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**) Sketch the parabola $f(x) = 2(x - 3)^2 - 8$ by HAND by working through the following steps: {4,5}

a. Start with the graph of the parent function, $y = x^2$. Label 3 points. State the location of the "optimal point" (i.e. vertex)

b. List the required transformations, given that the "new" equation is $f(x) = 2(x - 3)^2 - 8$

c. Now apply the transformations to $y = x^2$ and graph the "new" parabola. Label three (3) points. State the location of the optimal point (vertex)

2. A parabola whose vertex is at (-4,12) and goes through the point (2, -6). {3,4,5}

a. Write the equation in vertex & in standard form

b. Determine the y-intercept of this parabola.

c. Determine 2 other points of the parabola (HINT: It's easy to use symmetry).

d. Explain how the parent function $y = x^2$ was transformed.

e. Find the zeroes of the parabola and HENCE write the equation in factored form.

f. Sketch the parabola, labelling the points you determined in previous questions.

3. (CI) Given the quadratic relation $y = x^2 - 8x + 12$; {3,4,9}

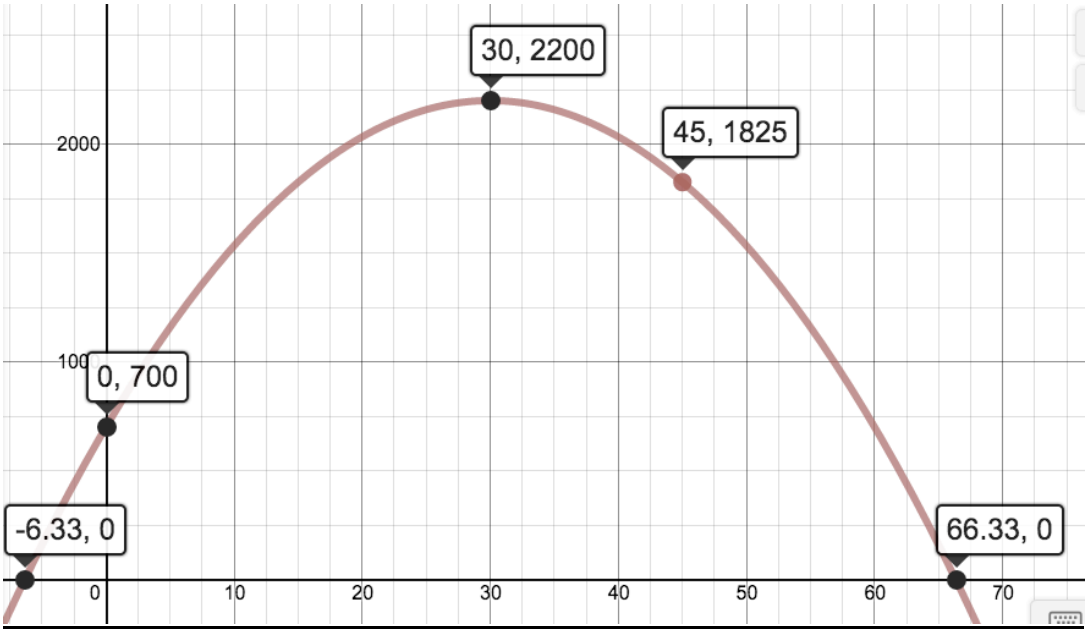
a. Solve $0 = x^2 - 8x + 12$. What does your solution mean?

b. Solve $-3 = x^2 - 8x + 12$. What does your solution mean?

c. Solve $5 + 8x = x^2 + 12$. What does your solution mean?

d. Sketch a graph of this parabola and label all key points/features.

4. Mr S's sister is a motorcycle instructor and runs a training school. Because she works for herself, she can charge any amount (as an hourly charge) that she wishes. She keeps track of her hourly fees and her profits and has prepared a graph showing the relationship between her hourly wages and her profits. In this relation, the variables: x represents the hourly fee my sister charges & y represents the monthly profit she makes. {1,3,15,16,18}



a. State a reasonable domain and range for this relationship, given the context of the problem

b. State the coordinates of the vertex and explain its meaning in this context

c. State the zero(s) of the relation and explain its meaning in this context

d. HENCE, write the equation in FACTORED form

e. Write the equation in STANDARD form.

f. Evaluate $P(45)$ and explain its meaning

g. Evaluate $P(15)$ and explain your thinking

h. Hence or otherwise, solve $P(x) = 1825$

i. Determine the equation for this relation in VERTEX form. Show your work

j. My sister would like to know what hourly fee OPTIMIZES her profits?

5. (CI) Quadratic Algebra Skills Review: {7,9}
   a. Solve the equation $0 = -2(x + 2)^2 + 3$
   b. Find the vertex of the parabola $f(x) = x^2 + 6x - 7$. HENCE, write the equation in vertex form.

6. (CA) Mr. S's brother is a carpenter and builds fences and decks for his clients. Because he works for himself, he can charge any amount (as an hourly charge) that he wishes. He keeps track of his hourly fees and his profits and has prepared a DATA TABLE showing the relationship between the hourly wages and his profits. In this relation, the variables: x represents the hourly fee my brother charges and y represents the monthly profit he makes. {15,16,18,20}

   Here is the data set

Hourly fee	10	22	31	17	45	51	38
profit	1300	1750	1700	1600	950	400	1400

   a. Graph the data points on graph paper and HAND DRAW the curve of best fit. ESTIMATE the value of the vertex and HENCE, determine the equation of this quadratric model.
   b. Graph the data points on the TI-84.
   c. On your TI-84, attempt to draw the parabola that best fits the data set using a guess and check method. Explain what values/coefficients you are using and why you are using them & how you know that the values/coefficients you selected are or are not reasonable.
   d. Use the TI-84 to determine the QUADREG equation.

7. (CI) Given the quadratic relation $y = 6x^2 + x - 15$, {3,4,9}
   a. Factor $y = 6x^2 + x - 15$
   b. Solve $0 = 6x^2 + x - 15$
   c. Solve $36 = 6x^2 + x - 15$
   d. Find the vertex and re-write the equation in vertex form.

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

1. The Next Cup coffee shop sells a special blend of coffee for $2.60 per mug. The shop sells about 200 mugs per day at this price. Customer surveys show that for every $0.05 decrease in price, the shop would sell 10 more mugs per day. {7,9,15,16}

(HINT: start with numbers and a data table to see what may be going on)

(a) Determine the REVENUE that the coffee shop makes initially, given the price per mug and the amount of mugs sold.

(b) Since we are making changes in the pricing & revenues of the coffee shop, we need to decide upon an INDEPENDENT variable to use in modeling a change in the revenues ➔ so we need an R(x) equation …..

(c) Determine the MAXIMUM daily revenue from coffee sales and the price per mug in order to earn this revenue.

(d) Write an equation in both standard form and vertex form to model this problem. Then sketch the graph.

2. A parabola with the equation of $g(x) = a(x - h)^2 - 2$ goes through the points (1,2) and (-5,-1). Find the values of a and h. After you have the equation for $y = g(x)$, then perform the compositions $g \circ g^{-1}(x)$ and $g^{-1} \circ g(x)$. What do you notice and why?