

16. $f(x) = (x - 1)^2 - 36$

Lesson 4.2, pp. 213–215

1. **a)** 16 **b)** 36 **c)** 25 **d)** $\frac{25}{4}$

2. **a)** $m = 10, n = 25$ **c)** $m = 12, n = 36$
b) $m = 6, n = 9$ **d)** $m = \frac{7}{2}, n = \frac{49}{4}$

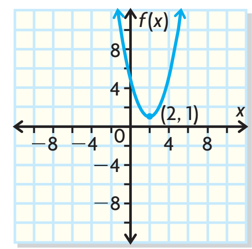
3. **a)** $(x + 7)^2$ **c)** $(x - 10)^2$
b) $(x - 9)^2$ **d)** $(x + 3)^2$

4. **a)** $(x + 6)^2 + 4$ **c)** $(x - 5)^2 + 4$
b) $(x - 3)^2 - 7$ **d)** $\left(x - \frac{1}{2}\right)^2 - \frac{13}{4}$

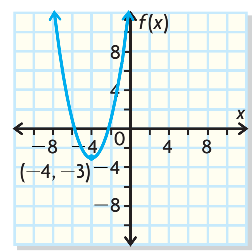
5. **a)** $a = 3, h = 2, k = 5$
b) $a = -2, h = -5, k = -3$
c) $a = 2, h = 3, k = 5$
d) $a = \frac{1}{2}, h = -3, k = -5$

6. **a)** $f(x) = (x + 4)^2 - 13$ **d)** $f(x) = -(x - 3)^2 + 16$
b) $f(x) = (x - 6)^2 - 1$ **e)** $f(x) = -\left(x - \frac{3}{2}\right)^2 + \frac{1}{4}$
c) $f(x) = 2(x + 3)^2 - 11$ **f)** $f(x) = 2\left(x + \frac{3}{4}\right)^2 - \frac{1}{8}$

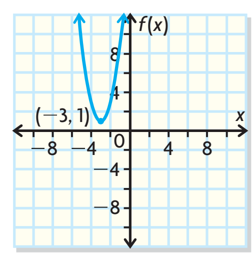
7. **a)** $f(x) = (x - 2)^2 + 1$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \geq 1\}$



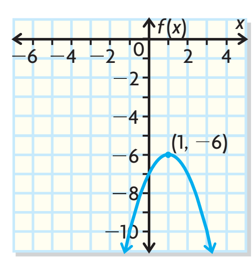
b) $f(x) = (x + 4)^2 - 3$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \geq -3\}$



c) $f(x) = 2(x + 3)^2 + 1$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \geq 1\}$

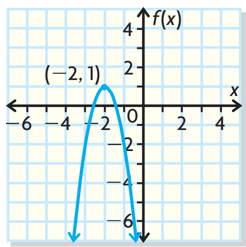


d) $f(x) = -(x - 1)^2 - 6$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \leq -6\}$

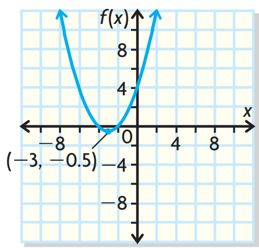


Answers

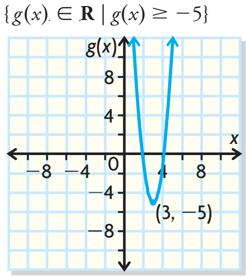
e) $f(x) = -3(x + 2)^2 + 1$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \leq 1\}$



f) $f(x) = \frac{1}{2}(x + 3)^2 - \frac{1}{2}$; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \geq -0.5\}$



8. **a)** $g(x) = 4(x - 3)^2 - 5$
b) $x = 3$
c) $(3, -5)$
d) minimum value of -5 because $a > 0$; parabola opens up
e) domain: $\{x \in \mathbf{R}\}$
f) $\{g(x) \in \mathbf{R} \mid g(x) \geq -5\}$
g)



9. Colin should have taken the square root of both 9 and 4 to get $\frac{3}{2}$, not $\frac{3}{4}$.
10. 61 250 m^2
11. \$15
12. **a)** $y = 3(x - 5)^2 - 2$
b) vertex, axis of symmetry, max/min
13. Reflection about the x-axis, a vertical stretch of 2, a horizontal shift of 4, a vertical shift of 3. I completed the square to determine the vertex.
14. Each form provides different information directly.
15.
$$\begin{aligned} f(x) &= ax^2 + bx + c \\ &= x^2 + bx + c \\ &= x^2 + bx + \left(\frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c \\ &= \left(x + \frac{b}{2}\right)^2 + \left(c - \frac{b}{2}\right)^2 \end{aligned}$$
Example:
$$\begin{aligned} f(x) &= x^2 + 6x + 4 \\ &= x^2 + 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 + 4 \\ &= x^2 + 6x + 9 - (9 + 4) \\ &= (x + 3)^2 - 5 \end{aligned}$$

