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. What is a perfect square trinomial? Use your research to answer the following question ➔ Determine the value of c that will create a perfect-square trinomial. Verify by factoring the trinomial you created AND by graphing the trinomial. {11}

   a. $x^2 + 8x + c$ b. $x^2 + 40x + c$ c. $x^2 - 14x + c$

   d. $x^2 - 5x + c$ e. $x^2 + 3x + c$ f. $x^2 + x + c$

   g. $x^2 + 4x + \boldsymbol{c}$ h. $x^2 + 12x + \boldsymbol{c}$ i. $x^2 - 20x + \boldsymbol{c}$

2. If the length of one side of a square is tripled and the length of an adjacent side is increased by 10, the resulting rectangle has an area that is 6 times the area of the original square. Find the length of a side of the original square. {17}

3. (CI – Ideally) Sounds Inc. makes CD players. Last year, accountants modelled the company's profit by using the equation $P(x) = -5x^2 + 60x - 135$. Over the course of the next year, in an effort to become more efficient, Sounds Inc. restructured its operation (eliminating some employees and reducing costs). This year, accountants are using the model $P(x) = -7x^2 + 70x - 63$ to project the company's profit. In both models, P is the profit in hundreds of thousands of dollars and x is the number of CDs made, in the hundreds of thousands. Was Sounds Inc's restructuring effective? Justify your answer. {15,16}

4. The following algebra review questions deal with perfect square trinomials and are important in understanding the completing the square method. {7,8,9,11}

Expand $(x + 3)^2$ Solve $0 = (x + 3)^2$	Expand $(x - 2)^2$ Solve $0 = (x - 2)^2$	Expand $(2x + 5)^2$ Solve $0 = (2x + 5)^2$	Expand $(x + h)^2$ Solve $0 = (x + h)^2$
Factor $x^2 + 8x + 16$ Solve $0 = x^2 + 8x + 16$	Factor $x^2 - 6x + 9$ Solve $0 = x^2 - 6x + 9$	Factor $x^2 + 14x + 49$ Solve $0 = x^2 + 14x + 49$	Factor $x^2 + 2cx + c^2$ Solve $0 = x^2 + 2cx + c^2$
(b) Graph several of these "perfect square trinomials. What do you notice?			
(c) What value does c have so that the trinomial is a "perfect square trinomial"?			

5. (CI) Mr Santowski runs a clothing business and models how his revenues on sales of denim jeans are related to price changes. He uses the quadratic equation $R(x) = 300 + 20x - x^2$, where R represents his daily revenue in dollars and x represents an increase or decrease in price.

   (So $x = +1$ represents a price increase of 1 dollar and $x = -2$ represents a price decrease of 2 dollars) {2,4,15,16}

   a. Determine the price change that will result in maximum revenues. What is the maximum revenue
   b. Factor the equation $R = 300 + 20x - x^2$.
   c. Solve the equation $0 = 300 + 20x - x^2$ and interpret what the answers mean, given the context.
   d. Solve the equation $300 = 300 + 20x - x^2$ and interpret what the answers mean, given the context.
   e. Make a sketch of the relation.
   f. Solve the equation $375 = 300 + 20x - x^2$ and interpret what the answers mean, given the context
   g. Solve the equation $144 = 300 + 20x - x^2$ and interpret what the answers mean, given the context

6. (CI) Sketch the parabola $g(x) = -3(x+5)^2 + 12$ and label the key points (vertex, y-intercept, x-intercept(s), axis of symmetry. Secondly, graph the inverse of g(x) and determine its equation. {3,4,5}

7. Mr. S has run through a detailed solution to this question: Solve the equation $0 = x^2 + 8x + 12$ using the square root method (Solution is shown on the left side of the following chart). On the right side of the chart are questions asking why the various steps where performed. Answer these why questions. {11}

SOLVE BY SQUARE ROOT METHOD	Complete the Square & then Square Root
Example #1: Solve the equation $0 = x^2 + 8x + 12$ using the square root method.	**Why Did I Do That????**
To solve $0 = x^2 + 8x + 12$:	
STEP 1: $-12 = x^2 + 8x$  **#1**	STEP #1 ➔ Why is there a -12 on the left side?
STEP 2: $-12 + 16 = x^2 + 8x + 16$  **#2B** **#2A**	STEP #2A ➔ Why do I want a 16 on the right side? STEP #2B ➔ Why is there a +16 on the left side?
STEP 3: $4 = (x + 4)^2$  **#3**	STEP #3 ➔ Where did the $(x + 4)^2$ come from?
STEP 4: $\pm 2 = (x + 4)$ So $-2 = x + 4$ ➔ $x = -6$ And $2 = x + 4$ ➔ $x = -2$	STEP #4 ➔ Where did the exponent of 2 go?

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

1. The underside of a concrete railway underpass forms a parabolic arch. The arch is 24 m wide at the base and 8.0 high in the center. The upper surface of the underpass is 40 m wide. The concrete is 2 m thick at the center. Can a truck that is 5 m wide and 7.5 tall get through this underpass if the time is 3:30pm? (HINTS below pic) {2,9,17}

(a) Visualize the information by drawing a diagram wherein you label the relevant information.

(b) Recall that our general starting point would be a quadratic model and that the vertex form of the quadratic equation is $y = a(x - h)^2 + k$

(c) How can you use the quadratic equation to address the problem of the truck passing through the underpass?

5. If $f(x) = x^2 - x + 5$ and $g(x) = 2x^2 - x + 3$, solve $f(x) > g(x)$ {26}