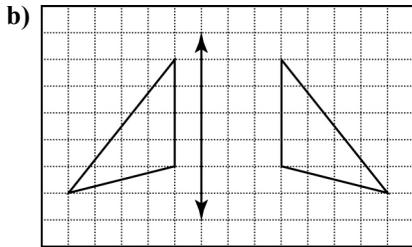
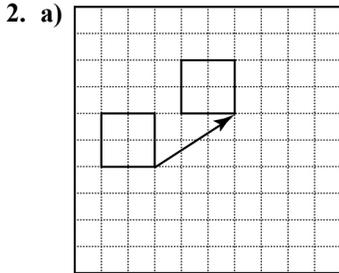


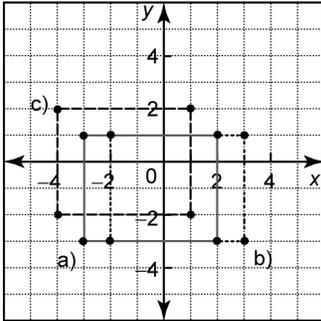
BLM Answers

Get Ready

1. a) independent: time in years, dependent: height in centimetres
 b) linear relationship c) 536 cm



3. a), b), c)

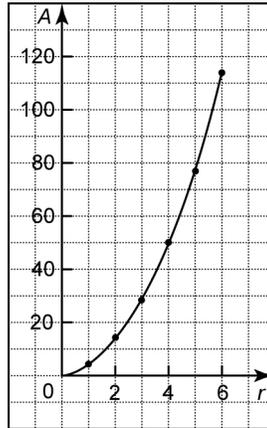


4. a) 2^5 b) 3^{10} c) $\left(\frac{1}{5}\right)^5$
 d) $(-4)^2$ e) 3^8 f) 5^0
 g) $\left(\frac{2}{3}\right)^1$ h) $(-2)^1$
5. a) 3^5 b) $(-7)^1$ c) 2^8 d) $\left(\frac{3}{4}\right)^2$
 e) 0.1^0 f) $(-0.4)^3$

Section 4.1 Practice Master

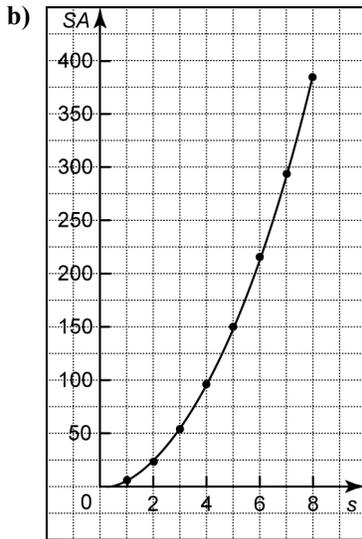
1. The data in part b) could be modelled using a curve of best fit, because the data follow a curve, not a straight line.
 2. a) Yes, all data points are evenly spread around the line.
 b) No, this should be a curve of best fit, as the data are not linear.
 3. Part a) is linear; part b) is non-linear.
 4. a), c)

Radius, r (cm)	Area, $A = \pi r^2$ (cm ²)
1	3.14
2	12.56
3	28.26
4	50.24
5	78.5
6	113.04



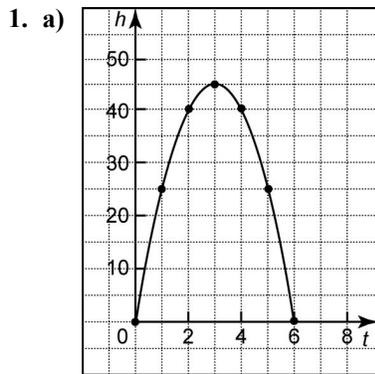
- b) quadratic d) 20 cm² e) 200 cm²
5. a), d)

Side Length, s (cm)	Surface Area, $SA = 6s^2$ (cm ²)
1	6
2	24
3	54
4	96
5	150
6	216
7	294
8	384

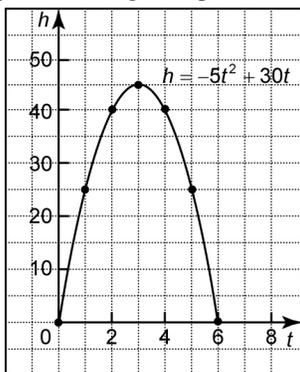


- c) quadratic e) 340 cm^2
 f) Since the data are based on area, there is a squared term in the expression.

Section 4.2 Practice Master



- b) The flight path of the cannonball is a parabola opening downward, starting at an initial height of 0 m, rising to 45 m, and then falling to the ground.
 c) $x = 3, (3, 45)$
 d) 45 m
 e) Graph the equation $h = -5t^2 + 30t$ to verify that it passes through the points in the table.



2. a) linear

x	y	First Differences	Second Differences
0	3	3	0
1	6	3	0
2	9	3	0
3	12	3	0
4	15	3	0

- b) neither

x	y	First Differences	Second Differences
-4	5	5	5
-2	10	10	0
0	20	10	0
2	30	10	0
4	40	10	0

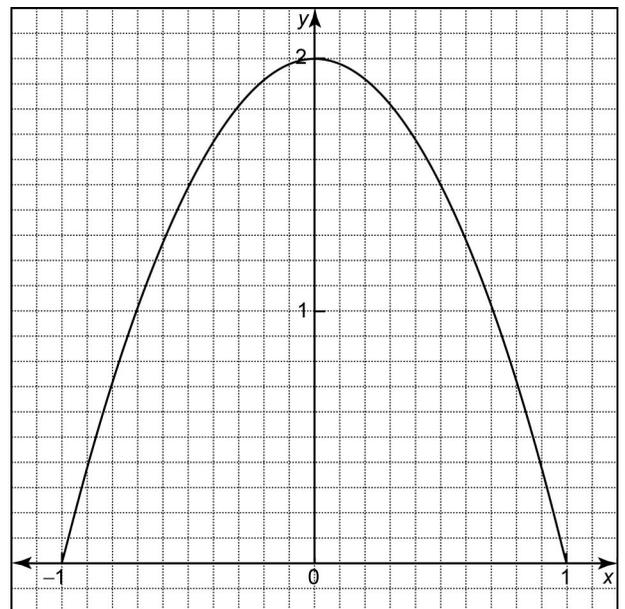
- c) quadratic

x	y	First Differences	Second Differences
1	1	8	8
3	9	16	8
5	25	24	8
7	49	32	8
9	81	32	8