16. $y = -5(x - 1)^2 + 6$
17. $(1, 6)$

Lesson 4.3, pp. 222–223

1. **a)** $a = 3, b = -5, c = 2$ **c)** $a = 16, b = 24, c = 9$
b) $a = 5, b = -3, c = 7$ **d)** $a = 2, b = -10, c = 7$

2. **a)** **a)** $x = \dfrac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(2)}}{2(3)}$

b) $x = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(7)}}{2(5)}$

c) $x = \dfrac{-(24) \pm \sqrt{(24)^2 - 4(16)(9)}}{2(16)}$

d) $x = \dfrac{-(-10) \pm \sqrt{(-10)^2 - 4(2)(7)}}{2(2)}$

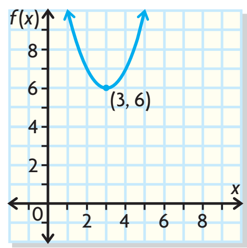
b) **a)** $x = 1$ or $x = \frac{2}{3}$ **c)** $x = -\frac{3}{4}$
b) no solution **d)** $x = 4.16$ or $x = 0.84$

3. **a)** no solution
b) $x = -5$ or $x = 1.5$
c) $x = 5.5$
d) $x = -0.84$ or $x = 2.09$
e) no solution
f) $x = -0.28$ or $x = 0.90$
4. **a)** no solution
b) $x = -5$ or $x = 1.5$
c) $x = 5.5$
d) $x = -0.84$ or $x = 2.09$
e) no solution
f) $x = -0.28$ or $x = 0.90$
5. For example:
a) factoring, $x = 0$ or $x = 15$
b) take the square root of both sides, $x = -10.72$ or $x = 10.72$
c) factoring, $x = 8$ or $x = \frac{3}{2}$
d) expand, then use quadratic formula, $x = 2.31$ or $x = 11.69$
e) isolate the squared term, $x = -2$ or $x = 8$
f) quadratic formula, $x = 0.09$ or $x = 17.71$
6. **a)** 10.9 s **b)** approx. 9 s
7. 20 m × 20 m and 10 m × 40 m
8. 9.02 s
9. 91 km/h
10. Answers may vary. E.g., 2 solutions $2x^2 - 4x = 0$, $3x^2 - 4x - 2 = 0$; 1 solution $3x^2 - 6x + 3 = 0$, $x^2 - 2x + 1 = 0$; 0 solutions $x^2 - 6x + 10 = 0$
11. **a)** $x = 1.62$ or $x = 6.38$
b) $x = 1.62$ or $x = 6.38$
c) The method in part (a) was best because it required fewer steps to find the roots.
12. $(-1, -2)$ and $(3, 6)$
13. $(-1.21, -5.96)$ and $(2.21, 4.29)$
14. **a)** $x = 0$ and $x = 0.37$
b) $x = -3$ and $x = -2.4$, and $x = 2.4$ and $x = 3$

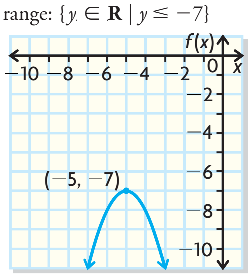
Mid-Chapter Review, p. 226

1. **a)** $f(x) = x^2 - 16x + 68$
b) $g(x) = -x^2 + 6x - 17$
c) $f(x) = 4x^2 - 40x + 109$
d) $g(x) = -0.5x^2 + 4x - 6$

2. **a)** vertex: (3, 6); axis: $x = 3$; min. 6; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \geq 6\}$



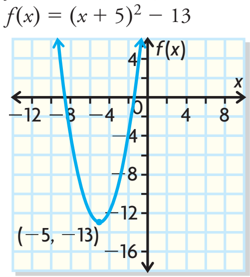
b) vertex: $(-5, -7)$; axis: $x = -5$; max. -7; domain: $\{x \in \mathbf{R}\}$; range: $\{y \in \mathbf{R} \mid y \leq -7\}$



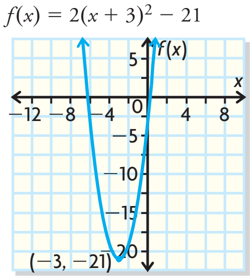
3. Answers may vary. E.g., the vertex form. From this form, I know the location of the vertex, which helps me sketch the graph. If $f(x) = (x + 2)^2 - 5$, then the vertex is $(-2, -5)$ and the parabola opens up.

