Date: _____

CHAPTER 6

Quadratic Relations

Get Set

Answer these questions to check your understanding of the Get Ready concepts on pages 236–237 of the *Foundations of Mathematics 10* textbook.

Evaluating Expressions

1. Substitute the given x-value and then solve.

a) $2x^2 - 12$, $x = 4$

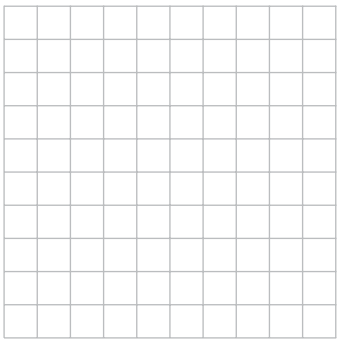
b) $3x^2 - 10x + 50$, $x = -2$

Linear Relations

2. For each relation, complete the table of values and graph the relation.

a) $y = 3x - 5$

x	y
–3	
–2	
–1	
0	
1	
2	
3	

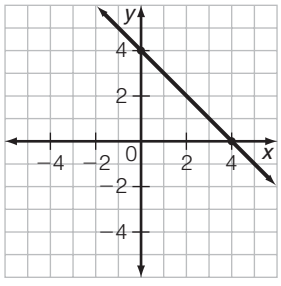


b) $y = -x - 2$

x	y
–3	
–2	
–1	
0	
1	
2	
3	

3. State the x- and y-intercepts for each graphed relation.

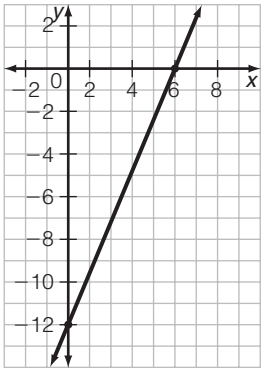
a)



x-intercept: _____

y-intercept: _____

b)



x-intercept: _____

y-intercept: _____

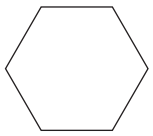
Lines of Symmetry

4. Write the number of lines of symmetry for each shape. Then draw the lines of symmetry for each.

a)

Number of lines of symmetry: _____

b)



Number of lines of symmetry: _____

Date: _____

6.1 Explore Non-Linear Relations

Textbook pp. 238–244

Warm-Up

1. Math Literacy

What type of graph is a parabola?

A parabola is a _____

_____ _____ graph.

2. Number Sense

Draw a line from the type of relation to the correct term.

linear relation non-linear relation

curve of best fit line of best fit

3. Fractions

Multiply the following.

a) $\frac{1}{2}(4) =$

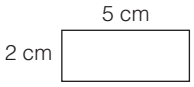
b) $\frac{1}{2}(12)(3) =$

4. Area

Identify the length and width of this rectangle. Then, find the area.

Length: _____ cm

Width: _____ cm



$A =$ _____ $\times$ _____

$=$

$=$

5. Perimeter

Calculate the perimeter of this rectangle.

$P =$ _____ $\times$ _____

$=$

$=$

$=$

6. Multiplication

Multiply the following.

a) $12 \times 4 =$

b) $5 \times 9 =$

7. Non-Linear Relations

What is one type of non-linear relation?

One type of non-linear relation is a

_____ relation.

8. Relations and Functions

What is a graph of a quadratic relation called? Circle the correct answer.

A graph of a quadratic relation is called

a curve of best fit,

a line of best fit, or

a parabola.

Date: _____

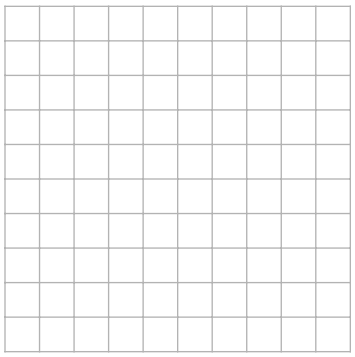
Practise

Section 6.1

1. Graph the data in each table. Draw a line or curve of best fit. Explain your choice.

a)

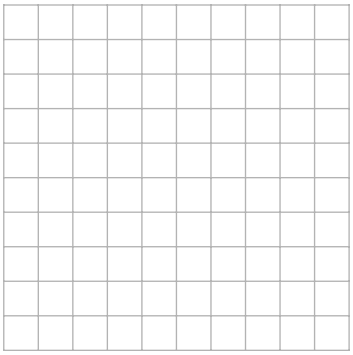
x	*y*
0	3
1	5
2	7
3	9
4	11
5	13



The points _____ (lie, do not lie) in a line, so I drew a _____ (line, curve) of best fit.