- d) neither

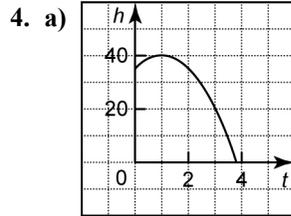
x	y	First Differences	Second Differences
-5	-125	98	-72
-3	-27	26	-24
-1	-1	2	24
1	1	26	72
3	27	98	
5	125		

3. a) This is a parabola with x-intercepts -1 and 1 and vertex (0, 2).

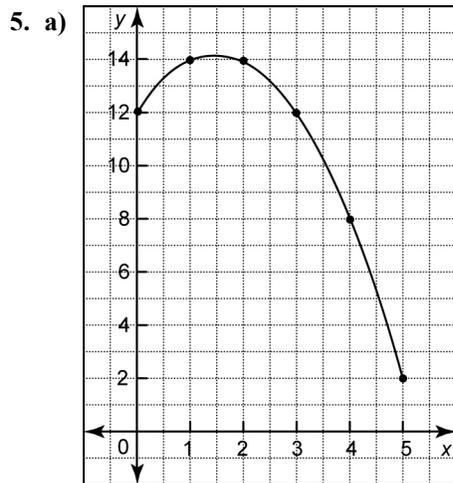


- b) The shape of the rope is a parabola opening downward.

Section 4.3 Practice Master



- b) The flight path of the ball is a parabola opening downward, starting at an initial height of 35 m, rising to about 40 m, and then falling to the ground.
 c) 40 m d) 1 s

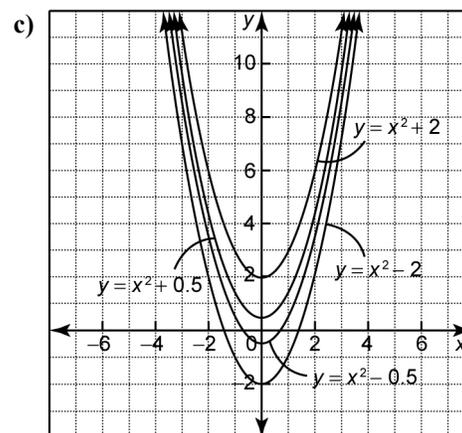
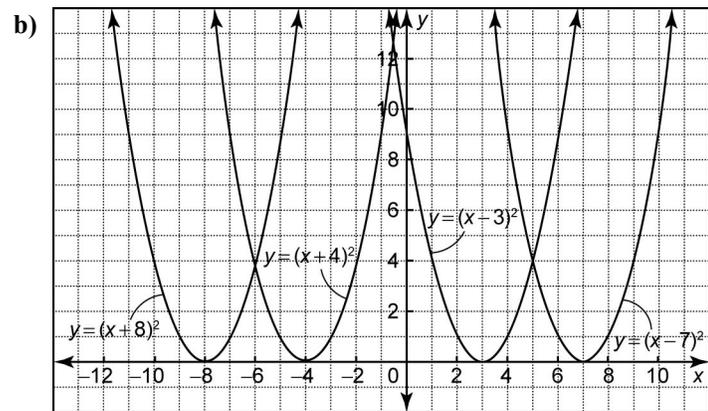
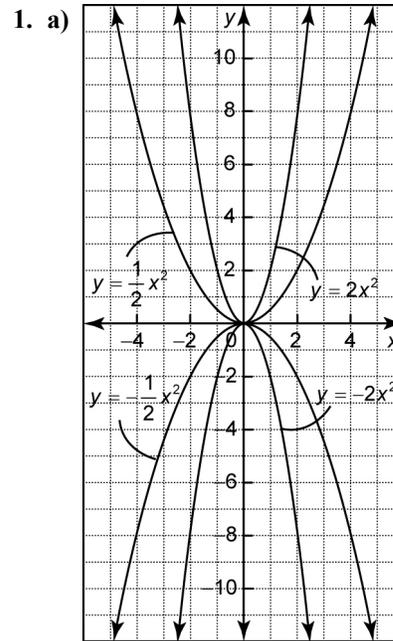


- b) The flight path of the ball is a parabola opening downward, starting at an initial height of 12 m, rising to just over 14 m, and then falling to the ground.
 c) $x = 1.5$; points on the left side of the line $x = 1.5$ are reflections of points on the right side of the line
 d) (1.5, 14.25) e) 14.25 m
 f) Test the points in the table in the equation $h = -x^2 + 3x + 12$. For example, test the point (2, 14):

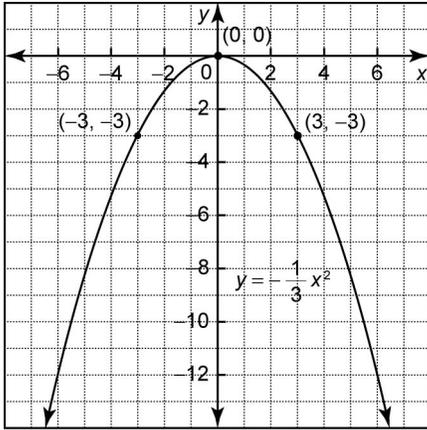
L.S. = h	R.S. = $-x^2 + 3x + 12$
= 14	= $-(2)^2 + 3(2) + 12$
	= $-4 + 6 + 12$
	= 14

L.S. = R.S.

