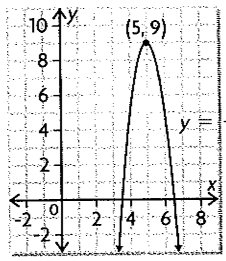
6. a) 16 b) 25 c) 6.25 d) 12.25 e) -36 f) 40.5

7. a) $y = (x + 3)^2 - 12$
b) $y = (x - 2)^2 + 1$
c) $y = 2(x + 4)^2 - 2$
d) $y = -3(x + 3)^2 + 10$
e) $y = 2(x + 2.5)^2 - 4.5$
f) $y = -3(x - 1.5)^2 + 4.75$

8. a) $y = -4(x - 5)^2 + 9$
b) vertex: (5, 9); equation of the axis of symmetry: $x = 5$
c)



9. \$20/kg

10. 2 s

Lesson 6.4, page 342

1. a) $a = 1, b = 5, c = -2$
b) $a = 4, b = 0, c = -3$
c) $a = 1, b = 6, c = 0$
d) $a = 1, b = -10, c = -1$

2. a) i) $3, -21$
ii) $3, -21$
iii) Answers may vary, e.g., I prefer factoring because it is faster.
b) i) $-\frac{1}{4}, \frac{3}{2}$
ii) $-\frac{1}{4}, \frac{3}{2}$
iii) Answers may vary, e.g., I prefer the quadratic formula because it is more straightforward.

3. a) $5, -5$ b) $1, -1$ c) $2, -2$ d) $6, -6$

4. a) $-5, 3$
b) $-4, -6$
c) 6, 8
d) about 3.12, about 0.882
e) about -1.59, about -4.41
f) 0, 8

5. a) -1.5, about 1.67
b) 2.5
c) $4, -4$
d) 0, 2.2
e) $-4, -5$
f) -1.25, about 2.67

6. Answers may vary, e.g., yes, since all the answers in question 5 are integers or fractions, the equations could have been solved by factoring.

7. Answers may vary, e.g., they will not have square roots. Since the solutions are the same whether you use factoring or the quadratic formula, and the solutions determined from factoring contain no square roots, the solutions found using the quadratic formula cannot contain roots either.

8. a) $4.24, -0.24$
b) $-0.27, 1.47$
c) $-0.28, -2.39$
d) $-1, 1.5$
e) 0.70, 4.30
f) 3.29, 0.71

9. a) $-1.16, 5.16$
b) $-1.27, -4.73$
c) $-2.5, 1$
d) 1.49, 0.05
e) $-1.44, 2.44$
f) 1.46, 7.54

10. a) $1.68, -4.18$
b) $1.68, -4.18$
c) $1.68, -4.18$
d) $1.68, -4.18$

11. a) All the solutions are the same.
b) Answers may vary, e.g., all the equations are constant multiples of each other. The equations are proportional to each other.

12. about $(-0.92, -10.91)$, $(1.52, 4.23)$

13. about 8

14. a) about 0.2 s b) about 1.9 s

15. about 9.98 cm by about 14.98 cm

16. 9.7 m by 9.7 m

17. Answers may vary, e.g.,

Strategy	Advantages	Examples
factoring	is usually quick if the equation is easily factorable; allows roots to be seen from the factors; involves less complicated calculations	$x^2 + 5x + 4 = 0$
quadratic formula	can be used when the equation is not factorable over integers; can be used when coefficients are great	$2x^2 + 5x - 12 = 0$ $3.5x^2 + 15.7x + 2.8 = 0$ $105x^2 - 187x - 156 = 0$

18. about (0.49, 5.98), about $(-4.49, -3.98)$

19. Answers may vary, e.g.,
a) $x^2 - 2x - 15 = 0$ b) $9x^2 - 12x - 1 = 0$

20. 6 cm, 8 cm, 10 cm

Lesson 6.5, page 349

1. a) 1, 5
b) The graph has two x-intercepts.
c) $D = 16$; since $D > 0$

2. a) no solutions; e.g., the vertex is at (1, 3), and the graph opens upward; $D < 0$
b) two solutions; e.g., the vertex is at (5, 8), and the graph opens downward; $D > 0$
c) one solution; e.g., the vertex is at $(-3, 0)$; $D = 0$

