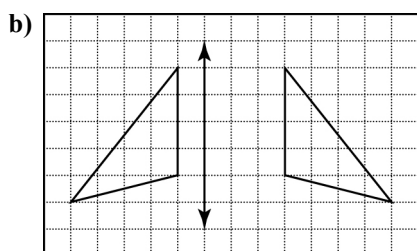
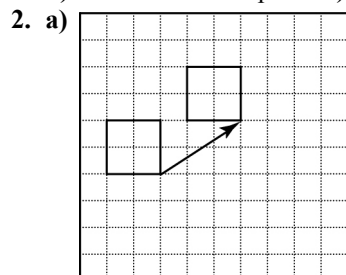


# BLM Answers

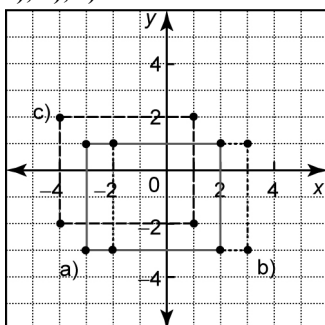
## Get Ready

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.

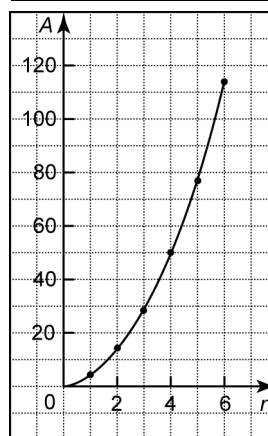
2. a) Yes, all data points are evenly spread around the line.

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)

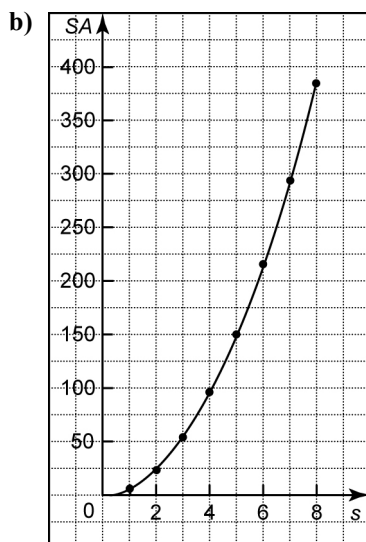
Radius, $r$ (cm)	Area, $A = \pi r^2$ (cm <sup>2</sup> )
1	3.14
2	12.56
3	28.26
4	50.24
5	78.5
6	113.04



b) quadratic d) 20 cm<sup>2</sup> e) 200 cm<sup>2</sup>

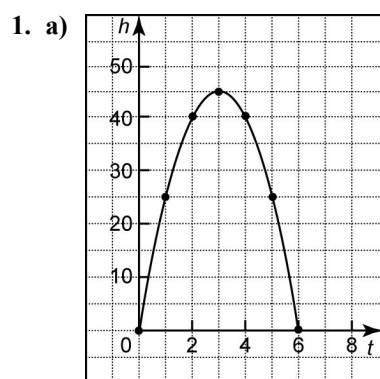
5. a), d)

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

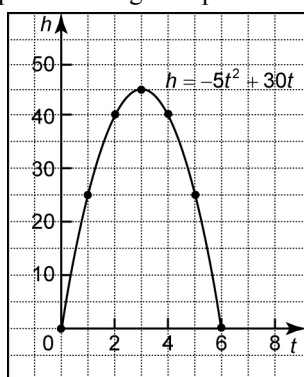


- c) quadratic    e)  $340 \text{ cm}^2$   
f) Since the data are based on area, there is a squared term in the expression.

## 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

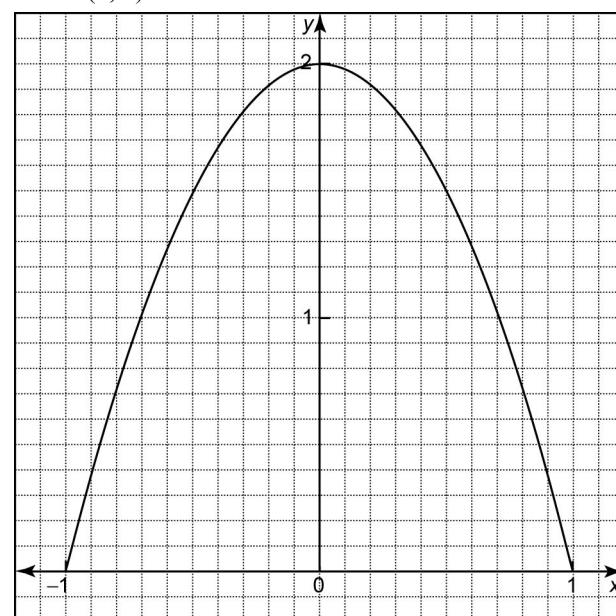
- c) quadratic

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

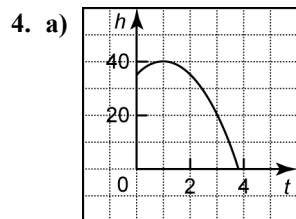
- d) neither

$x$	$y$	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  $(0, 2)$ .