The point (2, 14) is on the parabola $h = -x^2 + 3x + 12$.

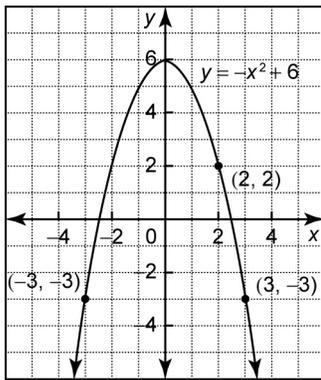


2. a) $y = -\frac{1}{3}x^2$ i), ii) Labelled points may vary.



iii) reflection in the x -axis; compression by a factor of $\frac{1}{3}$

b) i), ii) Labelled points may vary.

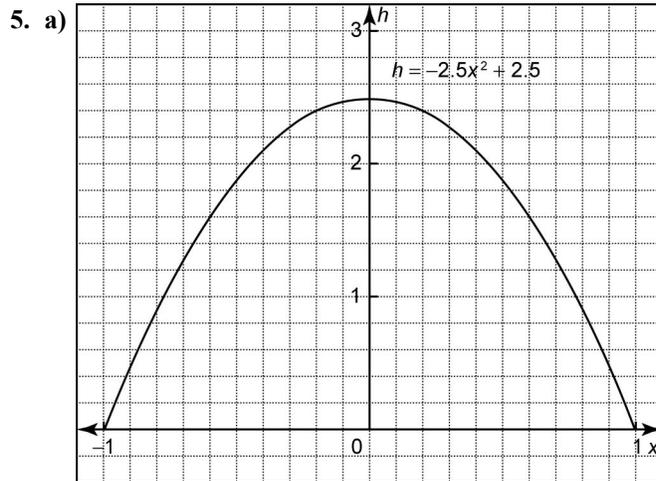


iii) reflection in the x -axis; translation of 6 units upward

3. a) $y = x^2 + 5$ b) $y = x^2 - 9$

c) $y = (x - 6)^2$ d) $y = (x + 10)^2$

4. a) $y = -x^2$ b) $y = x^2$ c) $y = \frac{1}{2}x^2$ d) $y = 6x^2$



b) 2.5 cm c) $h = -3.0x^2 + 3.0$

6. a) 86 m b) 2 m c) 8 s

7. $a = 3, k = 2$

Section 4.4 Practice Master

1. a)

Property	$y = (x - 3)^2 + 2$
vertex	(3, 2)
axis of symmetry	$x = 3$
stretch or compression	none
direction of opening	upward
values that x may take	all real numbers
values that y may take	$y \geq 2$

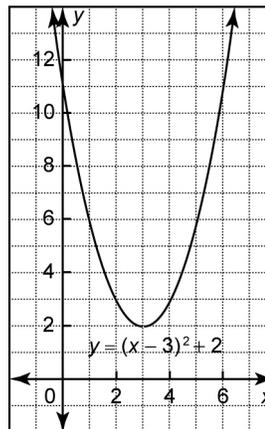
b)

Property	$y = \frac{1}{3}(x + 1)^2 - 4$
vertex	(-1, -4)
axis of symmetry	$x = -1$
stretch or compression	vertical compression of factor $\frac{1}{3}$
direction of opening	upward
values that x may take	all real numbers
values that y may take	$y \geq -4$

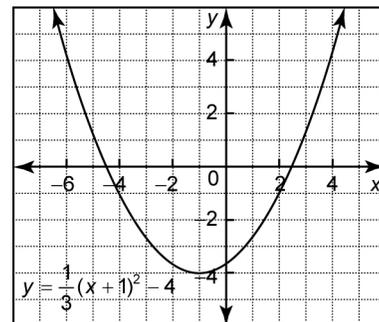
c)

Property	$y = -2(x + 4)^2 + 3$
vertex	(-4, 3)
axis of symmetry	$x = -4$
stretch or compression	vertical stretch of factor 2
direction of opening	downward
values that x may take	all real numbers
values that y may take	$y \leq 3$

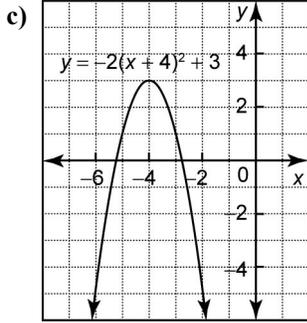
2. a)



b)



