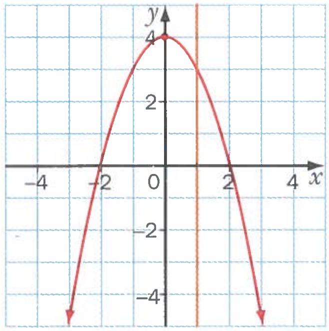
REVIEW OF *Key* CONCEPTS

4.1 Functions

Refer to the Key Concepts on page 196.

To determine whether the graph represents a function, use the vertical line test. No vertical line passes through more than one point on the graph. For every value of x, there is only one value of y. The graph represents a function.



1. State whether each set of ordered pairs represents a function.

a) {(2, 5), (4, 3), (6, 1), (8, −1), (9, −2)}
b) {(3, 2), (5, 6), (6, 8), (3, −2), (6, −4)}
c) {(2, 3), (2, 2), (2, 1), (2, 0), (2, −1)}
d) {(8, 1), (7, 1), (−3, 1), (−4, 1)}

2. If $y = 2x + 3$, find the value of y for each of the following values of x.

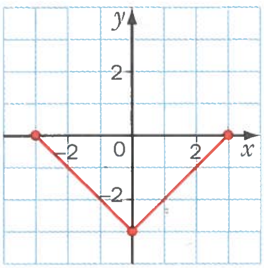
a) 4 **b)** 8 **c)** 0
d) −1 **e)** −4 **f)** 0.5
g) −0.1 **h)** 100 **i)** 5000

3. If $y = 4x^2 - 9$, find the value of y for each of the following values of x.

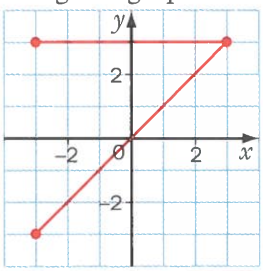
a) 2 **b)** 3 **c)** −2
d) 0 **e)** −3 **f)** 0.5
g) −0.5 **h)** 10 **i)** 20

4. State whether each of the following is a graph of a function.

a)



b)

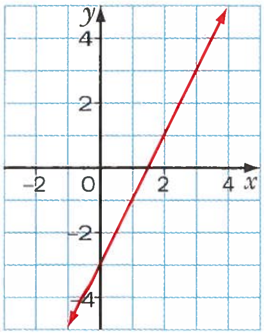


5. State the domain and range of each relation.

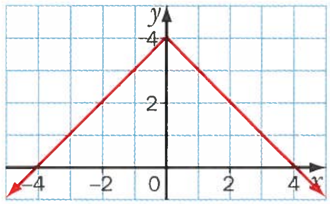
a) {(0, 4), (1, 5), (2, 6), (3, 7)}
b) {(−3, 1), (−1, 3), (1, 3), (2, −1)}

6. Determine the domain and range of each relation.

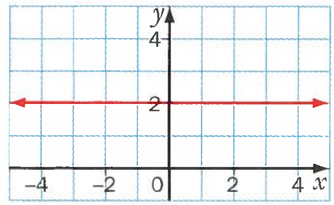
a)



b)



c)



7. Graph each function. The domain is the set of real numbers. Find the range.

a) $y = 2x - 4$

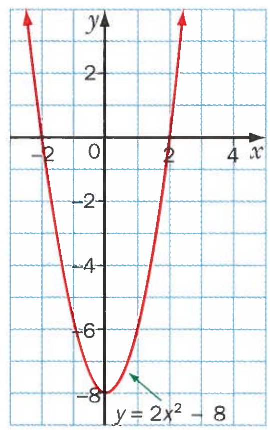
b) $y = x^2 - 1$

4.2 Graphing $y = x^2 + k$, $y = ax^2$, and $y = ax^2 + k$

Refer to the Key Concepts on page 212.

To sketch the graph of $y = 2x^2 - 8$, stretch the graph of $y = x^2$ vertically by a factor of 2. Then, translate 8 units downward.

