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. (**CI**) Given quadratic function $f(x) = -\frac{1}{2}(x+8)(x-6)$: {3,5,6}

   a. find the zeroes

   b. find the axis of symmetry

   c. find the vertex

   d. find the y-intercept

   e. write the equation in standard form

   f. write the equation in vertex form

   g. Sketch the parabola, labelling key features

   h. State the domain interval in which the function values are **increasing**.

2. A quadratic function is defined by the equation $f(x) = x^2 - 4x - 5$. {3,5,6}

   a. Determine the equation of the axes of symmetry.

   b. Determine the vertex of this parabola.

   c. Rewrite the equation in vertex form and state the optimal value of the quadratic function.

   d. Find the zeroes of the parabola.

   e. Sketch the parabola, labelling the vertex and the y-intercept.

   f. Solve $f(x) = -5$.

   g. State the domain interval in which the function values are **decreasing**.

3. Expand and simplify the following binomial products: {7,8}

   a. $(2x + 3)(3x + 4)$ b. $-(3a - 8)(2a + 3)$ c. $\frac{1}{2}(5x + 8)(x - 6)$ d. $(4 - 3x)^2$

   e. $(5x - 6)(5x + 6)$ f. $5(2t - 9)(6 - t)$ g. $-5(11 - t)(3t + 2)$ h. $(2x - 1)^2(x - 4)^2$

4. Factor the following trinomials: {7,8}

   a. $6x^2 - 13x - 5$ b. $3x^2 + 10x - 25$ c. $10x^2 + 17x + 3$ d. $6x^2 - 7x - 3$

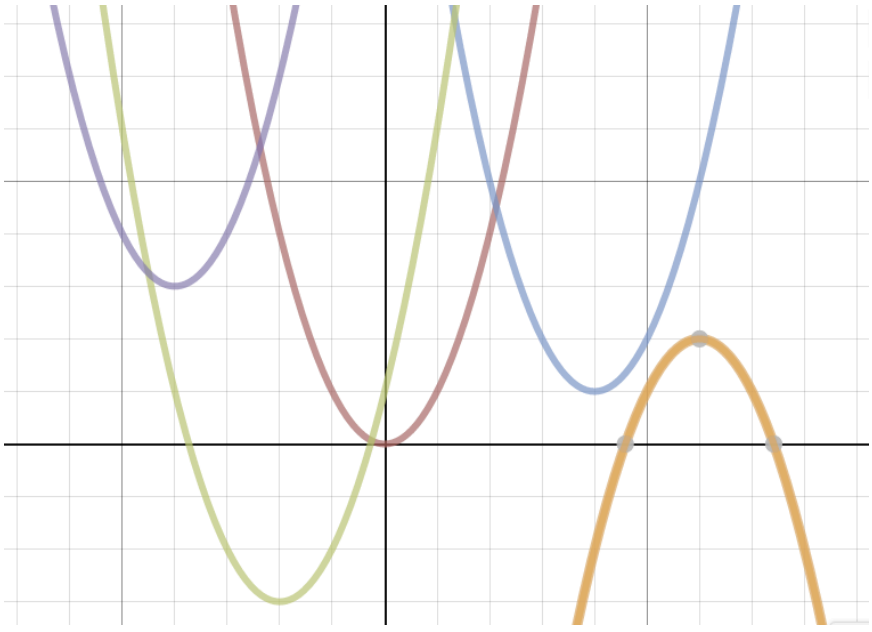
   e. $12x^2 - 28x - 5$ f. $3x^2 - 32x + 45$ g. $14x^2 - 9x + 1$ h. $12x^3 - 8x^2 - 15x$

5. Solve the following quadratic equations. {9}

   a. $x^2 - 5x - 14 = 0$ b. $3x^2 - 5x - 2 = 0$ c. $4x^2 - 3 = 4x$

   d. $(x + 3)^2 = 9$ e. $-2(x + \frac{1}{2})^2 = -32$ f. $4.9(t - 5)^2 - 25 = 50$

6. (CI) You are given graphs of parabolas in the form of $y = (x - \boldsymbol{h})^2 + \boldsymbol{k}$. PREDICT the equations of each one & give a reason for your prediction. The parent function, $y = x^2$, is the purple curve. After each equation, describe how the parent function was transformed to create the new function. {3,5,6}



(a) light blue curve

(b) light brown curve

(c) light green curve

(d) dark blue curve

7. (CI) Sketch the graph of $f(x) = 2(x + 4)^2 - 8$ by transforming the graph of $y = x^2$ (HINT: What transformations are you being asked to make?) Sketch both graphs, label each graph. Label the points (1,1) and (-1,1) on the parent function. Then label the corresponding, transformed points (i.e. where do these two original points wind up, AFTER the transformation?) {3,5,6}

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

1. (CI) Quadratic Composites: given the quadratic function $g(x) = x^2 - 2x - 8$: {25}
   a. Determine the zeroes of $g(x)$.
   b. Now let $f(x) = 2^x$. Write the equation for the composite $g \circ f(x)$. Hence, solve $g \circ f(x) = 0$.
   c. Again, let $f(x) = 2^x$. Write the equation for the composite $f \circ g(x)$. Hence, solve $f \circ g(x) = 1$.
   d. Show that $2^{2x-1} = \frac{1}{2}\left(2^x\right)^2$. HENCE, solve $2^{2x-1} - 2^{x+1} - 6 = 0$ and show that $\log_2 6$ is a solution.

2. Explain what a complex number is and why mathematicians "invented" complex numbers. {21,22}

3. Quadratic Composites: given the quadratic function $g(x) = x^2 - 2x - 8$: {23, 25}
   a. Determine the zeroes of $g(x)$.
   b. Now let $f(x) = x^2$. Write the equation for the composite $g \circ f(x)$. Hence, solve $g \circ f(x) = 0$.