Section 4.5 Practice Master



3. a) $y = -3(x - 3)^2 + 4$

b) $y = \frac{1}{2}(x + 1)^2 + 2$

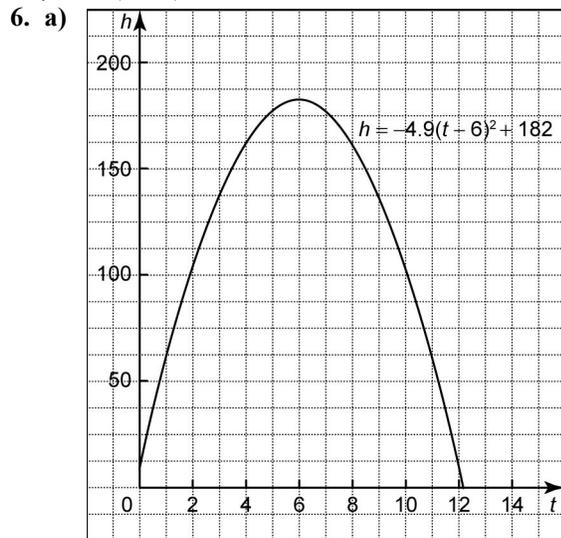
c) $y = -(x + 2)^2 - 4$

4. a) $y = (x + 3)^2 - 1$

b) $y = 2(x - 4)^2 + 2$

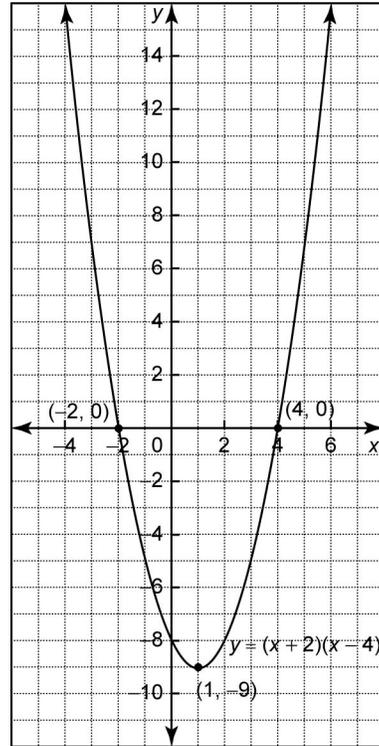
c) $y = -\frac{1}{3}(x + 2)^2 + 4$

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

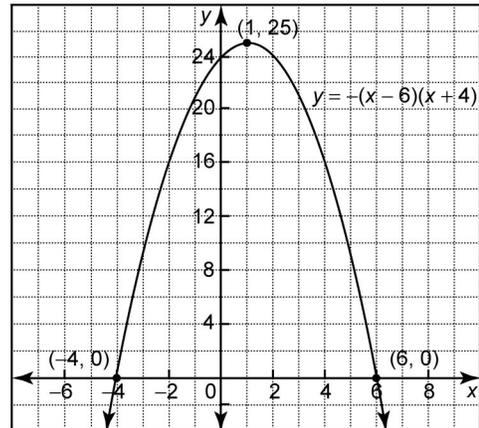


b) 182 m c) 6 s d) 5.6 m

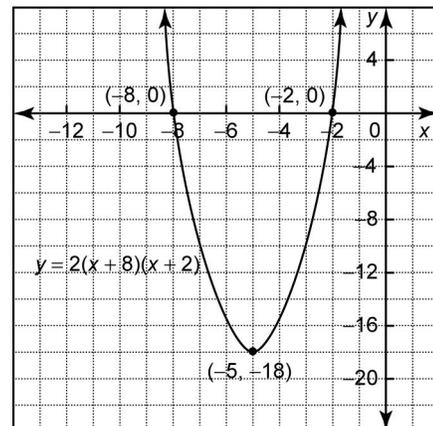
1. a)

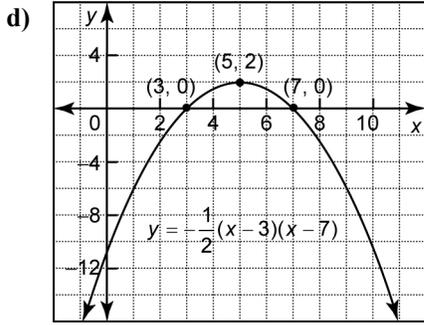


b)

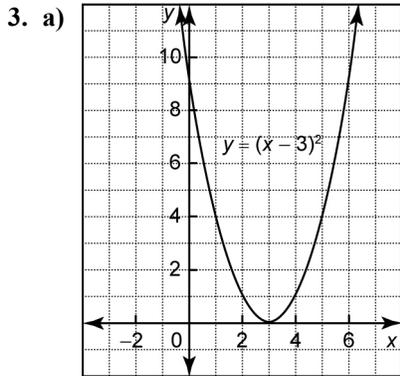


c)

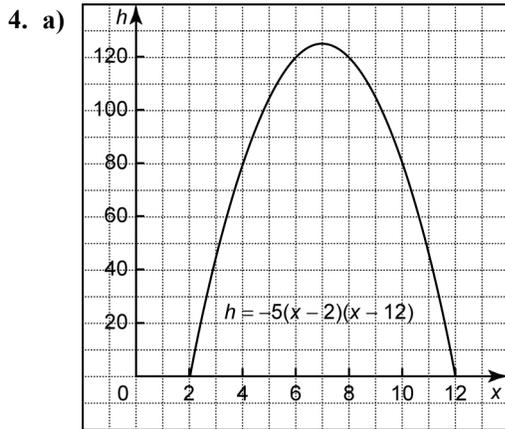




2. a) $y = 2(x+8)(x-2)$
 b) $y = -\frac{1}{2}(x-4)(x-10)$



- b) (3, 0) c) one d) $y = (x-3)(x-3)$



- b) 125 m c) 7 m d) 105 m e) 9 m
 5. a) 45 m b) Yes.

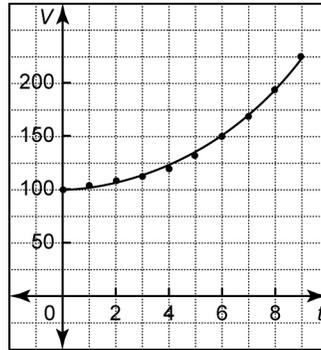
Section 4.6 Practice Master

1. a) $(\frac{1}{2})^3$ b) $(\frac{1}{4})^1$ c) $(\frac{1}{3})^2$
 d) $(-\frac{1}{4})^2$ e) $(-\frac{1}{3})^2$ f) $(-\frac{1}{14})^3$
2. a) $\frac{1}{16}$ b) 1 c) $\frac{1}{10\,000}$ d) $\frac{1}{9}$
 e) $-\frac{1}{64}$ f) -1 g) 27 h) $\frac{49}{9}$
3. a) $81\frac{1}{3}$ b) $\frac{3}{4}$ c) 1 d) $10\frac{1}{81}$