The coordinates of the vertex are (0, −8).
The equation of the axis of symmetry is $x = 0$.
The domain is the set of real numbers.
The range is $y \geq -8$.
The minimum value of the function is −8 when $x = 0$.
The graph crosses the y-axis at (0, −8), so the y-intercept is −8.
The graph appears to cross the x-axis at (2, 0) and (−2, 0), so the x-intercepts are 2 and −2.



8. Communication Write one sentence that compares each pair of graphs.

a) $y = x^2$ and $y = x^2 - 3$

b) $y = -x^2$ and $y = -4x^2$

9. Sketch the graph of each parabola and state the direction of the opening, the coordinates of the vertex, the equation of the axis of symmetry, the domain and range, and the maximum or minimum value.

a) $y = x^2 + 4$

b) $y = -x^2 - 2$

c) $y = 0.5x^2$

d) $y = -3x^2 + 3$

10. Without graphing each function, state the direction of the opening, the coordinates of the vertex, the domain and range, and the maximum or minimum value.

a) $y = -4x^2$ **b)** $y = -x^2 + 3.5$

c) $y = -2x^2 - 7$ **d)** $3 + 0.2x^2 = y$

11. Use a graphing calculator or graphing software to determine any x-intercepts, to the nearest tenth.

a) $y = x^2 - 7$ **b)** $y = -x^2 + 2$

c) $y = x^2 + 1$ **d)** $y = 2x^2 - 9$

12. Xiaoshang Bridge The Xiaoshang Bridge over the Xiaoji River in Henan Province, China, was built in 584 A.D. It is one of the oldest surviving stone arch bridges. Suppose the curve of the arch is graphed on a grid, with the origin on the river directly under the centre of the arch. The arch can be modelled by the function

$$h = -0.06d^2 + 2.13$$

where h metres is the height of the arch, and d metres is the horizontal distance from the centre of the arch.

a) What is the maximum height of the arch?

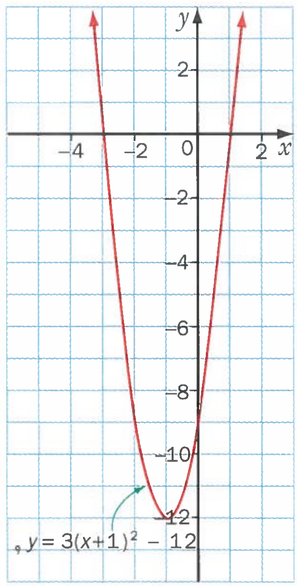
b) If the ends of the arch are at the level of the river, how wide is the arch, to the nearest metre?

c) At a horizontal distance of 2 m from one end of the arch, how high is the arch, to the nearest tenth of a metre?

4.3 Graphing $y = a(x - h)^2 + k$

Refer to the Key Concepts on page 222.

To sketch the graph of $y = 3(x + 1)^2 - 12$, stretch the graph of $y = x^2$ vertically by a factor of 3. Then, translate 1 unit to the left and 12 units downward.



The coordinates of the vertex are $(-1, -12)$.
The equation of the axis of symmetry is $x = -1$.
The domain is the set of real numbers.
The range is $y \geq -12$.
The minimum value of the function is -12 when $x = -1$.
The graph crosses the y-axis at $(0, -9)$, so the y-intercept is -9. The graph appears to cross the x-axis at $(1, 0)$ and $(-3, 0)$, so the x-intercepts are 1 and -3.

13. Sketch each parabola and state the direction of the opening, how the parabola is stretched or shrunk, if at all, the coordinates of the vertex, the equation of the axis of symmetry, the domain and range, and the maximum or minimum value.

a) $y = -2(x - 3)^2 + 1$
b) $y = (x + 7)^2 - 2$
c) $y = 0.5(x + 1)^2 + 5$
d) $y = -(x + 3)^2 - 1$

14. Without sketching each parabola, state the direction of the opening, how the parabola is stretched or shrunk, if at all, the coordinates of the vertex, the equation of the axis of symmetry, the domain and range, and the maximum or minimum value.

a) $y = (x + 1)^2 - 1$
b) $y = -4(x - 1)^2$
c) $y = -2(x - 4)^2 - 3$
d) $y = 0.25(x + 2)^2 + 1$

