Chapter 4 Review

4.1 Modelling With Quadratic Relations

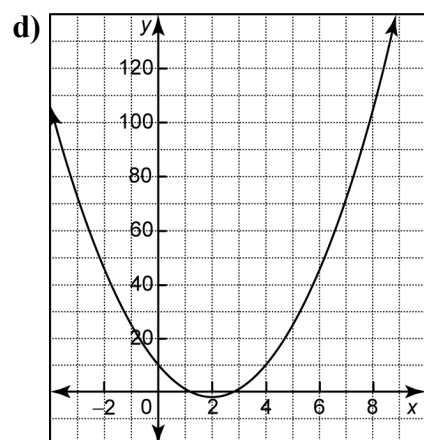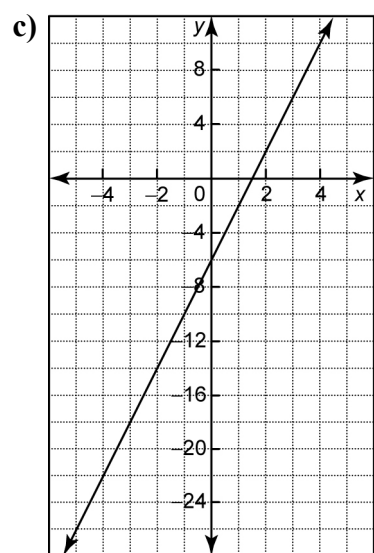**1.** Which of these relations are quadratic? Justify your answers.

a) $y = 3x^2 + 5$

b)

x	y
1	−5
2	2
3	21
4	58
5	119
6	210

c)

d)

2. A football was thrown in the air. Its path can be modelled by the relation $h = -5t^2 + 25t + 1.5$ where h is the height of the football in metres and t is the time in seconds.

**a)** Complete the table of values and graph the relation.

t	h
0	
1	
2	
3	
4	
5	

b) Use your graph to estimate how long the ball was in the air.

c) Use your graph to estimate the coordinates of the vertex of the relation. Explain the meaning of the coordinates of the vertex in this context.

d) Explain the meaning of the data in the first row of the table of values.

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3. A farmer has 100 m of fencing. He plans to build a rectangular enclosed area with maximum area along one side of the barn.
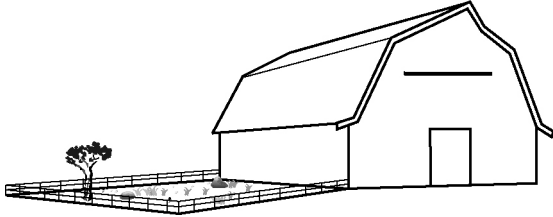

a) Complete the table.

Length (m)	Width (m)	Perimeter (m)
80	10	100
	15	
	20	
	25	
	30	
	35	
	40	

b) Add a fourth column to the table. Calculate the area for pair set of dimensions.

c) Draw a graph that compares the length and the area.

d) Use the graph to determine the dimensions that give the maximum area.

4.2 The Quadratic Relation $y = ax^2 + k$

4. Describe the shape relative to the graph of $y = x^2$, the orientation, and give the coordinates of the vertex of each parabola.

a) $y = -0.5x^2$ **b)** $y = x^2 - 2$

c) $y = 2x^2 + 7$ **d)** $y = -3x^2 - 5$

5. In each standard viewing window, the graph of $y = x^2$ is shown as a dotted parabola and the graph of a relation of the form $y = ax^2 + k$ is shown as a solid parabola. For each solid parabola, is k positive or negative? Explain.

a)

b)

c)

d)
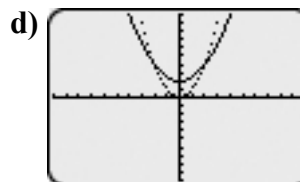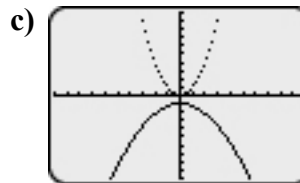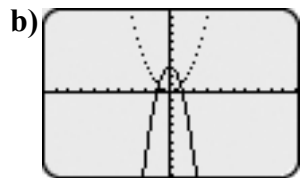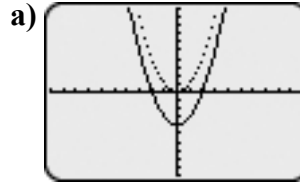
6. In each case, the parabola $y = x^2$ is transformed. Write the equation of the new parabola in the form $y = ax^2 + k$.

a) The parabola is stretched vertically by a factor of 2 and reflected in the x-axis.

b) The parabola is compressed vertically by a factor of 0.5.

c) The parabola is stretched vertically by a factor of 2 and translated down 3 units.