4. a) $x = 2$ b) $x = 4$
 c) $x = -3$ d) $x = -2$
5. a) 75 mg b) 37.5 mg c) 9.375 mg
6. a) 8000; 256 000 b) 500
 c) the starting value when measurements were first taken
7. a) 1600 years b) 100
 c) the amount of radium present at $t = 0$, or now
 d) the amount of radium present in the past, assuming the model applied
8. a) 800 g b) 400 g c) 200 g

Chapter 4 Review

1. a) curve of best fit b) line of best fit
 2. a)



- b) The data follow a parabola opening upward.
 c) \$253
 3. a) neither

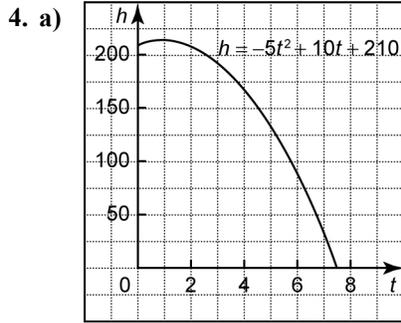
x	y	First Differences	Second Differences
1	3	7	
2	10	19	12
3	29	37	18
4	66	61	24
5	127		

- b) quadratic

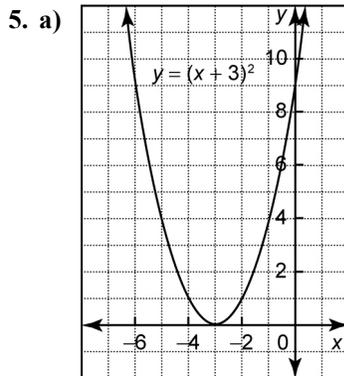
x	y	First Differences	Second Differences
-2	12	-9	
-1	3	-3	6
0	0	3	6
1	3	9	6
2	12		

- c) linear

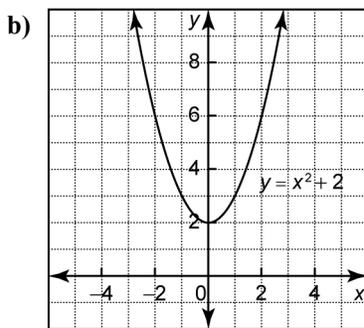
x	y	First Differences	Second Differences
1	5	8	
3	13	8	0
5	21	8	0
7	29	8	0
9	37		



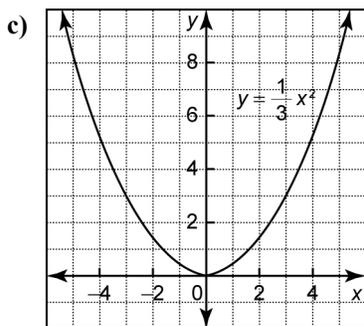
b) 215 m c) after 1 s



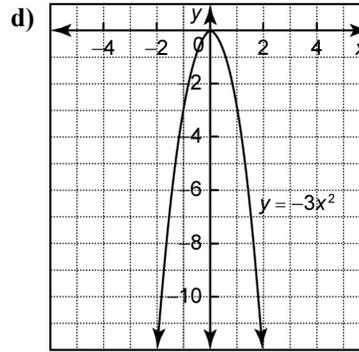
translation of 3 units to the left



translation of 2 units upward



vertical compression by a factor of $\frac{1}{3}$



reflection in the x -axis and vertical stretch by a factor of 3

6. a)

Property	$y = (x + 2)^2 + 3$
vertex	$(-2, 3)$
axis of symmetry	$x = -2$
stretch or compression	none
direction of opening	upward
values that x may take	all real numbers
values that y may take	$y \geq 3$

b)

Property	$y = 4(x - 5)^2 - 1$
vertex	$(5, -1)$
axis of symmetry	$x = 5$
stretch or compression	vertical stretch of factor 4
direction of opening	upward
values that x may take	all real numbers
values that y may take	$y \geq -1$

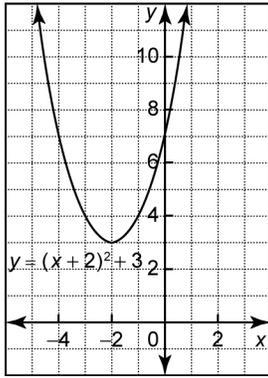
c)

Property	$y = -\frac{1}{3}(x + 2)^2 - 3$
vertex	$(-2, -3)$
axis of symmetry	$x = -2$
stretch or compression	vertical compression of factor $\frac{1}{3}$
direction of opening	downward
values that x may take	all real numbers
values that y may take	$y \leq -3$

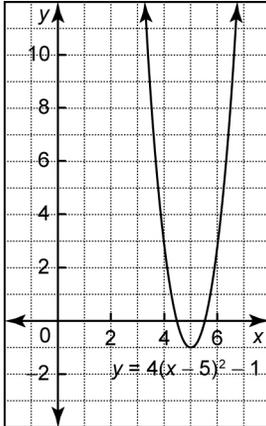
d)

Property	$y = -(x - 3)^2 - 4$
vertex	$(3, -4)$
axis of symmetry	$x = 3$
stretch or compression	None
direction of opening	Downward
values that x may take	all real numbers
values that y may take	$y \leq -4$

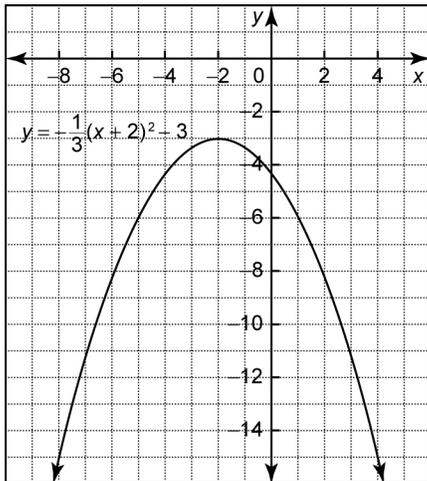
7. a)