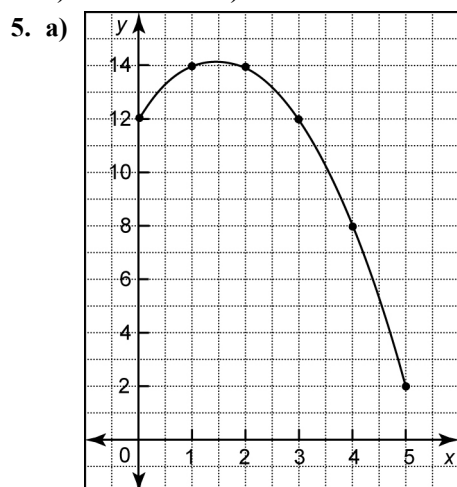


- b) The shape of the rope is a parabola opening downward.



- 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

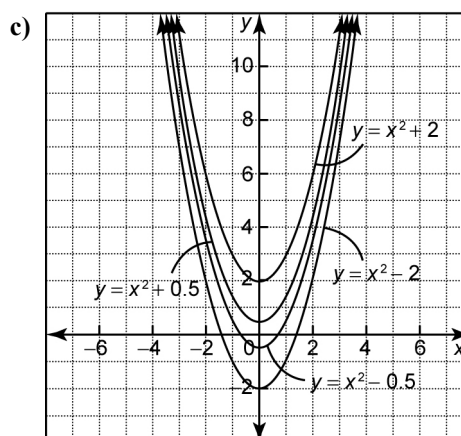
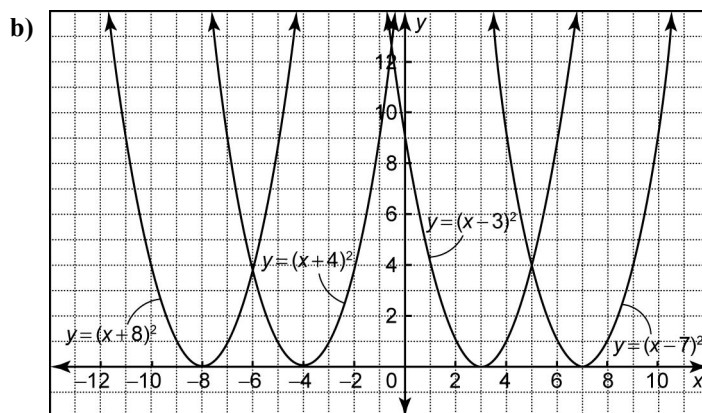
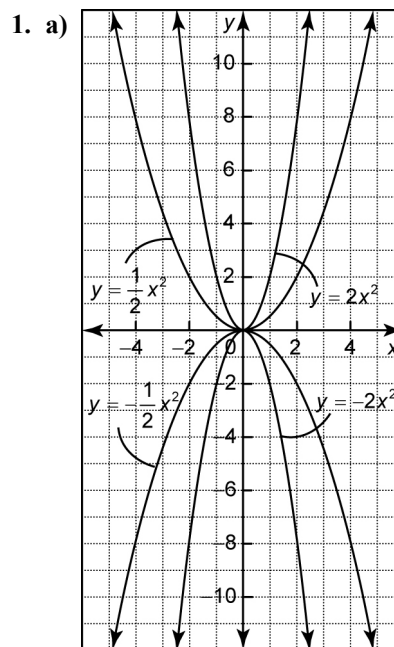
- f) Test the points in the table in the equation  $h = -x^2 + 3x + 12$ . For example, test the point (2, 14):

$$\begin{array}{ll} \text{L.S.} = h & \text{R.S.} = -x^2 + 3x + 12 \\ = 14 & = -(2)^2 + 3(2) + 12 \\ & = -4 + 6 + 12 \\ & = 14 \end{array}$$

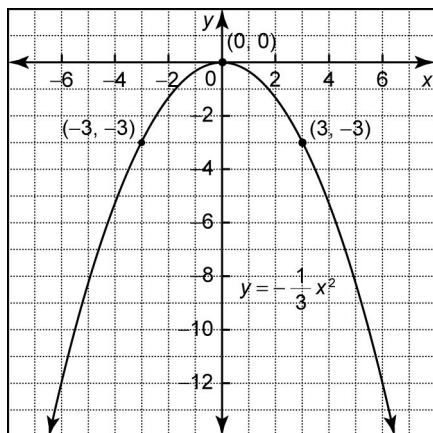
**L.S. = R.S.**

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

## Section 4.3 Practice Master

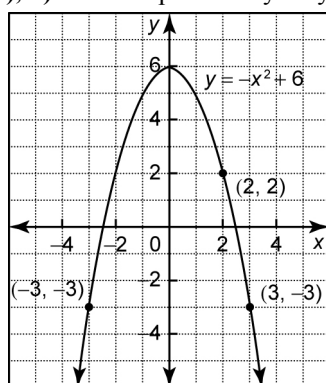


2. a)  $y = -\frac{1}{3}x^2$  i), ii) Labelled points may vary.