15. Sketch each parabola and find the coordinates of the vertex, the maximum or minimum value, any intercepts, and two other points on the graph.

a) $y = (x - 3)^2$
b) $y = (x + 2)^2 - 4$
c) $y = 2(x - 3)^2 - 8$
d) $y = -(x + 2)^2 + 9$

16. Use a graphing calculator or graphing software to determine any x-intercepts, to the nearest tenth.

a) $y = (x + 2)^2 - 5$
b) $y = -2(x - 1)^2 + 3$

17. **Baseball** The height, h metres, of a batted baseball as a function of the time, t seconds, since the ball was hit can be modelled by the function

$$h = -2.1(t - 2.4)^2 + 13$$

a) What was the maximum height of the ball?
b) What was its height when it was hit, to the nearest tenth of a metre?
c) How many seconds after it was hit did the ball hit the ground, to the nearest tenth of a second?
d) What was the height of the ball, to the nearest tenth of a metre, 1 s after it was hit?

4.4 Graphing $y = ax^2 + bx + c$ by Completing the Square

Refer to the Key Concepts on page 233.

18. Find the value of c that will make each expression a perfect square trinomial.

a) $x^2 + 8x + c$
b) $x^2 - 14x + c$

19. Write each function in the form $y = a(x - h)^2 + k$. Sketch the graph, showing the coordinates of the vertex, the equation of the axis of symmetry, and the coordinates of two other points on the graph.

a) $y = x^2 + 4x + 1$
b) $y = x^2 - 10x + 15$
c) $y = -x^2 - 6x - 5$
d) $y = 3 - 4x - x^2$

20. Sketch the graph of each function. Show the coordinates of the vertex and the equation of the axis of symmetry. State the range.

a) $y = x^2 + 6x$ **b)** $y = x^2 - 8x + 12$

c) $y + 9 = -x^2 - 4x$ **d)** $y = 15 + 8x + x^2$

21. Find the coordinates of the vertex.

a) $y = 2x^2 - 4x + 6$ **b)** $y = 3x^2 - 12x + 7$ **c)** $y = -2x^2 - 8x - 11$

d) $y = -3x^2 - 12x - 9$ **e)** $y = 4x^2 + 40x + 98$ **f)** $y = -3x^2 + 18x - 22$

22. Use a graphing calculator or graphing software to determine any x-intercepts. Round to the nearest tenth, if necessary.

a) $y = x^2 + 2x - 3$ **b)** $y = 4x^2 - 12x + 3$

23. Integers Find two integers whose difference is 12 and whose product is a minimum.

24. Rectangular fence A rectangular field is to be enclosed by 600 m of fence.

a) What dimensions will give the maximum area?

b) What is the maximum area?

4.5 Sketching Parabolas in the Form $y = ax(x - s) + t$

Refer to steps 1–7 on page 241.

25. Sketch the graph of each of the following quadratic functions by writing it in the form $y = ax(x - s) + t$.

a) $y = x^2 - 6x + 8$ **b)** $y = x^2 + 8x + 12$

c) $y = 2x^2 - 4x - 6$ **d)** $y = -3x^2 + 12x - 7$

4.6 Finite Differences

1 In tables with evenly spaced x-values, first differences are calculated by subtracting consecutive y-values, and second differences are calculated by subtracting consecutive first differences.

2 For a linear function, the first difference is a constant. For a quadratic function, the second difference is a constant.

26. Use finite differences to determine whether each function is linear, quadratic, or neither.

a)

x	y
1	3
2	5
3	7
4	9

b)

x	y
1	−3
2	−2
3	2
4	9

c)

x	y
1	0
2	1
3	8
4	27

d)

x	y
2	4
4	18
6	40
8	70

simplifying yields $y = t - \frac{as^2}{4}$.