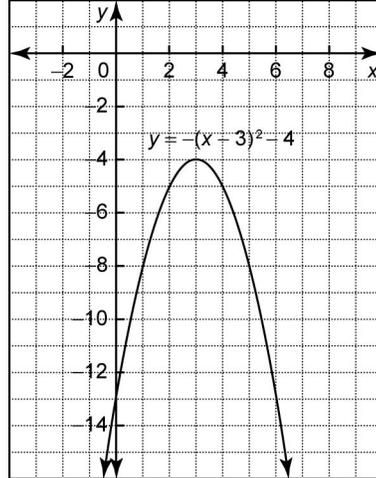
b)



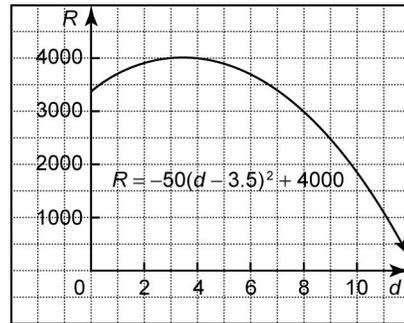
c)



d)

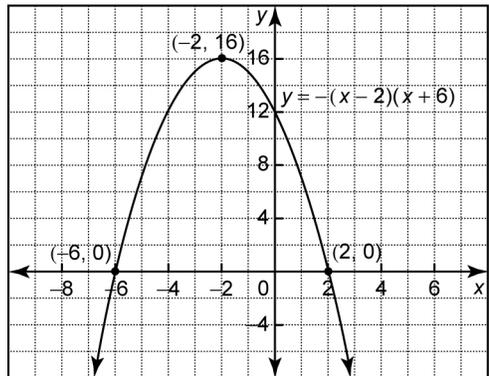


8. a)

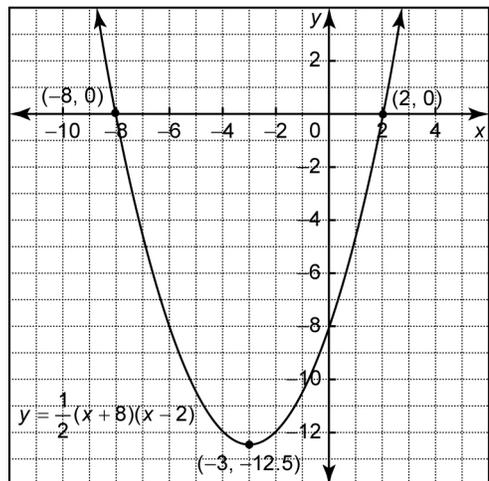


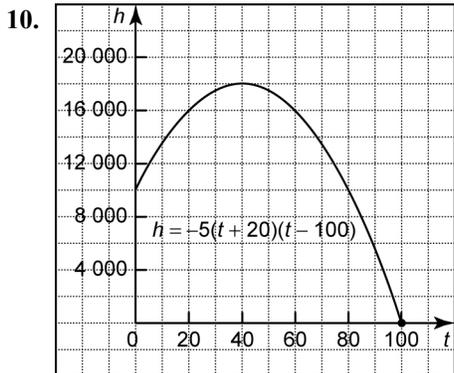
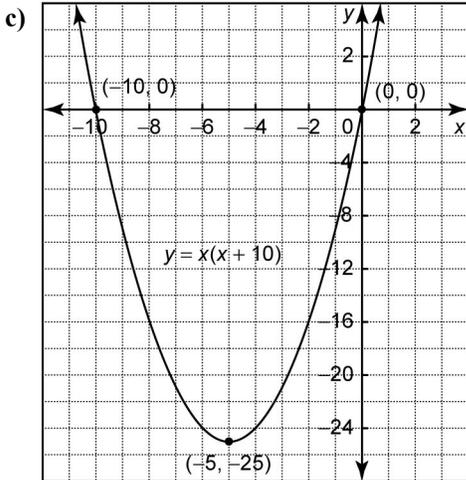
b) \$4000 c) \$3.50

9. a)



b)





b) 40 s c) 18 000 m

11. a) $\frac{1}{216}$ b) $\frac{1}{64}$ c) -1
 d) 16 e) $\frac{1}{9}$ f) $-\frac{125}{27}$
 g) -1 h) -27

12. a) $35\frac{5}{6}$ b) 1 c) $\frac{5}{16}$

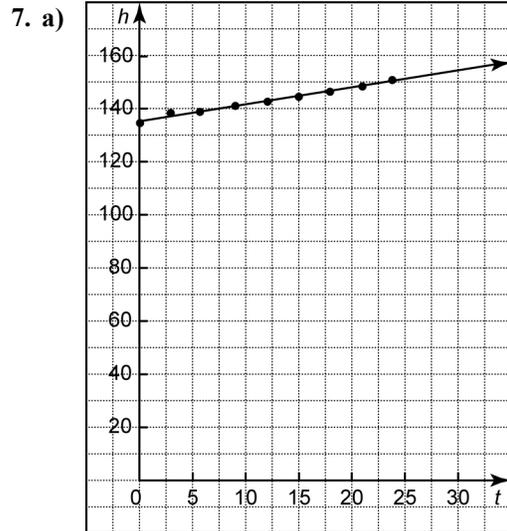
13. a) $x = -3$ b) $x = -2$ c) $x = \frac{4}{3}$

14. a) $\frac{1}{4}$ b) $\frac{1}{64}$ c) $2^{-2}; 2^{-6}$

Chapter 4 Practice Test

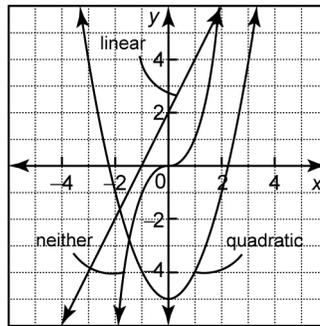
- 1. C
- 2. D
- 3. C
- 4. B
- 5. B

6. a) 19 b) $1\frac{1}{3}$ c) $\frac{13}{36}$ d) 1



- b) The data follow a linear pattern.
- c) about 158 cm
- d) Assume that Michael continues to grow at the same rate, following a linear pattern.