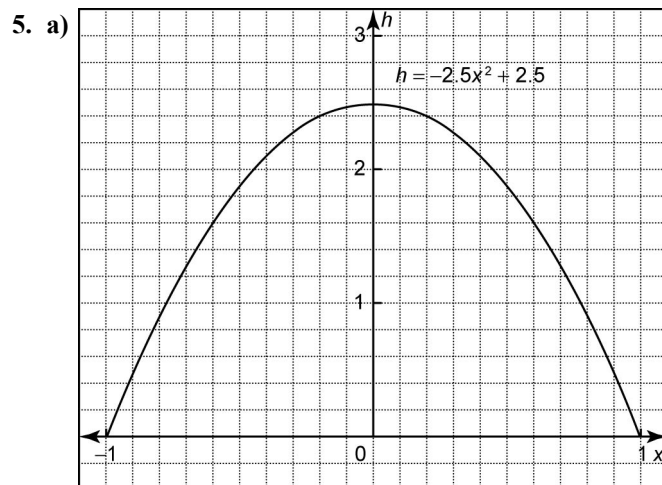
- iii) reflection in the  $x$ -axis; compression by a factor of  $\frac{1}{3}$

- 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)

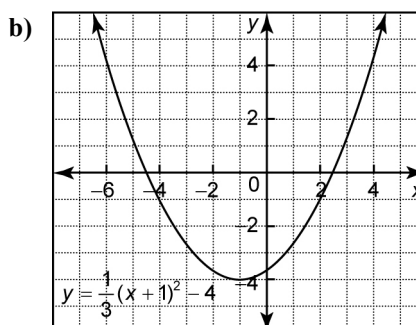
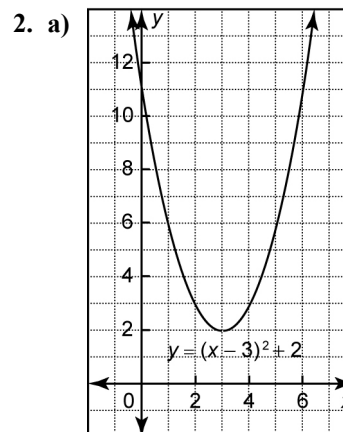
Property	$y = (x - 3)^2 + 2$
vertex	(3, 2)
axis of symmetry	$x = 3$
stretch or compression	none
direction of opening	upward
values that $x$ may take	all real numbers
values that $y$ may take	$y \geq 2$

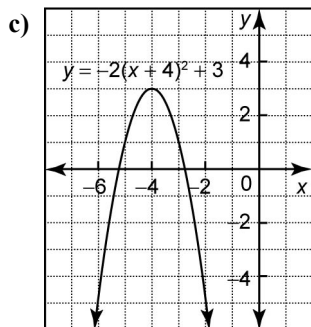
b)