Section 4.6 pp. 242–245

1 Reviewing Linear Functions, $y = mx + b$ **1. a)** y: 9, 11, 13; 1st Difference: 2, 2, 2 **b)** y: 2, 6, 10, 14; 1st Difference: 4, 4, 4, 4 **c)** y: 1, −2, −5, −8, −11; 1st Difference: −3, −3, −3, −3 **2.** It is a constant.
2 Investigating Quadratic Functions, $y = ax^2 + bx + c$ **1. a)** y: 13, 21; 1st Difference: 6, 8; 2nd Difference: 2, 2 **b)** y: 5, 6, 11, 20, 33; 1st Difference: 1, 5, 9, 13; 2nd difference: 4, 4, 4 **c)** y: −1, 4, 15, 32, 55; 1st Difference: 5, 11, 17, 23; 2nd Difference: 6, 6, 6 **2. a)** It increases by a constant amount. **b)** It is a constant. **4.** If the 1st difference is a constant, the function is linear. If the 1st difference is not a constant, but the 2nd difference is a constant, the function is quadratic. Otherwise, the function is neither linear nor quadratic.
3 Using Finite Differences **1. a)** linear **b)** linear **c)** quadratic **d)** neither **e)** quadratic **f)** linear **g)** neither **h)** quadratic **i)** linear **j)** quadratic **k)** linear **l)** neither **2. a)** $y = x + 4$ **b)** $y = 2x - 1$ **f)** $y = 2x + 3$ **i)** $y = 3x - 4$ **k)** $y = -4x + 2$ **3. c)** $y = x^2 + 3$ **e)** $y = x^2 + x$ **h)** $y = x^2 - x - 2$ **j)** $y = x^2 + x - 12$ **4. a)** 11, 16, 21, 26 **b)** linear **c)** $a = 5d + 6$ **d)** 81; 111 **e)** 25th diagram **5. a)** 0, 5, 12, 21 **b)** quadratic **c)** $n = s^2 - 4$ **d)** 96; 621 **6. a)** 3, 8, 15, 24 **b)** quadratic **c)** $t = d^2 + 2d$ **d)** 255; 2600 **7. a)** P: 4, 8, 12, 16, 20; a: 1, 3, 6, 10, 15 **b)** linear; quadratic **c)** $P = 4b$; $a = \frac{1}{2}(b^2 + b)$ **d)** 60 units, 120 square units; 120 units, 465 square units **8. a)** 1, 7, 19, 37 **b)** quadratic **c)** $h = 3r^2 - 3r + 1$ **d)** 271

Section 4.7 pp. 246–247

1 Parabolas in the Form $y = ax^2 + k$ **1. c)** $y = x^2 + 2$ **d)** $y = x^2 + 2$ **2. c)** $y = -x^2 - 3$ **d)** $y = -x^2 - 3$ **3. c)** Answers may vary. $y = x^2 - 5$ **d)** $y = x^2 + 0.23x - 5$ **4. c)** Answers may vary. $y = -x^2 + 4$ **d)** $y = -1.02x^2 - 0.11x + 4.43$ **5. c)** Answers may vary. $y = 2x^2$ **d)** $y = 1.94x^2 - 0.01x - 0.21$
2 The Flight of a Cannonball **2.** $y = -5(x - 3)^2 + 45$ **3.** $y = -5x^2 + 30x$ **4.** 43.2 m, 32.2 m
3 Stopping Distance **2.** Answers may vary. $y = 0.008x^2$ **3.** Answers may vary with equation used. **a)** 29 m **b)** 80 m **4.** $y = 0.01x^2 - 0.3x + 13$ **5. a)** 31 m **c)** 83 m

Rich Problem p. 251

1. a) 30 **b)** \$100 **c)** 18; 42 **d)** 26; 34 **2. a)** 60 **b)** \$125 **c)** 36; 84 **d)** 49; 71