8. a) $x = 3$ b) compression factor of $\frac{1}{2}$
 c) down d) all real numbers e) $y \leq -1$
9. Answers may vary. For example:



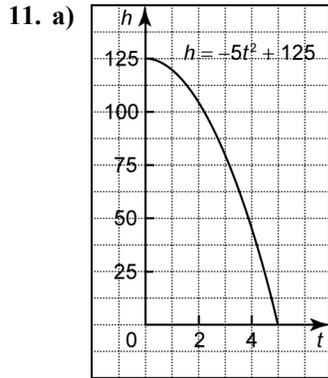
10. a) linear

x	y	First Differences	Second Differences
1	-8	3	
2	-5	3	0
3	-2	3	0
4	1	3	0
5	4		

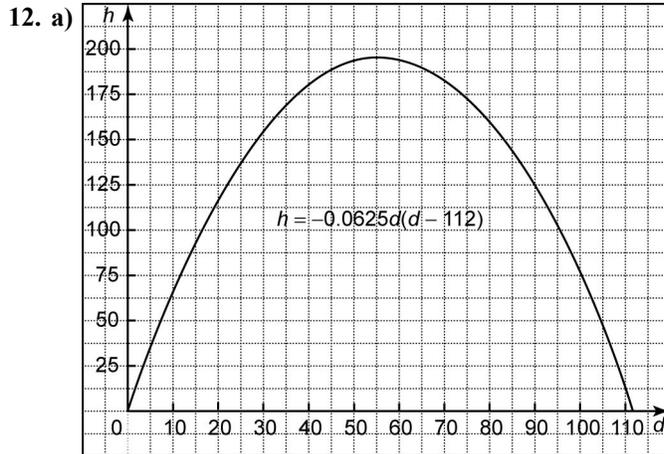
b) quadratic

x	y	First Differences	Second Differences
-2	51	-18	
-1	33	-14	4
0	19	-10	4
1	9	-6	4
2	3		

Chapter 4 Test

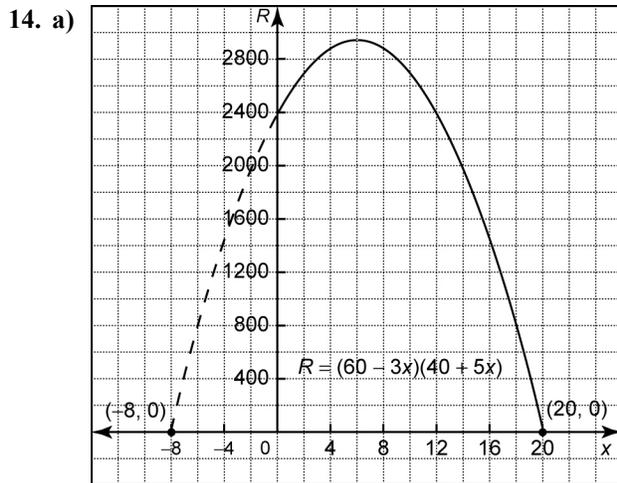


b) 125 m c) 5 s

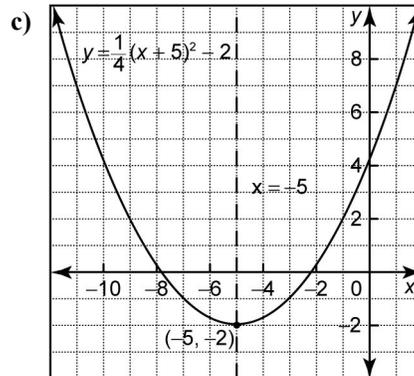
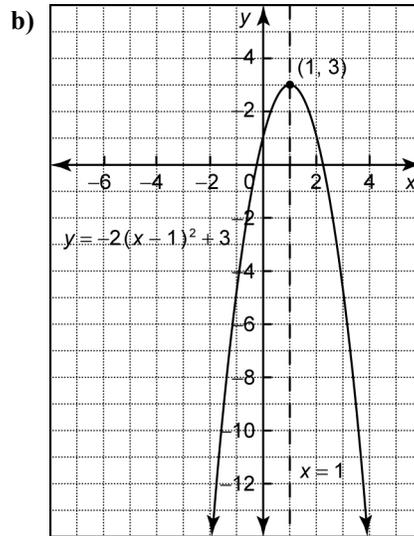
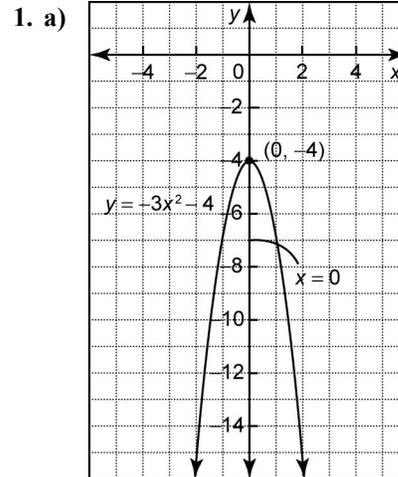


