A. Lesson Context

BIG PICTURE of this UNIT:	• How & why do we build NEW knowledge in Mathematics? • What NEW IDEAS & NEW CONCEPTS can we now explore with specific references to QUADRATIC FUNCTIONS? • How can we extend our knowledge of FUNCTIONS, given our BASIC understanding of Functions?		
CONTEXT of this LESSON:	Where we've been In Lesson 4, you worked with quadratic functions in the form of $y = \boldsymbol{a}(x - \boldsymbol{h})^2 + \boldsymbol{k}$	Where we are HOW do we apply the vertex form of quadratic models	Where we are heading How do we extend our knowledge & skills of quadratic functions, given the new ideas & concepts we now know about functions.

B. Lesson Objectives

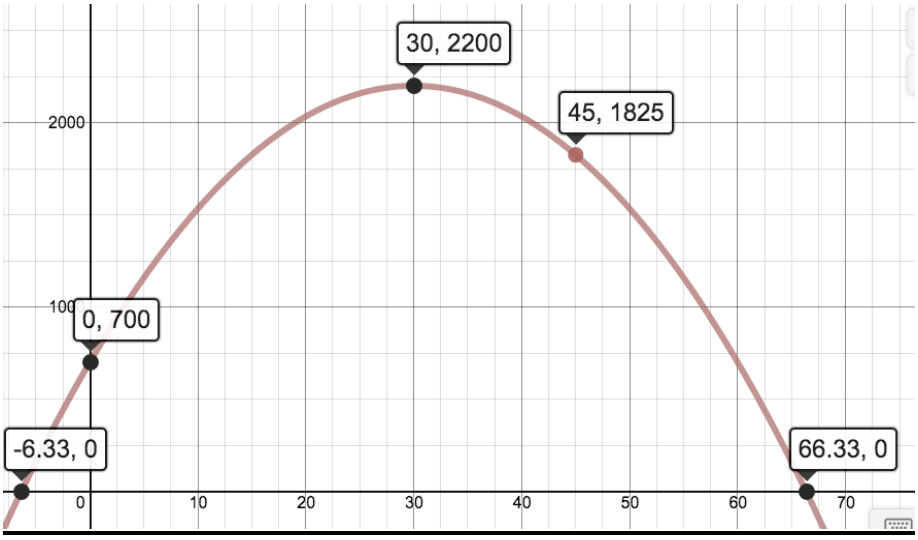
a. Apply the equation $y = \boldsymbol{a}(x - \boldsymbol{h})^2 + \boldsymbol{k}$ to geometrical contexts and to modeling contexts as well as data contexts (scatter plots)

C. Fast Five (Skills Review Focus)

Mini White Boards QUIZLET ➔ Sketching variations of $f(x) = \boldsymbol{a}(x - \boldsymbol{h})^2 + \boldsymbol{k}$	
Solve the equation: $0 = (x + 2)^2 - 9$	Factor $3x^2 - x - 2$ and then solve for x.
Expand the expression $-2(x + 3)^2 - 7$	Expand $(4 - 3x)^2$

D. Modeling with Quadratic Functions (Example #1)

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

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

(e) Evaluate P(15) and explain your thinking.

(f) Determine the equation for this relation. Show your work

(g) My sister would like to know what hourly fee OPTIMIZES her profits?

E. Modeling with Quadratic Functions (Example #2)

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 DATA TABLE showing the relationship between her hourly wages and her profits.

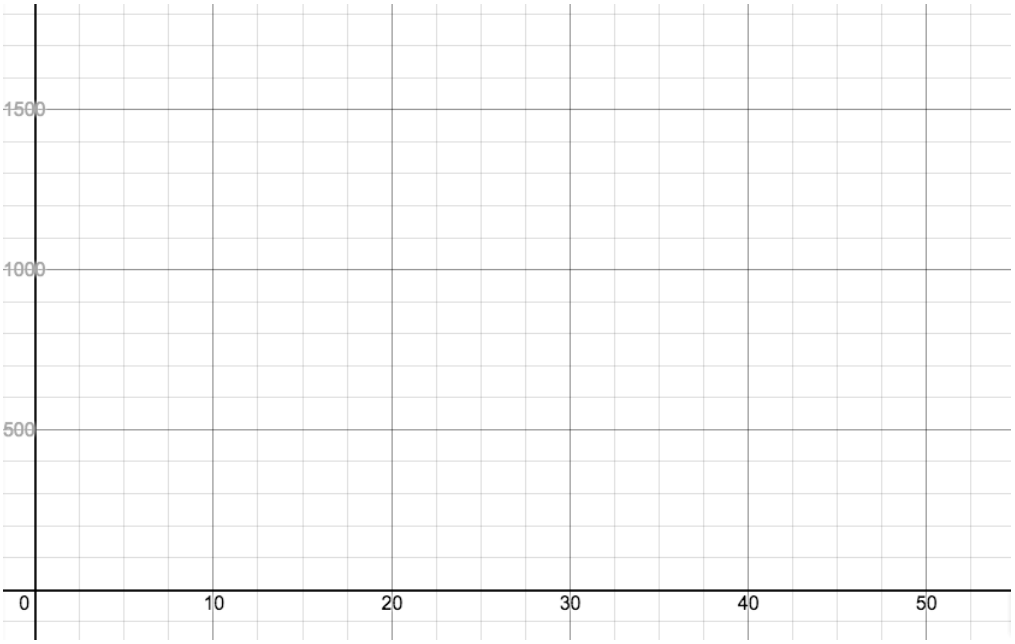
Here is her data set

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

In this relation, the variables:

X represents the hourly fee my sister charges

Y represents the monthly profit she makes



(a) Graph the data points

(b) Draw the parabola that best fits the data set as well as you can.

(c) Determine the equation for this relation. Show your work.

(d) My sister would like to know what hourly fee OPTIMIZES her profits?

(e) from your equation in question (c), expand and rewrite on standard form

(f) Use your TI-84 to determine the equation of the regression curve that best fits your data set.

F. Modeling with Quadratic Functions (Example #3)

(a) Determine the equation of a parabola whose vertex is at (-4,12) and goes through the point (2, -6)
(b) Determine the y-intercept of this parabola.
(c) Determine 2 other points of the parabola (HINT: its easy to use symmetry)
(d) Explain how the parent function $y = x^2$ was transformed.
(d) Sketch the parabola, labelling the 5 points you determined through Qa,b,c

G. Closing Exercise: Why Transform Functions in the First Place?

To help you through this transformation exercise, I have set up a DESMOS graph for you already. Follow this link to the graph in DESMOS for the quadratic data set exercise

To help you through this transformation exercise, I have set up a DESMOS graph for you already. Follow this link to the graph in DESMOS for the exponential data set exercise

To help you through this transformation exercise, I have set up a DESMOS graph for you already. Follow this link to the graph in DESMOS for the periodic data set exercise