4. **a)** $f(x) = 2(x - 2)^2 + 5$
b) $f(x) = -3(x + 1)^2 - 4$

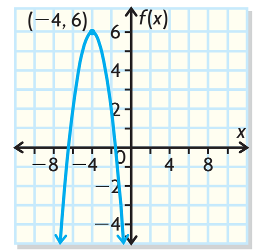
5. **a)** $f(x) = (x + 5)^2 - 13$



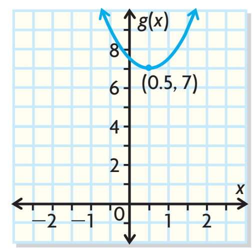
b) $f(x) = 2(x + 3)^2 - 21$



c) $f(x) = -(x + 4)^2 + 6$



d) $g(x) = 2(x - 0.5)^2 + 7$



6. \$205

7. $10\ 000\ m^2$

8. **a)** $x = -5, x = 3$ **c)** $x = 5.27, x = 8.73$
b) $x = \frac{1}{3}$ **d)** no solution

9. about 4 s

10. \$1.67 and \$10

11. **a)** 62 m **b)** about 8 s **c)** at 3 s and 5 s

Lesson 4.4, pp. 232–233

1. **a)** $(-5)^2 - 4(1)(7)$ **c)** $(12)^2 - 4(3)(-7)$
b) $(11)^2 - 4(-5)(17)$ **d)** $(1)^2 - 4(2)(-11)$

2. **a)** two distinct **c)** one **e)** two distinct
b) none **d)** none **f)** one

3. No, there are two solutions; $b^2 - 4ac = (-5)^2 - 4(1)(2) > 0$

4. **a)** two **c)** one **e)** none
b) none **d)** two **f)** one

5. $k > 4$ or $k < -4$

6. $m = 4$

7. $k < \frac{1}{2}, k = \frac{1}{2}, k > \frac{1}{2}$

8. **a)** Put a, b, and c into the discriminant and set the discrimant equal to zero. Solve for k.
b) $(-5)^2 - 4(3)(k) = 0, k = \frac{25}{12}$

9. $k = -4, k = 8$

10. **a)** $-50 < k < 50$
b) $k = \pm 50$
c) $k < -50, k > 50$

11. Answers may vary. E.g., if $a = 2$, $b = 3$, and $c = -1$, then $0 = 2x^2 + 3x - 1$. In this case, the discriminant $(b^2 - 4ac)$ has a value of 17, so there are 2 solutions.

12. Yes. The discriminant will be greater than zero. $x = 99.9$

13. Answers may vary. E.g., discriminant, quadratic formula

14. Yes. Set the expression equal to each other and solve. You would get $p = 1$ or $p = -13$.

15. two distinct zeros for all values of k

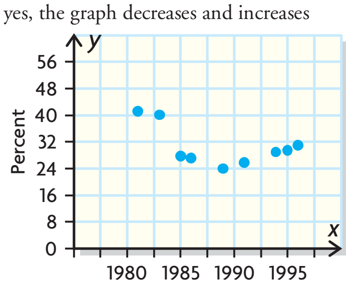
Answers

Lesson 4.5, pp. 239–241

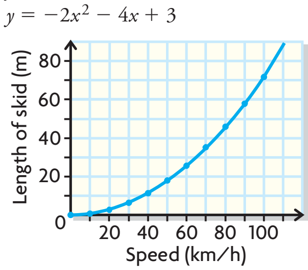
1. Complete the square to put the function in vertex form. The y-coordinate of the vertex will be the maximum revenue.
2. \$3025
3. Solve the equation $-4.9t^2 + 1.5t + 17 = 5$ for $t > 0$.
4. 1.73 s
5. \$1865; \$6
6. **a)** 8600
   b) approx. 2011
   c) no; the graph does not cross the horizontal axis
7. when selling between 1000 and 7000 pairs of shoes
8. 128 m^2
9. **a)** 8.4 m
   b) 20 km/h
10. 2 m
11. 2017
12. **a)** \$6.50 **b)** \$8.00
13. **a)** about 1.39 m **c)** no, the ball hits the ground at 4.3 s
    b) 23 m **d)** $t = 0.47$ s and $t = 3.73$ s
14. **a)** $f(x) = -60(x - 5.5)^2 + 1500$
    b) \$2 or \$9
15. An advantage of the vertex form is that is provides the minimum or maximum values of the function. A disadvantage is that you must expand and simplify to find the zeros of the function using the quadratic formula.
16. 5 cm $\times$ 12 cm
17. 10 cm