Review of Key Concepts pp. 252–257

1. a) function **b)** not a function **c)** not a function **d)** function **2. a)** 11 **b)** 19 **c)** 3 **d)** 1 **e)** −5 **f)** 4 **g)** 2.8 **h)** 203 **i)** 10 003 **3. a)** 7 **b)** 27 **c)** 7 **d)** −9 **e)** 27 **f)** −8 **g)** −8 **h)** 391 **i)** 1591 **4. a)** function **b)** not a function **5. a)** domain: {0, 1, 2, 3}, range: {4, 5, 6, 7} **b)** domain: {−3, −1, 1, 2}, range: {−1, 1, 3} **6. a)** domain: set of real numbers, range: set of real numbers **b)** domain: set of real numbers, range: $y \le 4$ **c)** domain: set of real numbers, range: {2} **7. a)** set of real numbers **b)** $y \ge -1$ **8. a)** The graph of $y = x^2 - 3$ is a translation of the graph of $y = x^2$ 3 units downward **b)** The graph of $y = -4x^2$ is a vertical stretch of the graph of $y = -x^2$ by a factor of 4. **9. a)** up; (0, 4); $x = 0$; domain: set of real numbers, range: $y \ge 4$; minimum: 4; **b)** down; (0, −2); $x = 0$; domain: set of real numbers, range: $y \le -2$; maximum:–2; **c)** up; (0, 0); $x = 0$; domain: set of real numbers, range: $y \ge 0$; minimum: 0 **d)** down; (0, 3); $x = 0$; domain: set of real numbers, range: $y \le 3$; maximum: 3 **10. a)** down; (0, 0); domain: set of real numbers, range: $y \le 0$; maximum: 0 **b)** down; (0, 3.5); domain: set of real numbers, range: $y \le 3.5$; maximum: 3.5 **c)** down; (0, −7); domain: set of real numbers, range: $y \le -7$; maximum: −7 **d)** up; (0, 3); domain: set of real numbers, range: $y \ge 3$; minimum: 3 **11. a)** ±2.6 **b)** ±1.4 **c)** none **d)** ±2.1 **12. a)** 2.13 m **b)** 12 m **c)** 1.2 m **13. a)** down; vertically stretched by a factor of 2; (3, 1); $x = 3$; domain: set of real numbers, range: $y \le 1$; maximum: 1 **b)** up; not stretched or shrunk; (−7, −2); $x = -7$; domain: set of real numbers, range: $y \ge -2$; minimum: −2 **c)** up; vertically shrunk by a factor of 0.5; (−1, 5); $x = -1$; domain: set of real numbers, range: $y \ge 5$; minimum: 5 **d)** down; not stretched or shrunk; (−3, −1); $x = -3$; domain: set of real numbers, range: $y \le -1$; maximum: −1 **14. a)** up; not stretched or shrunk; (−1, −1); $x = -1$; domain: set of real numbers, range: $y \ge -1$; minimum: −1 **b)** down; vertically stretched by a factor of 4; (1, 0); $x = 1$; domain: set of real numbers, range: $y \le 0$; maximum: 0 **c)** down; vertically stretched by a factor of 2; (4, −3); $x = 4$; domain: set of real numbers, range: $y \le -3$; maximum: −3 **d)** up; vertically shrunk by a factor of 0.25; (−2, 1); $x = -2$; domain: set of real numbers, range: $y \ge 1$; minimum: 1 **15. a)** (3, 0); minimum: 0; x-intercept: 3; y-intercept: 9; Points may vary. (1, 4), (2, 1) **b)** (−2, −4); minimum: −4; x-intercepts: −4, 0; y-intercept: 0; Points may vary. (1, 5), (2, 12) **c)** (3, −8); minimum: −8; x-intercepts: 1, 5; y-intercept: 10; Points may vary. (2, −6), (−1, 24) **d)** (−2, 9); maximum: 9; x-intercepts: −5, 1; y-intercept: 5; Points may vary. (2, −7), (−1, 8) **16. a)** −4.2, 0.2 **b)** −0.2, 2.2