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	$y \leq 3$





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

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

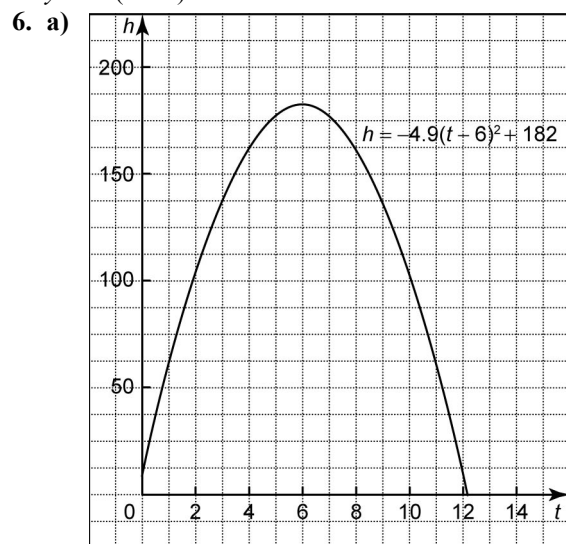
c)  $y = -(x + 2)^2 - 4$

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

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

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

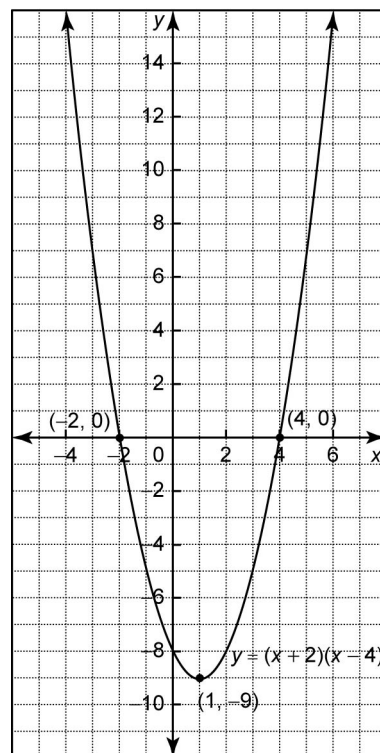
5.  $y = -2(x + 3)^2 + 1$



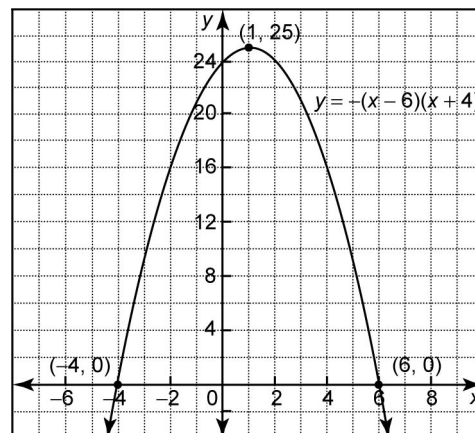
b) 182 m   c) 6 s   d) 5.6 m

## Section 4.5 Practice Master

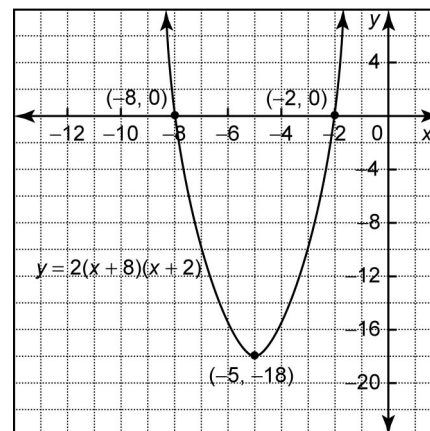
1. a)

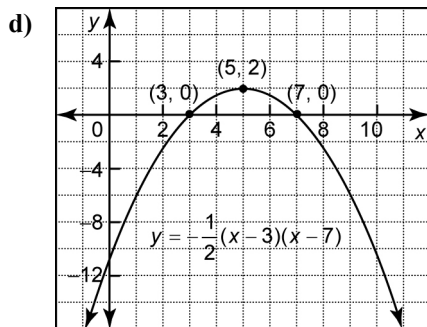


b)



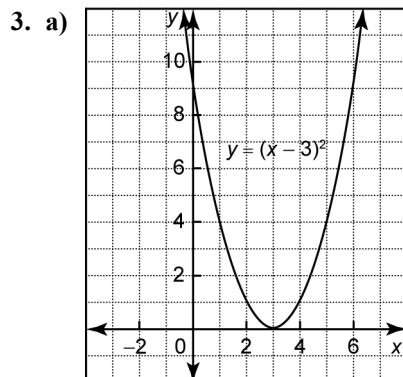
c)



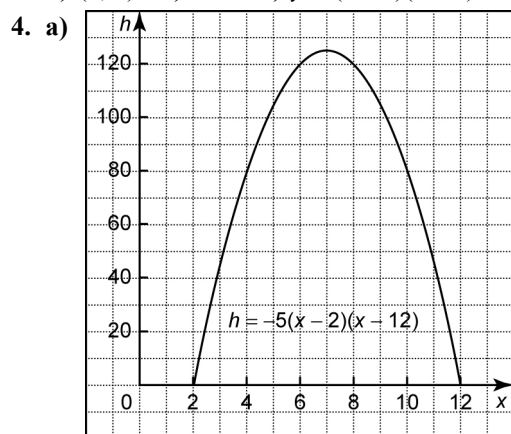


2. a)  $y = 2(x+8)(x-2)$

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)  $\left(\frac{1}{2}\right)^3$  b)  $\left(\frac{1}{4}\right)^1$  c)  $\left(\frac{1}{3}\right)^2$

d)  $\left(-\frac{1}{4}\right)^2$  e)  $\left(-\frac{1}{3}\right)^2$  f)  $\left(-\frac{1}{14}\right)^3$

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

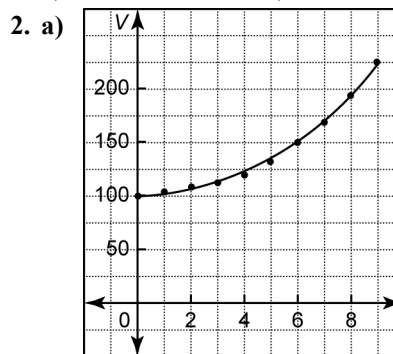
c) the amount of radium present at  $t = 0$ , or now

