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 5 DAY 2, you were introduced to different types of transformations	Where we are WHY & HOW do we transform parent functions, specifically a quadratic function	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. Review KEY IDEAS in transformation of parent function, as summarized by the transformational equation $y = a\boldsymbol{f}(b(x - c)) + d$

b. Investigate how critical points "behave" during the transformations and thus predict the new location and shape of the final transformed function

c. Apply the idea of transforming a parent function to further functions

C. Fast Five

Given the following equations, describe HOW the parent function will be transformed. You are provided with the "transformed" equation. The key terms I expect in your answers will be: {translated left/right/up/down by ……, stretched in a vertical/horizontal direction by a factor of ……

Parent function	"new" transformed function	List of transformations
$y = x^2$	$y = 2x^2 + 4$	
$y = x^2$	$y = -(x+2)^2 - 7$	
$y = x^2$	$y = 4(x - 5)^2$	
$y = \boldsymbol{f}(x)$	$y = 0.25\boldsymbol{f}(x - 3) + 12$	
$y = \boldsymbol{g}(x)$	$y = \boldsymbol{g}(2(x - 1))$	
$y = \boldsymbol{h}(x)$	$y = \boldsymbol{h}(x + 1) - 3$	

D. In Class Example: Exploring Patterns to Make Connections

I will draw a piecewise function on DESMOS for you and I will make various transformations for you. Your task will be to follow what happens to the "key points" given my transformations and then make some "summary statements" about how the transformation changes the "key points"

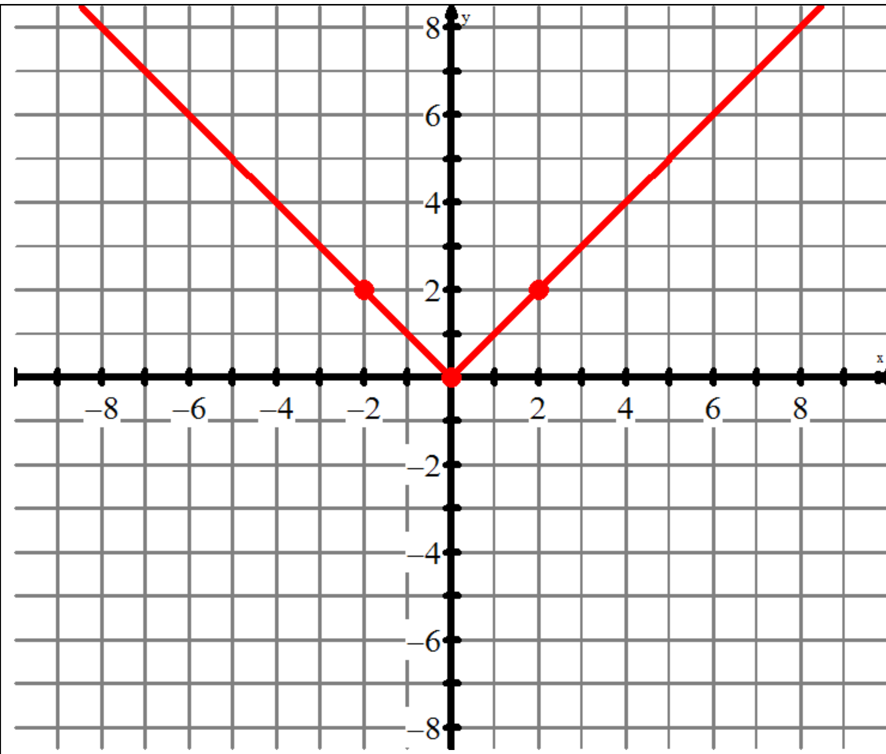
LINK to DESMOS GRAPH ➔ https://www.desmos.com/calculator/hfp69tnzvl

Changes to be made	**List of original key points**	**List of new locations of key points**	**Generalization**
Change a	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change d	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change a and d	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change b	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change c	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change b and c	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change c and d	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change a and c and d	(-2,4) (0,0) (2,4) (4,0) (5,-2)		
Change a, b, c and d	(-2,4) (0,0) (2,4) (4,0) (5,-2)		

E. Extending the Concepts – Working with Function Notation & Transformations

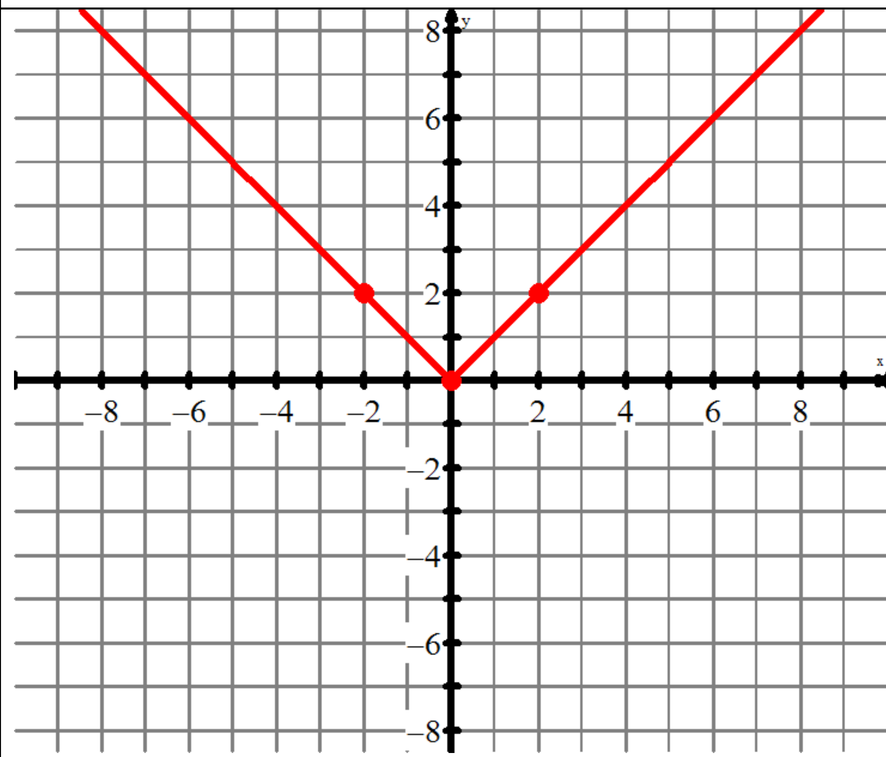
Example 1a: Now let f(x) be one of our new parent functions, f(x) = |x|. On the grid provided, I have sketched the parent function, clearly labelling the key points (0,0) and (2,2) and (-2,2)

