Lesson Plan

Grade 10 Academic Math **Lesson: 4 - 1**

Unit: Quadratic Relations **Topic: Exploring Quadratic Relations**

- ***homework check:*** **none**

- ***note:*** **Exploring Quadratic Relations**

A linear relation is a relationship between two variables that describes a line of best fit. A linear relation is represented by an equation in $y = mx + b$ form or standard form $Ax + By + C = 0$.

A quadratic relation is a relationship between two variables that describes a curve of best fit that is the shape of a parabola. A quadratic relation is represented by an equation in standard form $y = Ax^2 + Bx + C$.

A scatter plot can show either of these relationships when the independent variable and dependent variables are graphed on a grid. The independent variable represents the values chosen for the experiment and can usually be found in the left hand column of a chart or the horizontal x axis of a graph. The dependent variable represents values you can calculate and can usually be found in the right hand column of a chart or the vertical y axis of a graph.

We should be familiar with calculating first differences. The first differences for a linear relation are constant. If we calculate second differences, the second differences for a quadratic relation are constant. For example, once we establish that the independent variable is constantly increasing, we look at the differences of the dependent variable.

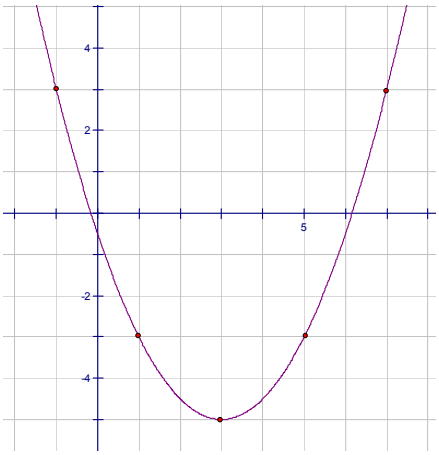
	x	y	First Differences
-2 - (-1) =1	**-2**	**5**	**7 – 5 = 2**
0 - (-1) =1	**-1**	**7**	**9 – 7 = 2**
1 – 0 =1	**0**	**9**	**11 – 9 = 2**
2 – 1 =1	**1**	**11**	**13 – 11 = 2**
	2	**13**	

Because the first differences are constant, this relationship is linear. Similarly, we calculate second differences. For example, once we establish a constant increase for the independent variable, we calculate first differences and then, if necessary, second differences.

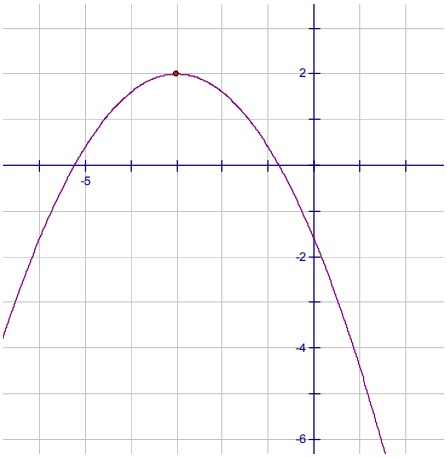
	x	y	First Differences	Second Differences
-2 - (-1) =1	-2	1	0 – 1 = -1	1 – (-1) = 2
0 - (-1) =1	-1	0	1 – 0 = 1	3 – 1 = 2
1 – 0 =1	0	1	4 – 1 = 3	5 – 3 = 2
2 – 1 =1	1	4	9 – 4 = 5	
	2	9		

Here, we see the first differences are not constant so we go on and calculate the second differences. We find the second differences are constant and therefore, this relationship is quadratic.

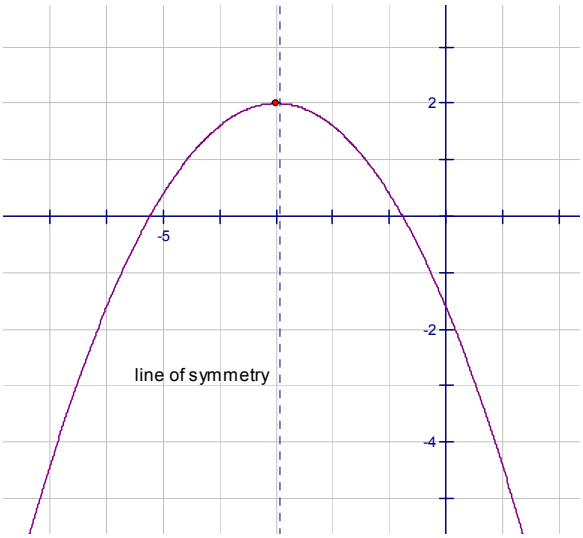
Because the graph of any quadratic relation is the shape of a parabola, we must understand that a parabola has two forms. For example, a positive parabola with A > 0 can look like:



And a negative parabola with A < 0 can look like:



It is important to note that a parabola is a smooth curve of this specific shape. Other curves are possible, but are not parabolas. Parabolas are symmetric meaning that they fold onto themselves on a vertical line of symmetry through the centre. For example, in our last parabola



The line of symmetry appears at x = -3. X and y intercepts can be found in any graph that we are given. Remember the x intercepts occur when the value of y is zero. *Factoring and solving may be necessary to find x intercepts.* Y intercepts occur when the value of x is zero. The y intercept is also the value of C from our equation.

The vertex of a parabola is the highest or lowest point in the curve. Whether this point is the highest or lowest depends on whether the parabola opens up or down. The equation of the line of symmetry occurs at the x value of the vertex.

- ***homework assignment:*** **<u>Principles of Mathematics 10</u> p. 132 # 5, 9**
  p. 136 # 2, 3, 4, 6