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



b) The data follow a parabola opening upward.

c) \$253

3. a) neither

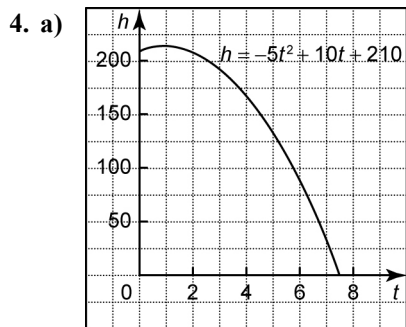
$x$	$y$	First Differences	Second Differences
1	3	7	12
2	10	19	18
3	29	37	24
4	66	61	
5	127		

b) quadratic

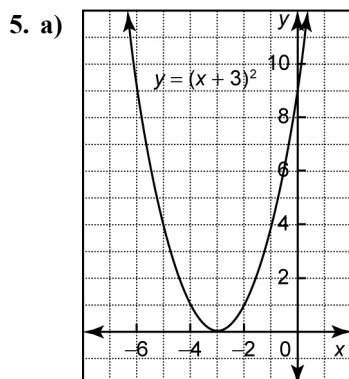
$x$	$y$	First Differences	Second Differences
-2	12	-9	6
-1	3	-3	6
0	0	3	6
1	3	9	
2	12		

c) linear

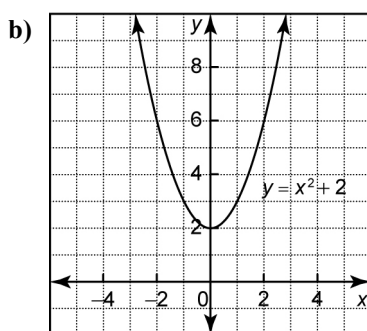
$x$	$y$	First Differences	Second Differences
1	5	8	0
3	13	8	0
5	21	8	0
7	29	8	0
9	37		



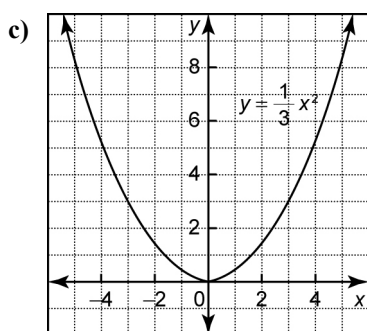
b) 215 m c) after 1 s



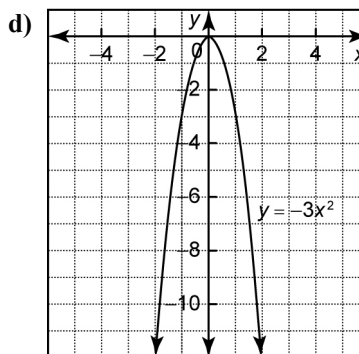
translation of 3 units to the left



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	$y \geq -1$

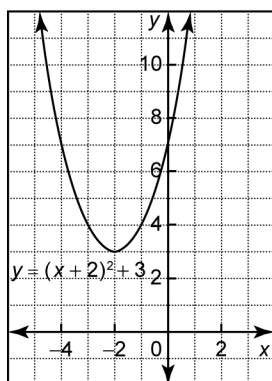
c)

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	$y \leq -3$

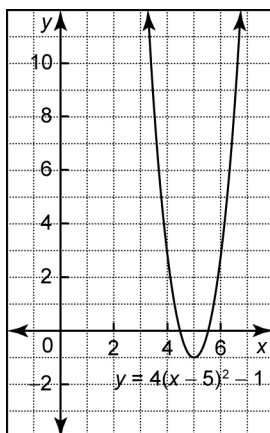
d)

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	$y \leq -4$

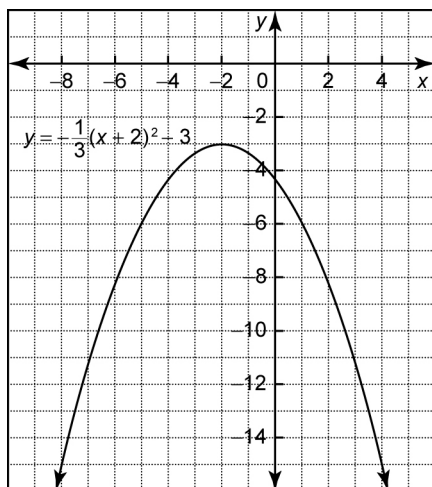
7. a)