b) 112 m c) 56 m d) 196 m

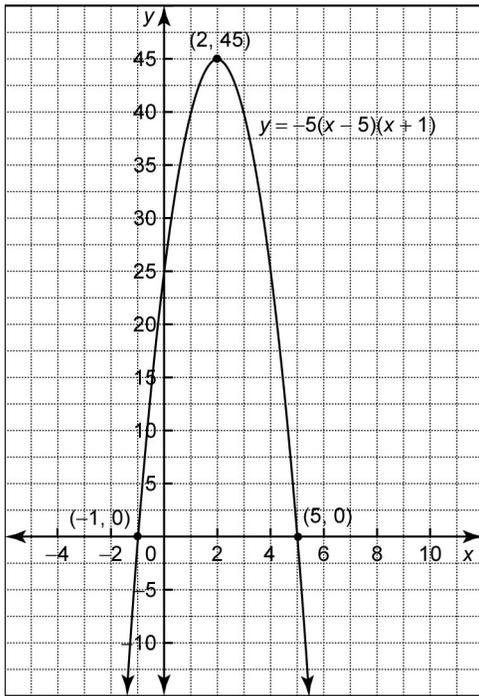
13. a) $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{64}$
 b) \$3 200 000, \$1 600 000, \$800 000, \$400 000, \$200 000, \$100 000
 c) Yes. \$100 000



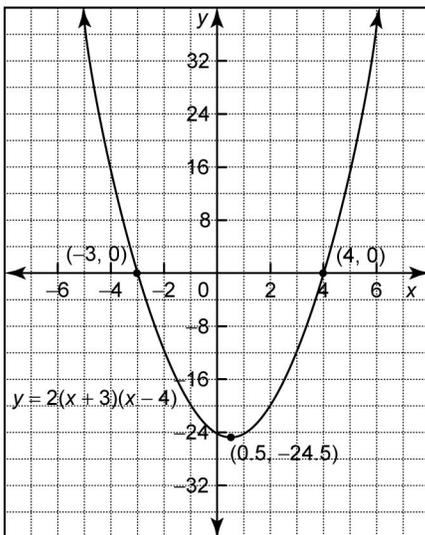
b) \$2940 c) 6 d) \$70 e) 42



2. a)



b)



3. a) $3\frac{1}{4}$ b) 1 c) 1 d) 9

4. a) $y = 2(x - 1)^2 - 4$ b) $y = -\frac{1}{3}(x + 3)^2 + 2$

5. a) quadratic

x	y	First Differences	Second Differences
-5	17	-10	4
-4	7	-6	4
-3	1	-2	4
-2	-1	2	
-1	1		

b) neither

x	y	First Differences	Second Differences
-1	-1	1	0
0	0	1	6
1	1	7	12
2	8	19	
3	27		

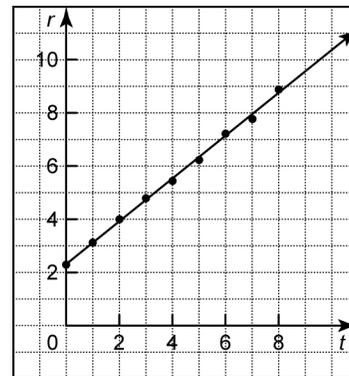
c) linear

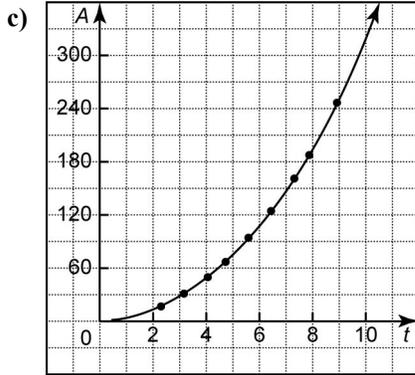
x	y	First Differences	Second Differences
2	26	7	0
4	33	7	0
6	40	7	0
8	47	7	0
10	54	7	

6. a)

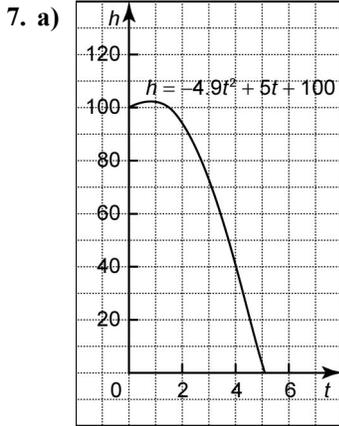
Time, t (h)	Radius, r (m)	Area, A (m ²)
0	2.3	16.6
1	3.1	30.2
2	4.0	50.2
3	4.7	69.4
4	5.5	95.0
5	6.3	124.7
6	7.3	167.4
7	7.8	191.1
8	8.9	248.8

b)



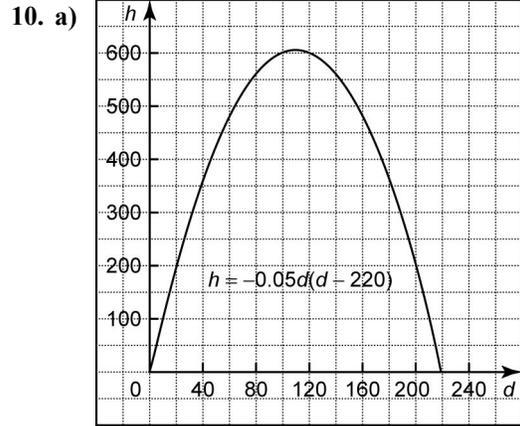


- d) 10.4 m; 339.8 m²
 e) 339.7 m²; The areas are very close. The difference may be due to rounding.



- b) The stone follows the path of a parabola opening downward.
 c) about 101.3 m d) about 0.5 s

8. $a = -2, k = 3$
 9. a) 125 mg b) 31.25 mg c) 7.8125 mg



- b) 220 m
 c) 110 m
 d) 605 m