17. a) 13 m **b)** 0.9 m **c)** 4.9 s **d)** 8.9 m **18. a)** 16 **b)** 49 **19. a)** $y = (x + 2)^2 - 3$; (−2, −3); $x = -2$; Points may vary. (0, 1), (1, 6) **b)** $y = (x - 5)^2 - 10$; (5, −10); $x = 5$; Points may vary. (0, 15), (1, 6) **c)** $y = -(x + 3)^2 + 4$; (−3, 4); $x = -3$; Points may vary. (0, −5), (1, −12) **d)** $y = -(x + 2)^2 + 7$; (−2, 7); $x = -2$; Points may vary. (0, 3), (1, −2) **20. a)** (−3, −9); $x = -3$; $y \geq -9$ **b)** (4, −4); $x = 4$; x-intercepts: 2, 6; y-intercept: 12; $y \geq -4$ **c)** (−2, −5); $x = -2$; $y \leq -5$ **d)** (−4, −1); $x = -4$; $y \geq -1$ **21. a)** (1, 4) **b)** (2, −5) **c)** (−2, −3) **d)** (−2, 3) **e)** (−5, −2) **f)** (3, 5) **22. a)** −3, 1 **b)** 2.7, 0.3 **23.** 6, −6 **24. a)** 150 m by 150 m **b)** 22 500 m² **25. a)** $y = x(x - 6) + 8$; points: (0, 8), (6, 8) **b)** $y = x(x + 8) + 12$; points: (0, 12), (−8, 12) **c)** $y = 2x(x - 2) - 6$; points: (0, −6), (2, −6) **d)** $y = -3x(x - 4) - 7$; points: (0, −7), (4, −7) **26. a)** linear **b)** quadratic **c)** neither **d)** quadratic **27. a)** $n = 4d + 1$ **b)** 81 **c)** 50th diagram **28. a)** $A = \frac{1}{2}(d^2 + 3d + 2)$ **b)** 136 **29. a)** $y = x^2 - 3$; $y = x^2 - 3$ **b)** $y = -x^2 + 1$; $y = -1.05x^2 + 0.15x + 0.83$ **c)** $y = -2x^2$; $y = -2x^2 - 0.2x$

Chapter Test pp. 258–259

1. a) not a function **b)** function **c)** function **2. a)** up; (0, −1); $x = 0$; domain: set of real numbers, range: $y \geq -1$; minimum: −1 **b)** down; (0, 5); $x = 0$; domain: set of real numbers, range: $y \leq 5$; maximum: 5 **3. a)** none **b)** ±3.2 **c)** ±1.6 **4. a)** up; not stretched or shrunk; (−3, −1); $x = -3$; domain: set of real numbers, range: $y \geq -1$; minimum: −1 **b)** down; vertically stretched by a factor of 2; (5, −2); $x = 5$; domain: set of real numbers, range: $y \leq -2$; maximum: −2 **c)** down; vertically shrunk by a factor of 0.5; (−2, 3); $x = -2$; domain: set of real numbers, range: $y \leq 3$; maximum: 3 **5. a)** −4.1, 0.1 **b)** 0.3, 3.7 **6. a)** $y = (x + 4)^2 - 8$; (−4, −8); $x = -4$; Points may vary. (0, 8), (−1, 1) **b)** $y = -(x + 5)^2 + 21$; (−5, 21); $x = -5$; Points may vary. (0, −4), (−1, 5) **7. a)** (5, −25); $x = 5$; x-intercepts: 0, 10; y-intercept: 0; $y \geq -25$ **b)** (−3, −1); $x = -3$; x-intercepts: none; y-intercept: −10; $y \leq -1$ **8. a)** (−3, −5) **b)** (4, −2) **9. a)** $y = x(x - 8) + 5$; points: (0, 5), (8, 5) **b)** $y = -2x(x - 2) - 3$; points: (0, −3), (2, −3) **10. a)** quadratic **b)** linear **c)** neither **11. a)** 86 m **b)** 2 m **c)** 8 s **12.** $12 **13. a)** $A = w^2 + 2w$ **b)** 675 **14. a)** $y = x^2 - 2$; $y = x^2 - 2$ **b)** $y = -x^2 + 3$; $y = -x^2 + 0.3x + 3$

Problem Solving: Use a Diagram p. 261

Applications and Problem Solving **1.** Schedules may vary. 13:00–13:30: C and F; 13:40–14:10: A and D; 14:20–14:50: B, 15:00–15:30: E **2. a)** Alliston to Bevan to Gaston is 56 km. **b)** Clearwater to Flagstaff to Dunstan is 55 km. **c)** Gaston to Flagstaff to Clearwater to Bevan is 79 km. **d)** Flagstaff to Clearwater to Bevan to Alliston is 70 km. **3.** 276 m² **4.** 60 **5.** 300 **6.** 12 L (assuming paint may be purchased only in whole litres) **7.** 4 blocks east and 7 blocks south