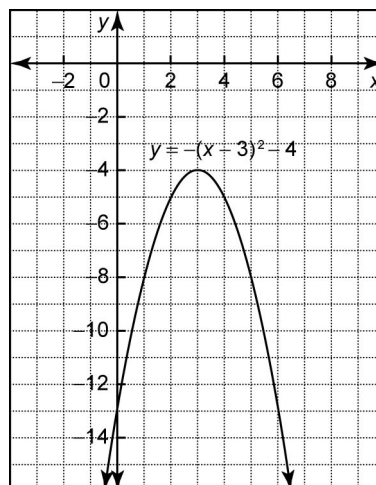
b)



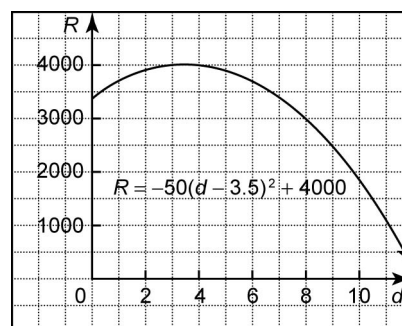
c)



d)

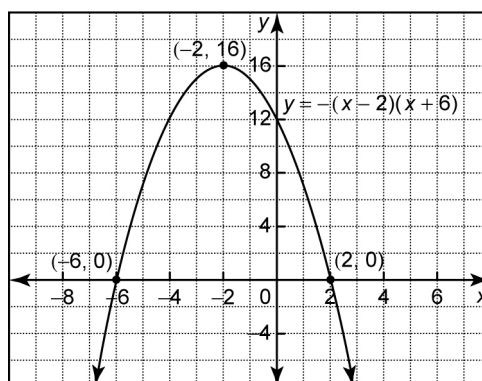


8. a)

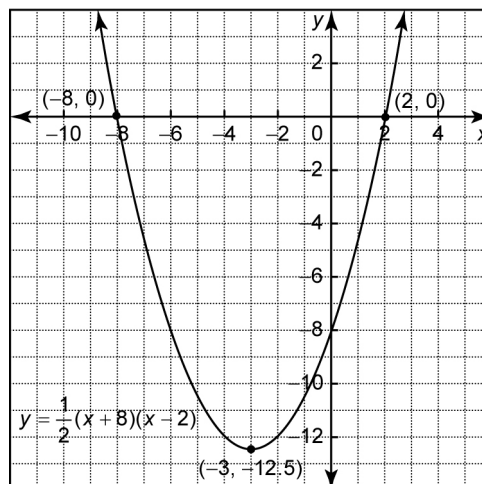


b) \$4000 c) \$3.50

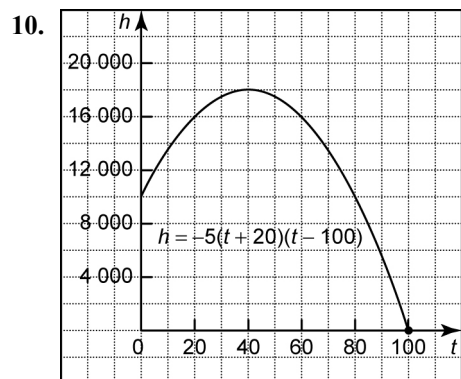
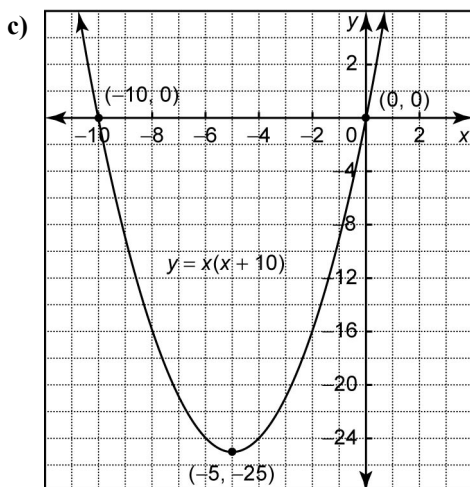
9. a)



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)  $\frac{5}{16}$

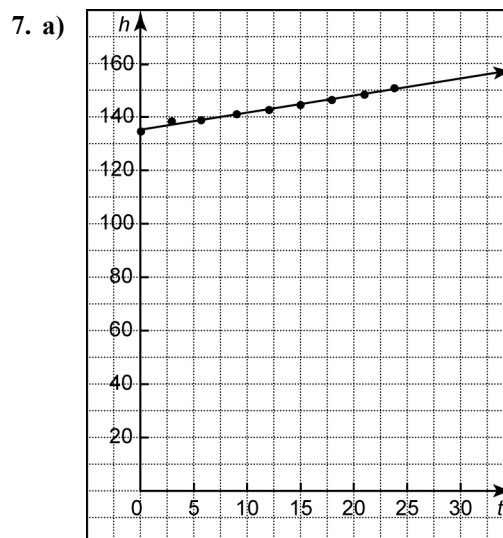
13. a)  $x = -3$  b)  $x = -2$  c)  $x = \frac{4}{3}$

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.