3. a) 2 b) 0 c) 2 d) 1 e) 2 f) 1

4. a) 2; e.g., the vertex is below the x-axis, and the graph opens upward; $D > 0$
b) 0; e.g., the vertex is below the x-axis, and the graph opens downward; $D < 0$
c) 1; e.g., the vertex is on the x-axis; $D = 0$
d) 0; e.g., the vertex is above the x-axis, and the graph opens upward; $D < 0$
e) 2; e.g., the vertex is above the x-axis, and the graph opens downward; $D > 0$
f) 1; e.g., the vertex is on the x-axis; $D = 0$

5. a) 0; $D < 0$
b) 0; $D < 0$
c) 2; $D > 0$
d) 1; $D = 0$
e) 2; $D > 0$
f) 2; $D > 0$

6. No. $500 = 250 + 5n - 2n^2$ has no real solutions.

7. a) Answers may vary, e.g., none, because the x^2 term must always be positive; the lowest point of the bridge (vertex) should be above the water level.
b) 24 m

8. a) 1; the ball starts above the ground and falls downward.
b) zeros: -0.10, 2.30; ignore the first zero since it is negative time.
c) Answers may vary, e.g., 5 m: twice; 7 m: once; 9 m: zero
d) For 5 m, $D = 39.2$; $D > 0$, so there are two roots. For 7 m, $D = 0$, so there is one root. For 9 m, $D = -39.2$; $D < 0$, so there are no roots.

9. a) below; the discriminant is positive, and the curve opens upward
b) below; the discriminant is positive, and the curve opens upward
c) on; the discriminant is zero
d) below; the discriminant is positive, and the curve opens upward

10. a) $k < 1.8$ b) $k = 1.8$ c) $k > 1.8$

11. a) 216 m
b) If her hair touches the water, then the corresponding equation is $0 = -5t^2 + t + 216$. This has two solutions: $t = 6.67$ and $t = -6.67$. Only the positive solution makes sense in this situation. 6.67 s is the time it takes her to drop to the water.

12. $y < -41$
13. about 7.07 or about -7.07
14. Agree. e.g., r and s are both solutions to the relation, therefore there must be two solutions and the discriminant cannot be negative.
15. Answers may vary, e.g.,
  a) $y = (x + 2)^2 - 9$; $y = x^2 + 4x - 5$; $D = 36$
  b) $y = 2(x - 3)^2$; $y = 2x^2 - 12x + 18$; $D = 0$
  c) $y = (x + 5)^2 + 2$; $y = x^2 + 10x + 27$; $D = -8$
16. Answers may vary, e.g.,
  a) i) $y = (x - 2)(x + 6)$ iii) $y = (x - 12)(x - 3)$
  ii) $y = (x + 1)(x + 2)$
  b) i) $y = x^2 + 4x - 12$ iii) $y = x^2 - 15x + 36$
  ii) $y = x^2 + 3x + 2$
  c) i) 64 ii) 1 iii) 81
  d) If the discriminant is a perfect square, then the equation is factorable.
17. 0

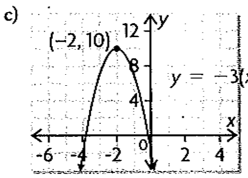
Lesson 6.6, page 357

1. a) vertex: maximum height and the time when it is reached; first zero: when the ball leaves the ground; second zero: when the ball returns to the ground
  b) vertex: maximum height and the horizontal distance when it is reached; first zero: no meaning; second zero: horizontal distance from the building where it hits the ground
  c) vertex: maximum profit, P, and the selling price that produces it; zeros: selling prices that would ensure the company breaks even
  d) vertex: minimum cost of running the machine and the number of items that should be produced to ensure the minimum cost; no zeros, because they would not make sense
  e) vertex: minimum height above the ground and the time when it is reached; no zeros, because zeros would mean that the person swinging went through the ground
2. a) 15 m b) 4.62 s c) 5 s d) 39.2 m
3. a) 23.88 m b) either 16.6 m or 73.4 m
4. 6.25 m
5. a) $P = -16(x - 28)^2 + 1024$ b) \$20 or \$36
6. a) about 1.46 s
  b) about 2.07 s
  c) Answers may vary, e.g., because the relation is nonlinear; gravity is causing the diver to accelerate.
7. 2.5 m by 7.5 m; 18.75 m^2
8. a) 570 b) 2006, 178 c) no
  d) Answers may vary, e.g., probably not, since the curve continues to increase after 2006; so, in 2020, there would be 1746 deer; yes, if the deer population was predicted to continue growing at this rate.
9. a) about 31.38 s b) about 24.6 m
10. a) 75
  b) when 35 to 115 items are produced
11. about 0.84 m
12. about 6.74 m
13. either 16, 18, and 20, or -16, -18, and -20
14. a) $y = -\frac{16}{289}x(x - 34)$ b) between 1.85 and 32.15 m
15. Answers may vary, e.g.,
  a) The sum of two integers is 11. The sum of their squares is 61. Determine the integers.
  b) Sean is practising skateboarding in a parabolic half-pipe. At one point, he has travelled 1.5 m horizontally and 2.5 m below the lip. If the half pipe is 15.0 m across, what is the vertical distance from the lip to the bottom?