b)

x	*y*
0	0
2	8
4	32
6	72
8	128
10	200



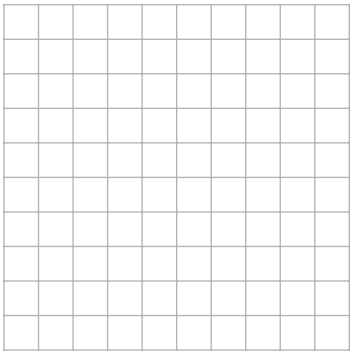
The points _____ (lie, do not lie) in a line, so I drew a _____ (line, curve) of best fit.

2. The relation $SA = 6s^2$ represents the formula for the surface area of a cube with a side length of s.

a) Find the surface area of a cube with a side length from 1 cm to 6 cm. Record the surface area values in the table.

b) Graph the data in the table. Draw a curve of best fit through the points. Label your graph completely.

Side Length (cm)	Surface Area (cm^2)
1	
2	
3	
4	
5	
6	



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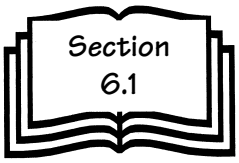


3. David has 30 m of fencing to create as large a dog run as possible.

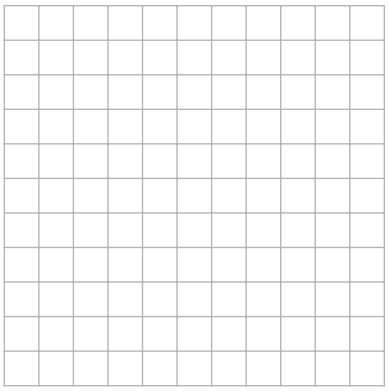
a) The formula to calculate perimeter is $P =$ _____.

The formula to calculate area is $A =$ _____.

b) Complete the table using various lengths and widths for a dog run with a perimeter of 30 m. Change the length and width by 1 m each time.

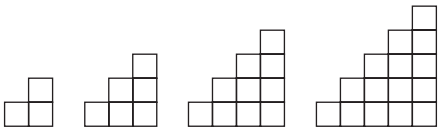
Length (m)							
Width (m)							
Area (m^2)							

c) Graph the data for the area related to width.



d) The relation between area and width is _____ because _____.

4. The first four figures in a pattern are given below.



Complete the table for the first six figures that would be in the sequence. Some entries have been filled in.

Figure	Base	Height	Area
1	2	2	3
2	3	3	6
3	4	4	10
4			15
5			
6			

Date: _____

6.2 Model Quadratic Relations

Textbook pp. 245–253

Warm-Up

1. Number Sense

A quadratic relation can be modelled by an equation in the form of

$y =$ _____ + _____ + _____

The coefficient of the squared term can never be what number?

It can never be _____.

2. Math Literacy

Which of the following are quadratic relations? Circle all that apply.

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

c) $y = 2x^2 + 5x + 2$

3. Mental Math

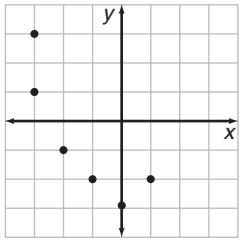
If you joined the following points, would they form a line of best fit or a curve of best fit?

They would

form a _____

of best fit.

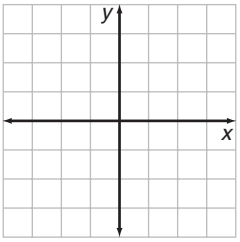
Join the points to check your answer.



4. Tables

Plot the following points on the graph.

x	y
−2	4
−1	1
0	0
1	1
2	4



5. Relations and Functions

Rearrange the following equations to isolate the y value.

a) $3x = y + 2$

b) $-5 = 4x - y$

6. Algebra

Find the value of y, if $x = 3$.

a) $y = 3x + 5$

b) $2y = 5x + 1$

7. Quadratic Relations

Find the value of y if $x = 2$.

