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. Write the equations of the following parabolas: {18}
   a. It has a vertex at (4, −3) and passes through (2, −15).
   b. It has a y – intercept of –2 and passes through the points (1, 0) and (−2,12).

2. (CI) Find the roots of the quadratic equations: {9,10}
   a. $f(x) = 2x^2 + 13x + 15$ b. $f(x) = 3x^2 - 11x + 10$ c. $f(x) = 3x^2 - 7x - 6$

3. (CI) Solve the quadratic equations: {9,10}
   a. $0 = 6x^2 + 23x + 7$ b. $36x^2 = -39x + 35$

4. Factor the following quadratic expressions: {7,8}
   a. $6x^2 + 11x - 10$ b. $8x^2 - 18x - 5$ c. $9x^2 + 101x + 22$

5. Use a GRAPH to help you factor the following quadratic functions. Include an explanation as to WHY and HOW a graph can help you write an equation in factored form. {4,7,8}
   a. $2x^2 + 13x + 15$ b. $3x^2 - 11x + 10$ c. $3x^2 - 7x - 6$

6. (CI) Find the roots of $9(x-3)^2 - 16(x+1)^2 = 0$ {7,8}

7. Mr. S. is given the equation $\frac{1}{x-3} + \frac{1}{x+1} = 1$ and is being asked to solve for x; {7,8}

   a. Graph the system $f(x) = \frac{1}{x-3} + \frac{1}{x+1}$ and $g(x) = 1$ and find the intersection point(s).

   b. Explain WHY Mr S uses this **system** to solve the original equation.

   c. Graph the parabola $k(x) = x^2 - 4x - 1$ and find the zeroes. What do you notice, given your work in the previous parts of this question?

Mr. S now has NO calculator, so must provide an algebra based solution for this problem. He carries out the following steps:

$$\frac{1}{x-3} + \frac{1}{x+1} = 1$$
$$(x+1) + (x-3) = 1(x-3)(x+1)$$
$$2x - 2 = x^2 - 2x - 3$$
$$0 = x^2 - 4x - 1$$

   d. Explain what Mr. S. did to get the second line of his solution.

   e. Given the work & explanations, solve the following:

      i. $\frac{1}{x+3} + \frac{1}{x-3} = 1$

      ii. $\frac{1}{x} + \frac{1}{x+1} = \frac{5}{6}$

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

1. Graph the following complex numbers and hence or otherwise, determine $|z|$ for each complex number.

   a. $z = 3 + 2i$
   b. $z = -5 + 4i$
   c. $z = -6 - 3i$
   d. $z = 2\text{i}$
   e. $z = 5$

2. Show a graphic representation of vector addition wherein you work with $z_1 = 3 + 5i$ and $z_2 = -4 - 2i$.

   a. Then show the result of $z_1 + z_2$.
   b. How about vector subtraction ➔ try $z_1 - z_2$
   c. Now try and then $z_2 - z_1$
   d. What about division and multiplication ➔ graph the result.