16. rectangle: about 7.0 m by 4.5 m; triangle: about 7.0 m on each side
17. 9 m by 12 m

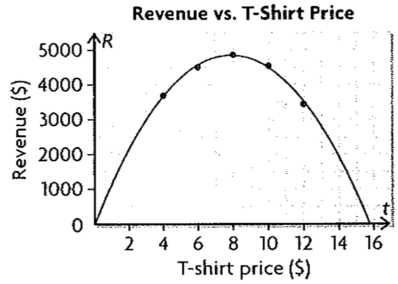
Chapter Review, page 361

1. a) $\frac{5}{2}, -\frac{8}{3}$ c) $-\frac{2}{3}, 4$ e) about -2.69, about 0.19
  b) $-8, -4$ d) 1, 8 f) about -0.26, about 1.11
2. a) about 6.82 m b) 45 km/h
3. a) 16 c) 90.25 e) -18.75
  b) 64 d) 18 f) 122.5
4. a) $y = (x + 4)^2 - 18$ d) $y = 0.2(x - 1)^2 + 0.8$
  b) $y = (x - 10)^2 - 5$ e) $y = 2(x + 2.5)^2 - 24.5$
  c) $y = -3(x - 2)^2 + 10$ f) $y = -4.9(x + 2)^2 + 31.6$
5. a) $y = -3(x + 2)^2 + 10$
  b) stretch by a factor of 3, reflection in the x-axis, translation 2 units left and 10 units up
  c)



6. 9.2 m
7. 11.5 m by 23.0 m
8. a) about 2.61, about -1.28 d) 1, 5
  b) $-2, 2$ e) about -2.42, about 0.76
  c) about -1.36, about 7.36 f) about 0.19, about 3.88
9. either about 0.82 m or about 23.18 m
10. either about 113.67 cm or about 246.33 cm
11. a) 2 b) 0 c) 0 d) 2 e) 2
12. a) 2 b) 2 c) 0 d) 2 e) 0
13. a) 500 m b) about 22.4 s
14. about 160.0 m
15. \$6.25
16. about 0.4 m
17. either 16 and 28, or -16 and -28
18. a) revenue: \$3692, \$4512, \$4864, \$4550, \$3444, \$1946
  b)

Revenue vs. T-Shirt Price



  c) Substitute the T-shirt prices into the relation, and determine whether the values of N you obtain are close to those in the table.
  $N = 1230 - 78(4) = 918$
  $N = 1230 - 78(6) = 762$
  $N = 1230 - 78(8) = 606$
  $N = 1230 - 78(10) = 450$
  $N = 1230 - 78(12) = 294$
  $N = 1230 - 78(14) = 138$
  These values of N are close to those in the table, so this relation does approximate the number of students who will buy a T-shirt.

