BIG PICTURE of this UNIT:	• How do we WORK WITH & EXTEND the concept of "functions" • Why are quadratic equations written in different forms? • How do we EXTEND and APPLY our knowledge of quadratic functions, beyond the basics of IM2?

This lesson will be based upon a STUDENT DIRECTED DISCUSSION model ….. in your groups, you should be having DISCUSSIONS about how to think and work through and then present the solutions to the following questions. So, discuss & prepare solutions to the following questions. Record the key ideas of your discussions/solutions in your notebook. Then, once you have had your discussions, present your solutions on the board. Solutions do NOT necessarily NEED to be correct – they simply form the basis for DISCUSSIONS!!!! If your group has (i) multiple solutions that lead to the same answers OR (ii) same/different solutions that lead to different answers, present them ANYWAY!!

1. Below is a picture of Sydney Harbour Bridge. The bottom "arch" is shaped as a parabola. You will need to research some data about the bridge so that you can create an equation you can use to model this bridge. {15,18}

2. Use the completing the square strategy to solve the following quadratic equations: {11}

   a. $x^2 - 10x + 22 = 0$ b. $m^2 - 9m - 4 = 3$ c. $2x^2 + 12x = 17$

3. For the following parabolas, find the vertex and the zeroes. Hence, rewrite the equation of each parabola in vertex form as well as factored form. {8,11}

   a. $f(x) = x^2 - 10x + 22$ b. $p(m) = m^2 - 9m - 7$ c. $g(x) = 2x^2 + 12x - 17$

4.

Lila is creating dog runs for her dog kennel. She can afford 30 m of chain-link fence to surround four dog runs. The runs will be attached to a wall, as shown in the diagram. To achieve the maximum area, what dimensions should Lila use for each run and for the combined enclosure?

{15,17,18]

a. Show that the equation that should be used to model this problem is $A(w) = (30-5w)w$.

b. Find the dimensions of the enclosure that should be used to maximize the area of the combined enclosure.

5. You will find a picture of my friend who visited Arches National Park a couple of years ago. She is 5 foot 6 inches tall. Determine an equation you can use to model the arch under which she is standing {15,17,18]

6. For each equation, first find the value of discriminant and state how many solutions the equation should have. Then, solve each equation using the quadratic formula. You can verify graphically on the GDC (using a graph or POLYSMLT2). {10,13}

   a. $0 = 3x^2 + 6x - 11$ b. $0 = 3x^2 - 6x + 3$ c. $1 = x^2 - 4x$

7. The revenue generated by a dance at school is modelled by the equation $R(t) = -60t^2 + 600t$, where R is the revenue in dollars and t is the ticket price in dollars. To find the PROFIT, the equation $P = R - E$ is used, where E represents the expense equation. {9,15,16}

   b. It was found that the expenses equation was a linear equation, $E(t) = 1000 - 90t$. Calculate the break even price for the tickets.

   c. Find the maximum profit and the ticket price that earns this profit.

   d. Determine the equation of the INVERSE of the Revenue function & explain what this equation can be used for.

Higher Level Questions for More Complex Concepts OR an EXTENSION of basic concepts involved with Quadratic Functions.

1. Here is a link to an animation showing a new definition of a parabola ➔ a locus definition of a parabola. Adjust the slider to "p" and a set of points will be produced, forming the shape of a parabola.

   https://www.geogebra.org/m/B8FNy9v5 and then this video https://www.youtube.com/watch?v=Ct-AoSbvPQY

   a. Define the terms: (i) locus, (ii) focus, (iii) directrix
   b. Determine the equations of these parabolas, given the following conditions:
      i. The focus is at (0,-3) and the vertex is at the origin.
      ii. The directrix is the line 2x + 10 = 0 and the vertex is at the origin.
      iii. The focus is on the x-axis, the parabola goes through the point (5,2) and the vertex is at the origin.
      iv. The directrix is the line x = -3, the focus is at (7,2) and the parabola goes through the point (9,10).

2. Find all values for m for which the roots of $2x^2 - mx - 8 = 0$ differ by $m - 1$.