d) The parabola is reflected in the x-axis and translated up 11 units.
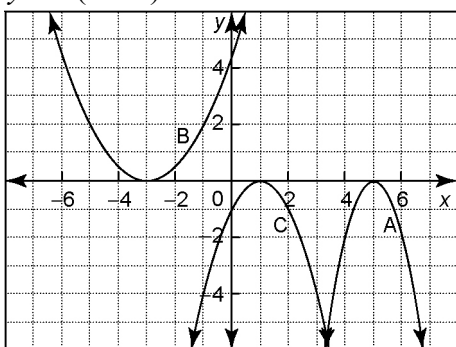
4.3 The Quadratic Relation $y = a(x - h)^2$

7. For a quadratic relation of the form $y = a(x - h)^2$, explain why the expression in brackets is expressed as $x - h$ instead of $x + h$.

8. Match each relation to its graph.
   a) $y = -2(x - 5)^2$
   b) $y = 0.5(x + 3)^2$
   c) $y = -(x - 1)^2$

9. Graph each relation, then write an equation in the form $y = a(x - h)^2$ to represent each parabola.
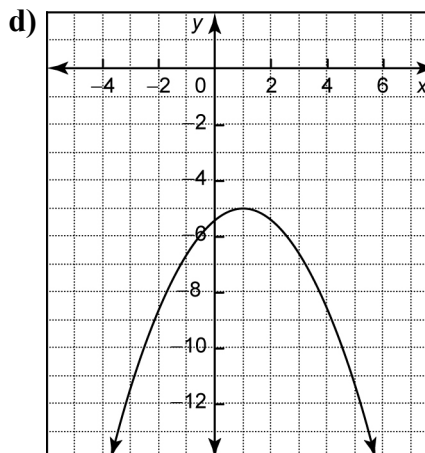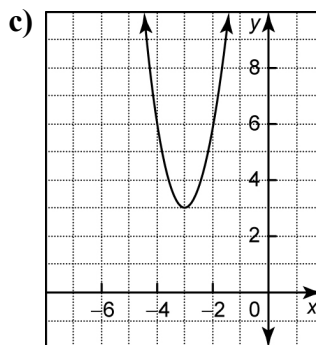
a)

x	y
−2	27
−1	12
0	3
1	0
2	3
3	12

b)

x	y
−4	−18
−2	−8
0	−2
2	0
4	−2
6	−8

4.4 The Quadratic Relation $y = a(x - h)^2 + k$

10. For each parabola
   • identify the coordinates of the vertex
   • determine whether a is positive or negative

a)

b)

c)

d)
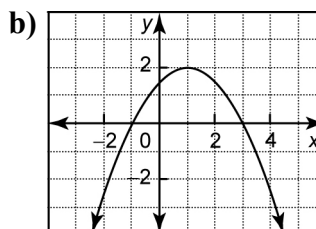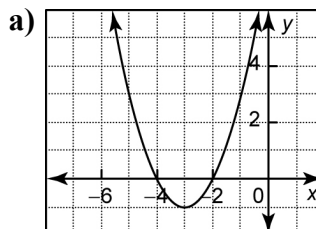
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11. Graph each relation.
   a) $y = 4(x - 2)^2 + 5$
   b) $y = -0.5(x - 6)^2 - 1$
   c) $y = -(x - 4)^2 + 3$
   d) $y = 0.3(x + 2)^2 - 3$

12. A baseball is hit in the air. Its path can be modelled by the relation $h = -3(d - 9)^2 + 57$, where h is the height of the ball and d is the horizontal distance, both in metres.
   a) What is the vertex of this relation?
   b) What is the maximum height of the ball?
   c) What is the height of the ball when it has travelled a total horizontal distance of 8 m?
   d) What do the coordinates of the vertex represent in this situation?

4.5 Interpret Graphs of Quadratic Relations

13. Find the initial value for each relation.
   a) $y = -5x^2 + 8x - 9$
   b) $y = 3(x + 3)^2 + 7$
   c) $y = -11x^2 - 11x - 14$
   d) $y = -2(x - 5)^2 + 3$

14. An arrow is shot from the top of a platform. The path of the arrow can be modelled by the relation $h = -0.005(t - 26)^2 + 5$, where h is the height of the arrow in metres and t is the time in seconds after the arrow was shot.
   a) Find the vertex of the parabola.
   b) How long will it take the arrow to reach its maximum height?
   c) What is the maximum height?
   d) What is the height of the platform?

15. **a)** Graph $y = -4(x - 1)^2 + 5$ using the vertex and four other points.
   b) Graph $y = -4x^2 + 8x + 1$ using a table of values.
   c) What do you notice about the two graphs? Explain.