Problem Solving: Work Backward p. 263

Applications and Problem Solving **1.** Scott: 6, Ivan: 11, Enzo: 4 **2.** $3500 **3.** (−2, 4) **4.** 6 cm by 4 cm **5.** 256

Problem Solving: Using the Strategies p. 264

1. 38 cm **2.** 15 **3.** (1, 15), (2, 14), (3, 13), (4, 12), (5, 11), (6, 10), (7, 18), (8, 17), (9, 16) **4.** 08:45 Saturday **5. a)** 10 **b)** 8 **6.** $143 **7.** $3 \times 54 = 162$ **8.** Tia: carpenter, turtle; Jane: lawyer, dog; Fran: police officer, parrot; Marta: teacher, cat

Cumulative Review, Chapters 3 and 4 p. 265

Chapter 3 **1. a)** $4x^2 - x + 2$ **b)** $-3y^2 - 2y + 9$ **2. a)** $4m - 9n$ **b)** $10p^2 - 7p$ **c)** $-4w^3 + 2w^2 - 9w$ **d)** $6x^2 + x - 1$ **e)** $13z^2 - 3z - 11$ **f)** $2y^3 + y^2 - 19y - 12$ **3. a)** $16x^2 - 1$ **b)** $4m^2 + 4mn + n^2$ **c)** $-8y + 20$ **d)** $12t^2 + 8t + 2$ **4. a)** $7x(2x - 1)$ **b)** $5yz(z - 7 + 2y)$ **c)** $(y - 3)(x - 4)$ **d)** $(2n + 3p)(m - 2)$ **5. a)** $(x - 2)(x - 10)$ **b)** $(y + 6)(y - 3)$ **c)** $(x + 9)(x - 9)$ **d)** $(2y + 1)(3y + 4)$ **e)** $(5a - b)(5a + b)$ **f)** $(n - 3)^2$ **g)** $(7b - 2)^2$ **6. a)** $2(s + 8)(s - 1)$ **b)** $3(x + 2)(3x + 2)$ **c)** $a(x + 3)^2$ **d)** $10(2c - d)(2c + d)$ **7. a)** $(4x - 5)(2x + 5)$ **b)** 63 mm by 39 mm

Chapter 4 **1. a)** down; vertically stretched by a factor of 2; (0, 0); $x = 0$; domain: set of real numbers, range: $y \leq 0$; maximum: 0 **b)** up; not stretched or shrunk; (0, −3); $x = 0$; domain: set of real numbers, range: $y \geq -3$; minimum: −3 **c)** up; not stretched or shrunk; (−3, 0); $x = -3$; domain: set of real numbers, range: $y \geq 0$; minimum: 0 **d)** down; not stretched or shrunk; (2, 1); $x = 2$; domain: set of real numbers, range: $y \leq 1$; maximum: 1 **e)** up; vertically shrunk by a factor of 0.5; (4, 3); $x = 4$; domain: set of real numbers, range: $y \geq 3$; minimum: 3 **f)** down; vertically stretched by a factor of 3; (−5, −2); $x = -5$; domain: set of real numbers, range: $y \leq -2$; maximum: −2 **2. a)** ±2.2 **b)** −4.7, −1.3 **3. a)** $y = (x + 2)^2 - 6$; (−2, −6); $x = -2$; Points may vary. (0, −2), (1, 3) **b)** $y = 3(x - 1)^2 + 4$; (1, 4); $x = 1$; Points may vary. (0, 7), (2, 7) **4. a)** (2, −4); x-intercepts: 0, 4; y-intercept: 0 **b)** (1, 9); x-intercepts: −2, 4; y-intercept: 8 **5.** $y = x(x - 6) + 3$; points: (0, 3), (6, 3) **6. a)** quadratic **b)** neither **c)** linear **7.** $22