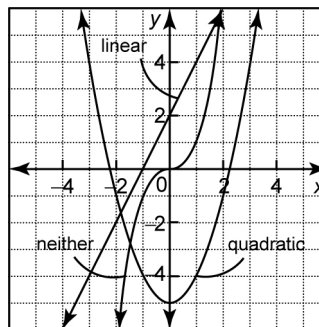
c) about 158 cm

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:



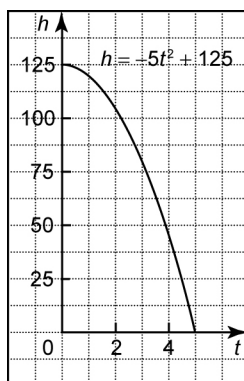
10. a) linear

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

b) quadratic

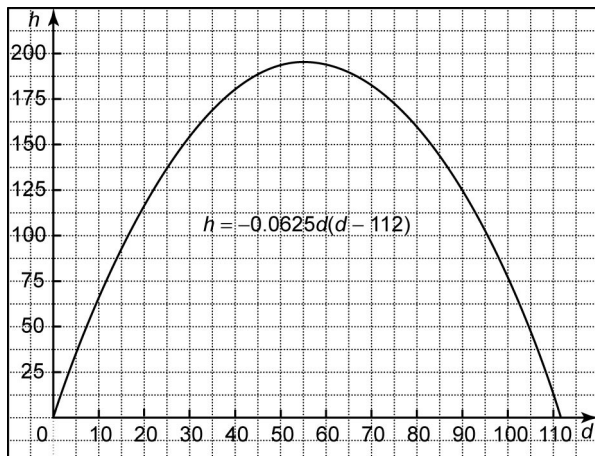
x	y	First Differences	Second Differences
-2	51	-18	
-1	33	-14	4
0	19	-10	4
1	9	-6	4
2	3		

11. a)



b) 125 m c) 5 s

12. a)



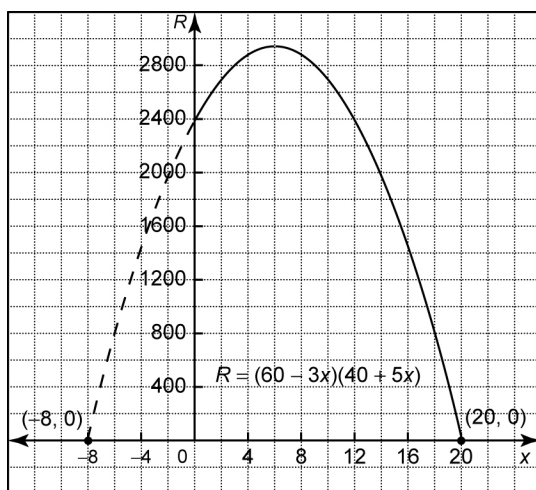
b) 112 m c) 56 m d) 196 m

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

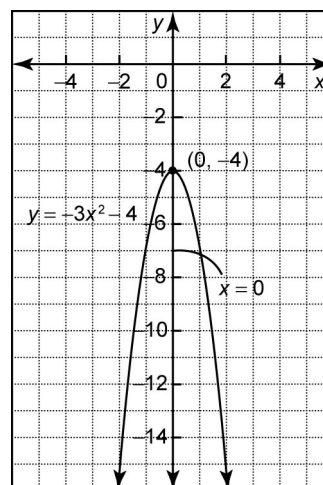
14. a)



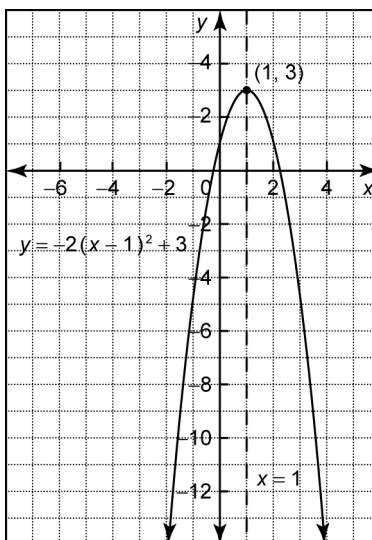
b) \$2940 c) 6 d) \$70 e) 42

## Chapter 4 Test

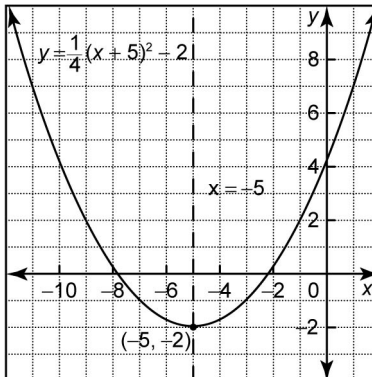
1. a)