Lesson 4.6, pp. 250–252

1. **a)** no, the graph increases too quickly
   b) yes, the graph decreases and increases
2. **a)**



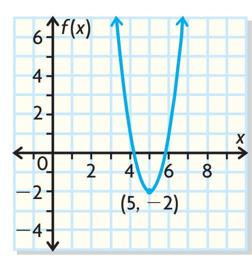
   b) (1989, 23.5)
   c) up, e.g., $a = 1$
   d) e.g., needs to be wider so use a smaller, positive value for a
   e) $y = 0.23(x - 1989)^2 + 23.5$, or
   $y = 0.23x^2 - 912.53x + 908\,060.52$
   f) domain: $\{x \in \mathbf{R} \mid 1981 \le x \le 1996\}$;
   range: $\{y \in \mathbf{R} \mid 23.5 \le y \le 41.7\}$
3. **a)** $y = (x - 5)^2 - 3$
   b) $y = -0.5(x + 4)^2 + 6$
4. **a)** $y = 2x^2 - 8x + 11$ **c)** $y = -4x^2 + 24x - 43$
   b) $y = -2x^2 - 4x + 3$ **d)** $y = 6x^2 + 24x + 19$
5. **a)**



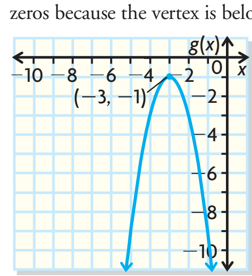
   b) $y = 0.007x^2 - 0.0005x - 0.016$
   c) Skid will be 100.7 m.
   d) domain: $\{x \in \mathbf{R} \mid x \ge 0\}$; range: $\{y \in \mathbf{R} \mid y \ge 0\}$
6. **a)** $y = 0.000\,83x^2 - 0.116x + 21.1$
   b) 21.1¢
   c) domain: $\{x \in \mathbf{R} \mid x \ge 0\}$; range: $\{y \in \mathbf{R} \mid y \ge 17\}$
7. **a)** $y = -15(x - 1987)^2 + 1075$
   b) not very well, because they would be selling negative cars
   c) domain: $\{x \in \mathbf{R} \mid x \ge 1982\}$; range: $\{y \in \mathbf{R} \mid y \le 1075\}$
8. $y = -5(x - 2)^2 + 20.5$; $x \ge 0$, $y \ge 0$; 4 s
9. **a)** $y = -0.53x^2 + 1.39x + 0.13$
   b) domain: $\{x \in \mathbf{R} \mid x \ge 0\}$; range: $\{y \in \mathbf{R} \mid y \le 1.1\}$
   c) 0.57 kg/ha or 2.05 kg/ha
10. **a)** $y = 0.03(x - 90)^2 + 16$
    b) 1096 mph, no a regular car can't drive that fast!
11. $f(x) = 2x^2 + 4x + 6$
12. If the zeros of the function can be determined, use the factored form $f(x) = a(x - r)(x - s)$. If not, then use graphing technology and quadratic regression.
13. 12.73 m
14. 15, 24
15. \$6250, \$12.50

Chapter Review, pp. 254–255

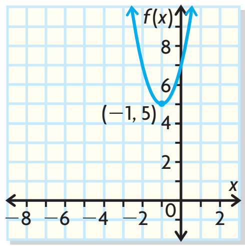
1. **a)** $f(x) = x^2 + 6x + 2$
   b) $f(x) = -x^2 - 14x - 46$
   c) $f(x) = 2x^2 - 4x + 7$
   d) $f(x) = -3x^2 + 12x - 16$
2. **a)** $y = (x - 3)^2 - 5$ **c)** $f(x) = \frac{1}{2}(x + 2)^2 - 3$
   b) $f(x) = -(x - 6)^2 + 4$ **d)** $f(x) = 2(x - 5)^2 + 3$
3. **a)** $f(x) = (x + 1)^2 - 16$ **d)** $f(x) = 3(x + 2)^2 + 7$
   b) $f(x) = -(x - 4)^2 + 9$ **e)** $f(x) = \frac{1}{2}(x - 6)^2 + 8$
   c) $f(x) = 2(x + 5)^2 - 34$ **f)** $f(x) = 2\left(x + \frac{1}{2}\right)^2 + \frac{7}{2}$
4. **a)** vertex: $(5, -2)$; axis: $x = 5$; opens up because $a > 0$; two zeros because the vertex is below the x-axis; parabola opens up