$y = x^2 + 2x - 5$

8. Rounding

Round the following to the nearest tenth.

a) 102.587 =

b) 25.09 =

c) 4.152 =

Date: _____

Practise

1. How is an equation for a quadratic relation different from an equation that represents a linear relation?

_____

2. Does the equation $y = 3x^2 - 4$ represent a linear or quadratic relation? How do you know?

_____

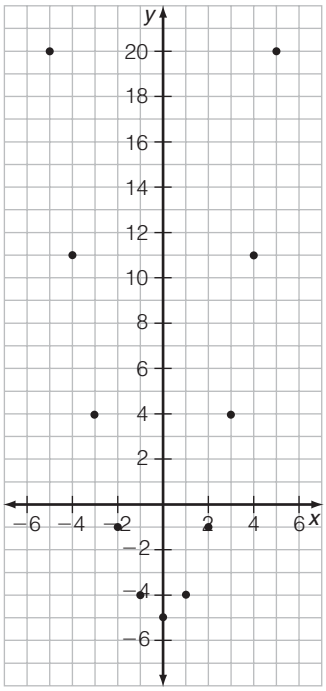
3. **a)** Use a graphing calculator to graph the data in the table.
b) What type of relation best represents the data?

_____

x	*y*
−3	27
−2	12
−1	3
0	0
1	3
2	12
3	27

4. **a)** Complete the table using the values for the points indicated in the graph. One coordinate has been filled in for you.

x	*y*
−5	20

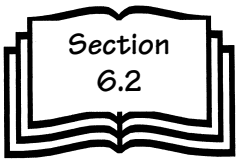


b) Using a graphing calculator, determine the equation of the curve of best fit.

The equation for the graph is _____.

c) What type of relation fits the data? _____

Date: _____



5. The path of a soccer ball was studied and the following data collected.

a) Enter the data on a graphing calculator.

Time (s)	Height (m)
0	0
1	24.5
2	39.2
3	44.1
4	39.2
5	24.5
6	0

b) The data appear on the graph in the shape of a _____, therefore, the data forms a _____ relation.

c) The equation of the relation is _____.

6. The data in the table describe the path of a fireworks display launched from a hill into a flat lowland area.

Horizontal distance (m)	Vertical distance (m)
0	0
3	28.13
6	44.91
9	53.52
12	51.75
15	19.21
18	−11.71

a) Enter the data on a graphing calculator, then display the scatter plot.

b) The equation of the quadratic relation is _____.

Date: _____

6.3 Key Features of Quadratic Relations

Textbook pp. 254–263

Warm-Up

1. Math Literacy

Rearrange the following equation to isolate the y variable.

$-2 - 4x^2 = -y + 15$

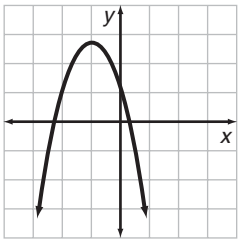
2. Graphs

Graph the following relation on a graphing calculator.

$y = x^2 - 5$

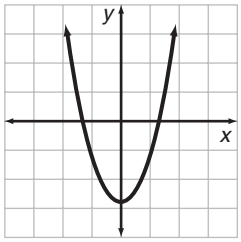
3. Key Features

Label the vertex and sketch and label the axis of symmetry for this parabola.



4. Quadratic Relations

Label the minimum point and the x-intercepts.

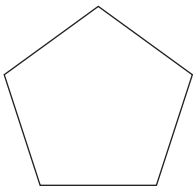


5. Axis of Symmetry

Draw the axis of symmetry for the following figure.

6. Lines of Symmetry

Draw the lines of symmetry for the following.



7. Number Sense

Solve for y if $x = 5$.

$y = x^2 + 2x - 7$

8. Algebra

Rearrange to isolate the y variable. Then solve for y if $x = 3$.

$3x^2 + 3y = 6 - 2x$

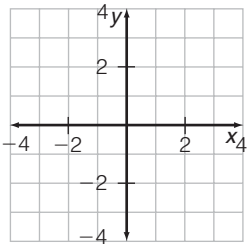
Date: _____

Practise

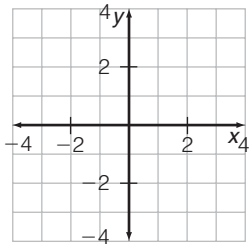
Section 6.3

1. Draw parabolas that have the following characteristics.

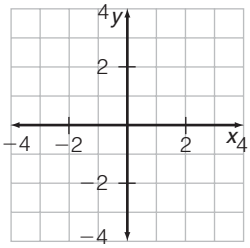
a) a minimum value



b) a maximum value



c) two x-intercepts



2. Complete the tables of values using the equations and then graph the data from both tables on the same grid. The first one for each data set has been done for you.