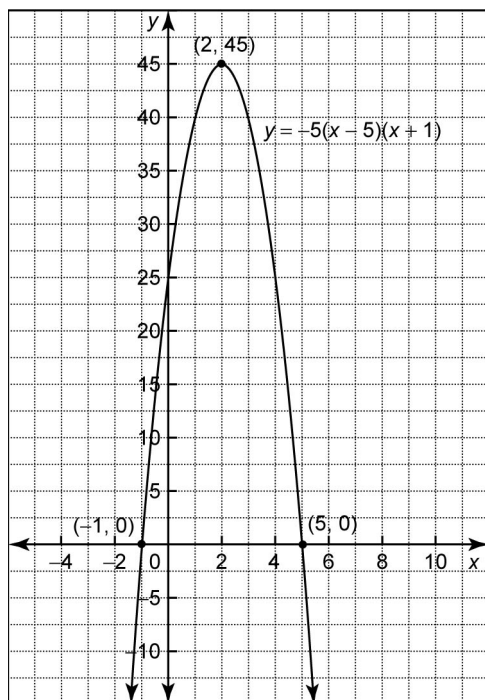
b)



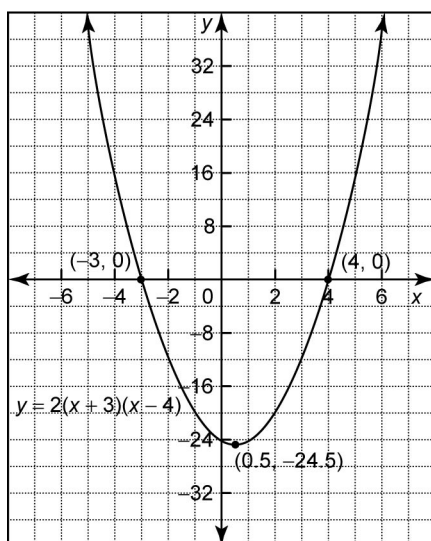
c)



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		

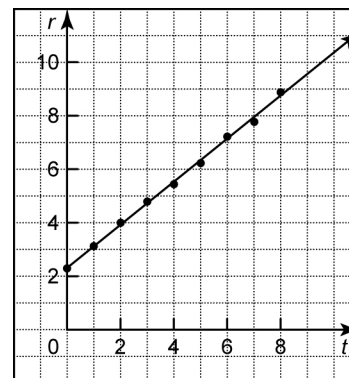
c) linear

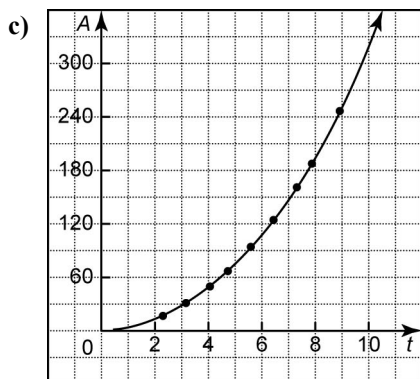
$x$	$y$	First Differences	Second Differences
2	26	7	0
4	33	7	0
6	40	7	0
8	47	7	0
10	54	7	

6. a)

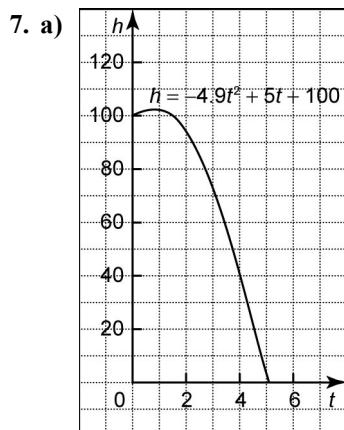
Time, $t$ (h)	Radius, $r$ (m)	Area, $A$ ( $m^2$ )
0	2.3	16.6
1	3.1	30.2
2	4.0	50.2
3	4.7	69.4
4	5.5	95.0
5	6.3	124.7
6	7.3	167.4
7	7.8	191.1
8	8.9	248.8

b)





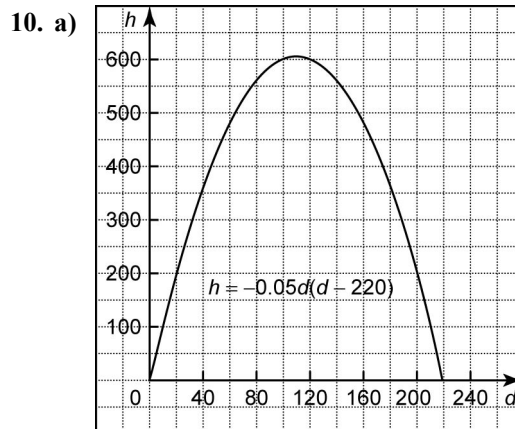
- d) 10.4 m; 339.8 m<sup>2</sup>  
e) 339.7 m<sup>2</sup>; The areas are very close. The difference may be due to rounding.



- 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