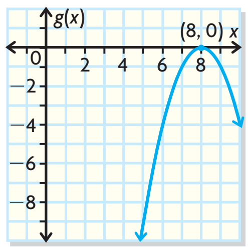
   b) vertex: $(-3, -1)$; axis: $x = -3$; opens down because $a < 0$; no zeros because the vertex is below the x-axis; parabola opens down



c) vertex: $(-1, 5)$; axis: $x = -1$; will have no zeros because the vertex is above the x-axis; parabola opens up



d) vertex: $(8, 0)$; axis: $x = 8$; $a < 0$, will have one zero because the vertex is on the x-axis; parabola opens down



5. **a)** $x = -\frac{1}{2}, x = 8$

b) no solution

c) $x = \frac{1}{3}$

d) $x = 1.16, x = -2.40$

6. **a)** 2.7 m **b)** 1.5 s

7. **a)** no solution

b) two distinct solutions

c) one solution

8. **a)** $\frac{16}{5} > k$ **b)** $\frac{16}{5} = k$ **c)** $\frac{16}{5} < k$

9. **a)** 25 cars **b)** \$525

10. **a)** 41 472 m^2 **b)** 10 720 m^2 **c)** 36 m

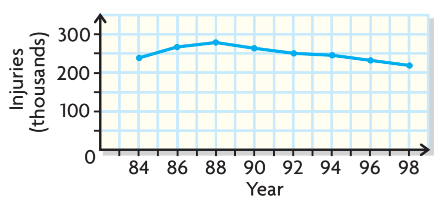
11. **a)** $y = -4.9(x - 1.5)^2 + 10.5$

b) domain: $\{x \in \mathbf{R} \mid 0 \leq x \leq 2.96\}$;

range: $\{y \in \mathbf{R} \mid 0 \leq y \leq 10.5\}$

c) 2.8 s

12. **a)**



b) $y = -673.86x^2 + 2\,680\,816x - 2\,665\,999\,342$

c) Use the quadratic regression function on a graphing calculator to determine the curve's equation. $y = -673.86x^2 + 2\,680\,816x - 2\,665\,999\,342$

d) 160 715, using the above equation

e) 1989

Chapter Self-Test, p. 256

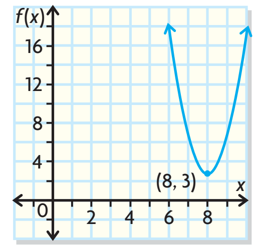
1. **a)** $f(x) = x^2 + 6x + 2$

b) $f(x) = -3x^2 - 30x - 73$

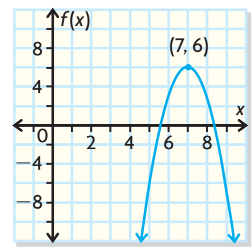
2. **a)** $f(x) = (x - 5)^2 + 8$

b) $f(x) = -5(x - 2)^2 + 8$

3. **a)** vertex: $(8, 3)$; axis: $x = 8$; min. 3



b) vertex: $(7, 6)$; axis: $x = 7$; max. 6



4. If you get a negative under the square root, you cannot solve. There are no solutions to these equations.

5. **a)** $x = -1.12, x = 7.12$

b) no solution

6. **a)** no solution **b)** one solution

7. **a)** 20.1m **b)** 15.2 m

8. **a)** \$13 812 **b)** \$24

9. **a)** $y = -1182(x - 2)^2 + 4180$

b) It fits the data pretty well.

c) domain: $\{x \in \mathbf{R} \mid x \geq 0\}$; range: $\{y \in \mathbf{R} \mid y \leq 4180\}$

d) \$4106

10. It is easier to use this method to find the max/min and vertex.

Chapter 5

Getting Started, pp. 260–262

1. **a)** (v) **c)** (ii) **e)** (iv)
b) (vi) **d)** (i) **f)** (iii)

2. **a)** $\sin A = \frac{12}{13}, \cos A = \frac{5}{13}, \tan A = \frac{12}{5}$

b) $\sin A = \frac{8}{17}, \cos A = \frac{15}{17}, \tan A = \frac{8}{15}$

3. **a)** $\angle A \doteq 27°$ **b)** $b \doteq 3$ **c)** $\angle A \doteq 50°$ **d)** $d \doteq 16$

4. **a)** 12 cm **b)** 10 m

5. **a)** $\sin A = \frac{4}{13}, \cos A = \frac{12}{13}, \tan A = \frac{1}{3}; \angle A \doteq 18°$

b) $\sin D = \frac{5}{7}, \cos D = \frac{5}{7}, \tan D = 1; \angle D \doteq 44°$

c) $\sin C = \frac{12}{13}, \cos C = \frac{4}{13}, \tan C = 3; \angle C \doteq 72°$