$y = x^2$

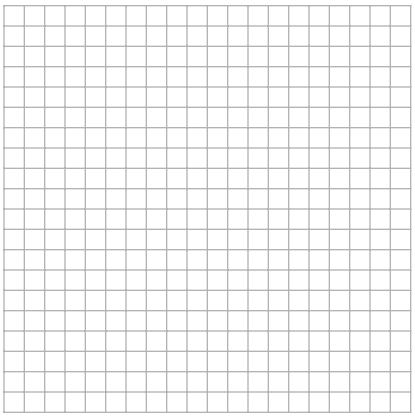
x	y
−3	9
−2	
−1	
0	
1	
2	
3	

Sample calculation:
$y = x^2$
$y = (-3)^2$
$y = 9$

$y = 2x^2$

x	y
−3	18
−2	
−1	
0	
1	
2	
3	

Sample calculation:
$y = x^2$
$y = 2(-3)^2$
$y = 18$



Date: _____

3. Compare the graphs you generated in question 2.

a) Write down ways they are similar and different.

Similarities: _____

_____

Differences: _____

_____

b) What do you think was the reason for the difference between the graphs?

_____

_____

c) How would the graphs in question 2 change if the sign of the coefficients of the x^2 terms for each equation were negative?

Changing the sign of the coefficient of x^2 would cause the graphs to _____.

4. Use a graphing calculator to graph the relation $y = -2x^2 + 3x + 5$, then complete the statements.

a) The coordinates of the vertex are (____, ____) because _____

_____.

b) The equation of the axis of symmetry is _____ because _____

_____.

c) The y-intercept is _____ because _____.

d) The x-intercepts are _____ because _____.

e) Does this graph have a minimum value or a maximum value? What is that value?

_____

Date: _____

6.4 Rates of Change in Quadratic Relations

Textbook pp. 264–271

Warm-Up

1. Math Literacy

Solve for y when $x = -2$.

$y = x^2 - 5x + 11$

2. Number Sense

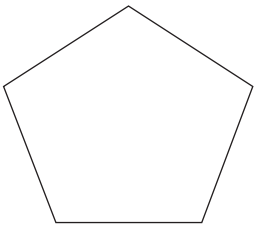
Circle the quadratic equation.

$y = x + 2$

$y = 2x^2 - 4x + 6$

3. Estimation

Estimate the number of diagonals you could draw for this polygon. Draw the diagonals to check your answer.



4. Tables

Calculate the first differences for the data below.

x	y	First Differences
-2	4	
-1	1	
0	0	
1	1	

5. Decimals

Evaluate the following.

$11.2 - 5.9 =$

6. Subtracting Integers

Subtract the following.

$-15 - (-17)$

7. Quadratic Relations

Rearrange to isolate the y variable. Then solve for y if $x = 4$.

$-8 + x + y = 2x^2$

8. Algebra

Solve for x.

$32 = 2x + 4$

Date: _____

Practise

1. Describe a method that does not involve graphing, which you can use to identify whether data in a table represents a quadratic relation.

_____

_____

2. Leon was working on the relation below and filled in the table of values for first and second differences.

x	*y*	First Differences	Second Differences
–3	5		
–2	7	2	
–1	9	2	0
0	11	2	0
1	13	2	0

Leon concluded the relation is quadratic because there is a constant value of zero for the second differences. Is he correct? Explain.

_____

_____

3. **a)** Complete the table. The first one has been done for you.

x	*y*	First Differences	Second Differences
−3	18		
−2	11	$11 - 18 = -7$	
−1	6	$6 - 11 = -5$	$-5 - (-7) =$ ____
0	3		
1	2		
2	3		
3	6		

b) This data forms a _____ relation because _____.

c) Based on the values you determined for the table, what would the shape of this graph be? Explain why.

