4 Review

4.1 Modelling With Quadratic Relations, pages 168–179

1. Is each relation quadratic? How do you know?

   a) $y = 3x - 15$

   b) $y = 4x^2 - 2x + 8$

   c)

x	y
−5	1
0	4
5	16
10	64
15	256

2. A baseball is thrown upward. The path of the ball is modelled by the relation $h = -4.9t^2 + 15t + 2$, where h is the baseball's height above the ground, in metres, and t is the time, in seconds.

   a) Copy and complete the table.

Time (s)	Height (m)
0.0	
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	

   b) How long will it take the baseball to reach its maximum height?

   c) After how many seconds will the baseball land?

   d) How can you tell that this relationship is quadratic? List as many reasons as possible.

4.2 The Quadratic Relation $y = ax^2 + k$, pages 180–193

3. Describe the shape and position of each parabola relative to the graph of $y = x^2$.

   a) $y = x^2 - 3.4$

   b) $y = -0.35x^2$

   c) $y = 0.005x^2 + 15$

   d) $y = 6.5x^2 - 3.4$

4. Sketch the graph of each relation in question 3.

5. Write a relation that models each table of values.

   a)

x	y
−1	−88
0	−100
1	−88
2	−52
3	8
4	92

   b)

x	y
−5.0	19.5
0.0	20.0
5.0	19.5
10.0	18.0
15.0	15.5
20.0	12.0

4.3 The Quadratic Relation $y = a(x - h)^2$, pages 194–203

6. Write a relation that models each table of values.

   a)

x	y
8	−32
10	0
12	−32
14	−128
16	−288
18	−512

   b)

x	y
−26	60
−16	15
−6	0
4	15
14	60
24	135

4.4 The Quadratic Relation $y = a(x - h)^2 + k$, pages 204–217

7. Describe the shape and position of each parabola relative to the graph of $y = x^2$.

a) $y = -0.004(x - 18)^2 + 15$

b) $y = 7(x + 1)^2 - 2$

c) $y = -80(x + 9)^2 + 10.8$

d) $y = 0.6(x - 40)^2$

8. Sketch the graph of each relation in question 7.

9. A computer repair technician is deciding what hourly rate to charge for her services. She knows that if she charges $60/h, she will get 30 h of work per week. She also knows that for every $5 increase in her hourly rate, she will lose 4 h of work per week.

a) Copy and complete the table.

Hourly Rate ($)	Expected Number of Hours per Week	Weekly Revenue ($)
45		
50		
55		
60	30	$(60)(30) = \$1800$
65	26	
70		

b) Graph the relation between hourly rate and weekly revenue.

c) Write a relation in the form $y = a(x - h)^2 + k$ to represent the graph.

d) What hourly rate should the technician charge to earn the maximum weekly revenue?

10. Sketch the graph of each parabola. Then, determine its equation.

a) opens upward, vertex is $(3, -5)$, passes through point $(13, 20)$

b) opens downward, vertex is $(-4, 7)$, passes through point $(0, -39)$

4.5 Interpret Graphs of Quadratic Relations, pages 218–225

11. One of the largest solar furnaces in the world is in Odeillo, France. The parabolic mirror is 54 m wide and 10 m deep. Write a relation to model the parabolic shape of the mirror.

12. A water balloon is thrown upwards. The balloon follows a path modelled by the relation $h = -2.6d^2 + 7.8d + 2.15$, where h is the balloon's height above the ground and d is the balloon's horizontal distance from the release point, both in metres.

a) Copy and complete the table. Graph the relation.

d	0.0	0.5	1.0	1.5	2.0	2.5	3.0
h							

b) What was the balloon's initial height above the ground?

c) Write a relation in the form $y = a(x - h)^2 + k$ to model the balloon's path.

For questions 1 to 6, choose the best answer.

1. Which of these relations is quadratic?

   A $y = 0.5x - 7$

   B $y = 5.8x + 3x^2 - 9$

   C $y = 4x^3 + 2x^2 - 5x + 1$

   D $3x + 2y + 10 = 0$

2. Which of these relations is not quadratic?

   A the path of a ball thrown in the air

   B the distance a car travels when it is accelerating

   C the distance travelled when running at a constant speed

   D the shape of a satellite dish

3. Which parabola has its vertex 3 units above the x-axis?

   A $y = 3(x - 5)^2 + 4$

   B $y = 5(x + 4)^2 - 3$

   C $y = 0.1(x - 15)^2 + 3$

   D $y = 0.3(x + 3)^2 - 10$

4. Which parabola has its vertex farthest from the y-axis?

   A $y = 3(x - 5)^2 + 4$

   B $y = 5(x + 4)^2 - 3$

   C $y = 0.1(x - 15)^2 + 3$

   D $y = 0.3(x + 0.8)^2 - 10$

5. Which parabola is the most vertically stretched?

   A $y = 3(x - 5)^2 + 4$

   B $y = 5(x + 4)^2 - 3$

   C $y = 0.1(x - 15)^2 + 3$

   D $y = 0.3(x + 0.8)^2 - 10$

6. The parabola represented by the relation $y = -8(x + 15)^2 + 12$ has which vertex?

   A $(-8, 15)$

   B $(-15, 12)$

   C $(-15, -12)$

   D $(-8, -12)$

7. What is always true about the first and second differences of a quadratic relation?

8. Describe the shape and position of each parabola relative to the graph of $y = x^2$. Sketch a graph of each parabola.

   a) $y = 0.5(x + 8)^2$

   b) $y = -8x^2 - 14$

   c) $y = -10(x - 7)^2 - 13$

   d) $y = 0.002(x + 20)^2 + 16$

9. A soccer ball is kicked from ground level. When it has travelled 35 m horizontally, it reaches its maximum height of 25 m. The soccer ball lands on the ground 70 m from where it was kicked.

   a) Model this situation with a relation in the form $y = a(x - h)^2 + k$.

   b) What is the soccer ball's height when it is 50 m from where it was kicked?

Chapter Problem Wrap-Up

Throughout this chapter you have developed relations to model the paths of a snowboarder, a skateboarder, a mountain biker, a motocross biker, and a ski jumper. There are many more extreme sports that involve flying through the air. Think of a different sport and develop a relation that can model the sport's motion to complete your video game.

10. Pennies are stacked in a triangular pattern.

a) Continue the pattern. Copy and complete the table for the first ten layers of pennies.

Number of Layers	Total Number of Pennies
1	1
2	3
3	6
4	
5	

b) Describe the relationship between the number of layers and the total number of pennies.

c) How many layers are in a triangle made of 105 pennies?

d) How many pennies are needed for a triangle with 50 layers? Explain how you found your answer.

11. A basketball was thrown upward. The basketball's path is given by the relation $h = -0.2(d - 2.5)^2 + 4.25$, where h is the basketball's height above the ground and d is the basketball's horizontal distance from where it was thrown, both in metres.

a) What was the basketball's initial height above the ground?

b) What was the basketball's greatest height above the ground? What was the basketball's horizontal distance at this point?

c) The basketball was thrown toward a net 6 m away and 3 m above the ground. Will the basketball go through the net? Justify your answer.