d) $R = -78t^2 + 1230t$
e) between \$6.76 and \$9.01

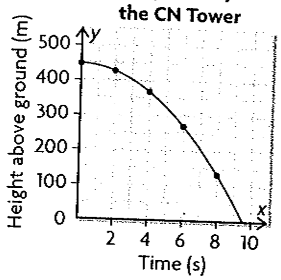
Chapter Self-Test, page 363

1. Answers may vary, e.g.,
   a) $-2.9, 0.9$ b) $-2, 0$ c) $-3, 1$
2. a) $-7, 2$ b) about 0.12, about 1.68 c) $4, -4$ d) about 2.58, about -0.58
3. a) $(-3, -32)$ b) $(2.5, -42.75)$
4. yes, because all quadratic equations have a vertex, so it is possible to write an equation in vertex form by completing the square
5. a) 0; e.g., $D = -40$; the discriminant is negative
   b) 1; e.g., the vertex is on the x-axis; both factors are the same
   c) 1; e.g., the vertex is on the x-axis; both factors are the same
6. a) No. The maximum revenue is \$1050.
   b) either 48 or 252
   c) either 76 or 224
   d) 150
7. 6 m by 12 m
8. Answers may vary, e.g.,
   Reason 1: I could not make a square using those algebra tiles.
   Reason 2: When 3 is factored out of all the terms, the coefficient of x is 2. This means that the constant term would have to be $\left(\frac{2}{2}\right)^2 \times 3 = 3$, not 6, to be a perfect square.
9. \$3.25 (\$15.67 would be an unreasonable increase)

Cumulative Review Chapters 4–6, page 365

1. D	6. D	11. C	16. D	21. C
2. B	7. C	12. D	17. C	22. B
3. A	8. B	13. A	18. A	23. B
4. C	9. D	14. C	19. C	24. D
5. A	10. D	15. A	20. A	25. D

26. Write each relation in factored form.
    The relation for Sid is $P = -6(n - 4)(n - 8)$. The maximum profit occurs at (6, 24), which is the vertex of the graph of the relation. The maximum profit is \$24 000; it occurs when 6000 pairs of shoes are manufactured and sold. The break-even points are 4000 and 8000 pairs of shoes manufactured and sold.
    The relation for Nancy is $P = -8(n - 1)(n - 4)$. The maximum profit occurs at (2.5, 18), which is the vertex of the graph of the relation. The maximum profit is \$18 000; it occurs when 2500 pairs of shoes are manufactured and sold. The break-even points are 1000 and 4000 pairs of shoes manufactured and sold.
27. a) **Dropping a Penny from the CN Tower**



   b) Yes. The second differences are constant.
   c) Answers may vary, e.g., $y = -4.9x^2 + 447$
   d) $y = -4.9x^2 + 447$; answers may vary, e.g., the fit is perfect.
   e) about 298.8 m above the ground
28. a) Equation ①: Profit is maximized at \$1960, when $x = 6$. Selling price is \$25.99.
    Equation ②: Profit is maximized at \$1653.69, when $x = 2.25$. Selling price is \$22.24.
    b) Equation ①: Zeros occur when $x = -8$ and $x = 20$. The break-even prices are \$11.99 and \$39.99.
    Equation ②: Zeros occur when $x = -10.01$ and $x = 14.51$. The break-even prices are \$9.98 and \$34.50.
    c) Answers may vary, e.g., the recommended selling price is \$25.99, based on equation ①. This gives the greatest possible profit.

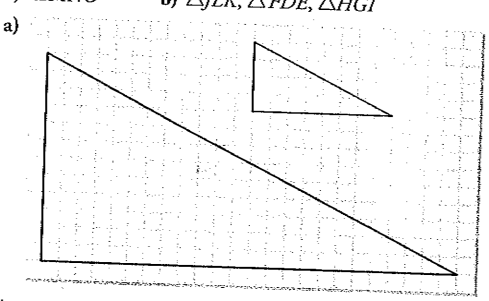
Chapter 7

Getting Started, page 370

1. a) ii b) iv c) v d) iii e) i f) vi
2. a) 1 b) 8 c) 17.5 d) 13.5 e) 3.38 f) 2
3. a) 6.0 m b) 10.5 cm
4. a) 2.8 cm b) 3.5 cm or 3.4 cm
5. a) 5:7 b) $\frac{1}{2}$ c) $-4{:}1$ d) $\frac{3}{4}$
6. a) 31° b) 33° c) 74° d) 60°
7. a) congruent; Both are the same shape and size.
   b) similar; Both are the same shape but different sizes.
8. the length of the side between the two 50° angles
9. 40.7 m
10. Answers may vary, e.g.,
    a) ... they are opposite angles; ... they are the corresponding angles in a case with parallel lines
    b) ... they are supplementary; ... they are the three interior angles in a triangle

Lesson 7.1, page 378

1. Yes. Corresponding angles are equal and the sides are proportional.
2. a) $\triangle MNO$ b) $\triangle JLK$, $\triangle FDE$, $\triangle HGI$
3. a)



   b)