_____

_____.

Date: _____

Section 6.4

4. **a)** Make a table of values for the relation $y = x^2 + 5x + 4$ and use the values in the table to determine whether it is quadratic.

x	y	First Differences	Second Differences
−5	4	___ − 10 = ___	
−4			
−3			
−2			
−1			
0			
1			

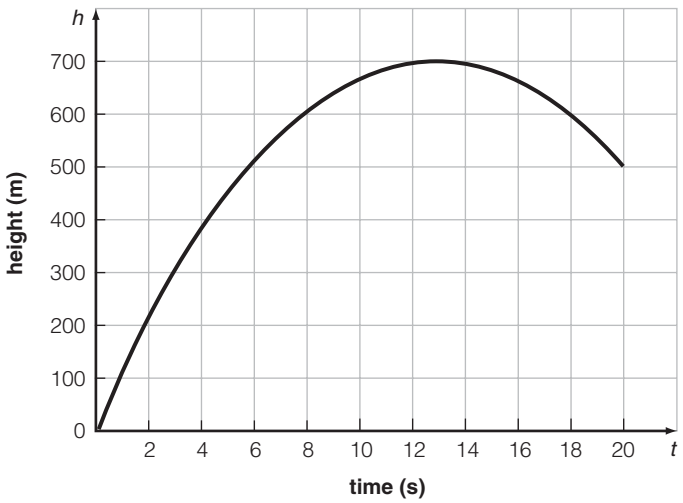
Sample calculation:
$y = x^2 + 5x + 4$
$y = (-5)^2 + 5(-5) + 4$
$y = 25 - 25 + 4$
$y = 4$

Calculations:

b) Is the relation quadric? _____. Based on the equation, does this make sense? Explain._____

5. This graph shows a quadratic relation.
a) Make a table of values for the graph.

time (s)	height (m)
0	
3	
5	
6	
8	
10	
13	
15	
20	



b) Use a graphing calculator to find the expression for this relation.

The equation is_____.

Date: _____

Chapter 6 Review

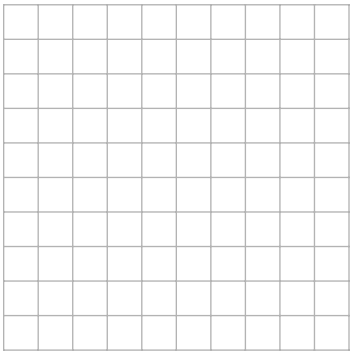
6.1 Explore Non-Linear Relations, textbook pages 238–244

1. Graph the data in each table. Join the points with a line or a curve of best fit. Explain your choice.

I used a _____ because

_____.

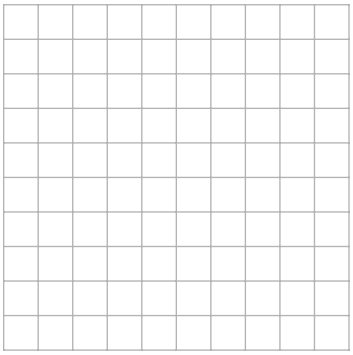
x	*y*
0	2
1	3
2	6
3	11
4	18
5	27
6	38
7	51
8	66



2. The formula for the area of a circle is $A = \pi r^2$, where r represents the radius.

a) Find the areas of circles for the given radii and record them in the table. Graph the data in the table and connect the data points with a smooth curve. (Use $\pi = 3.14$ for your calculations.)

radius (cm)	Area (cm^2)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



6.2 Model Quadratic Relations, textbook pages 245–253

3. Is each relation linear or quadratic? Explain your answer.

a) $y = x^2 + 4$

_____

b) $y = 3x + 4$

_____

c) $y = x^2 + 5x - 6$

_____

Date: _____

4. Using a graphing calculator, graph the set of data. Describe the type of relation the data set best represents and explain why.

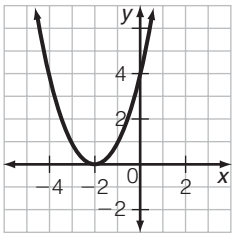
x	*y*
0	2
0.5	1.25
1	−1
1.5	−4.75
2	−10
2.5	−16.75
3	−25
3.5	−34.75

I think the relation is _____ because _____

_____.

6.3 Key Features of Quadratic Relations, textbook pages 254–263

5. Provide the information for the graph.



Coordinates of the vertex: (____, ____)

Equation of the axis of symmetry: _____

y-intercept(s): _____

Minimum or maximum value: _____

x-intercept(s): _____

6.4 Rates of Change in Quadratic Relations, textbook pages 264–271

6. Determine if the relation is linear, quadratic, or neither. Provide an explanation for your answer.

x	*y*	First Differences	Second Differences
–3	12		
–2	7		
–1	4		
0	3		
1	4		
2	7		
3	12		

The relation is _____ because _____.