(a) Graph $y = |x-4| - 5$, clearly labelling the new locations for the original key points



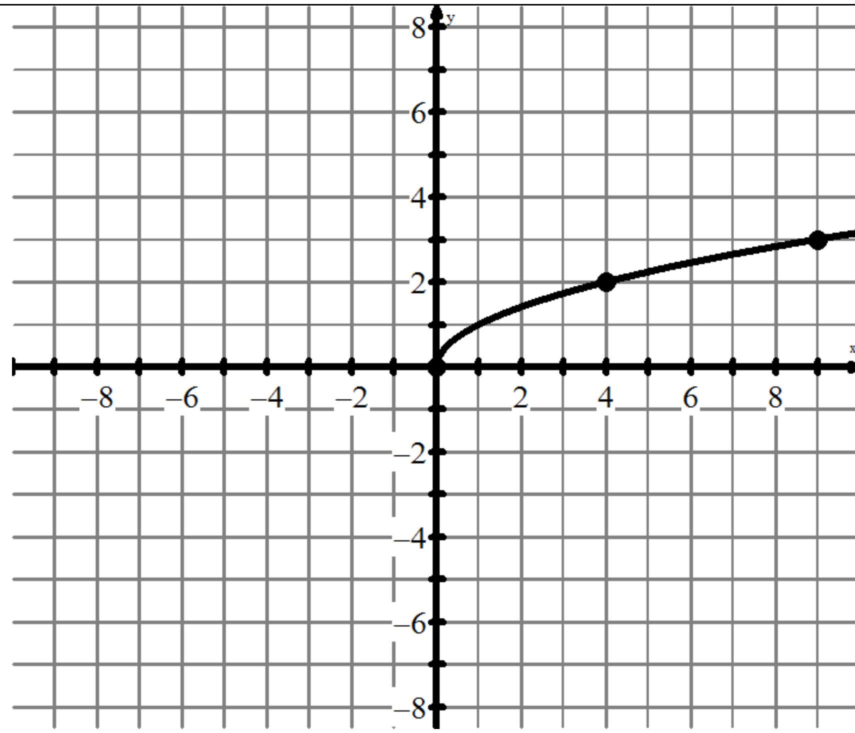
Example 1b: Now let f(x) be one of our new parent functions, f(x) = |x|. On the grid provided, I have sketched the parent function, clearly labelling the key points (0,0) and (2,2) and (-2,2)

(b) Graph $y = \frac{1}{4}|x+2| + 3$, clearly labelling the new locations for the original key points



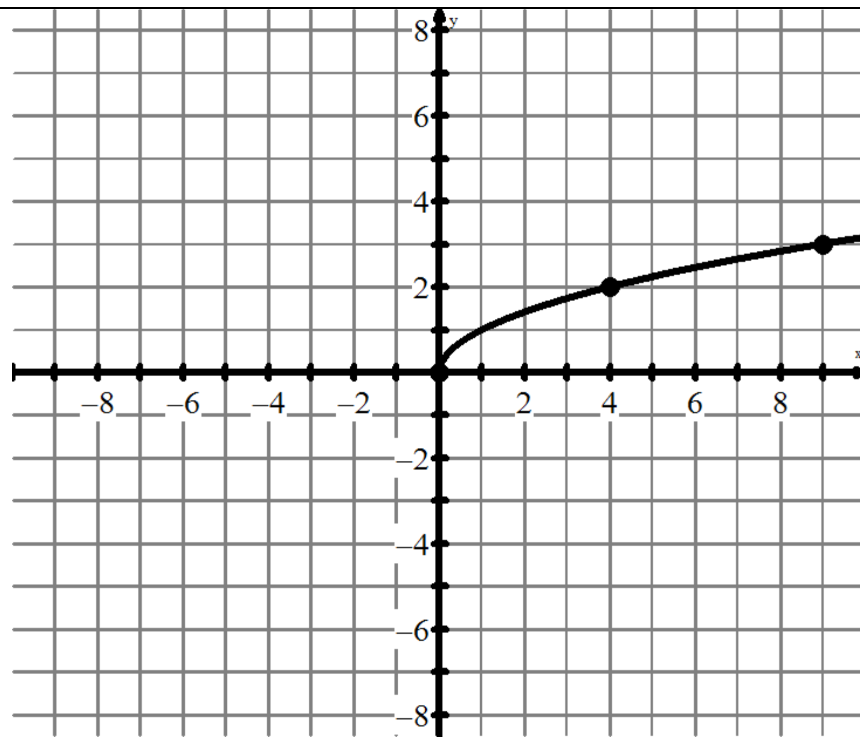
Example 2a: Now let f(x) be one of our new parent functions, f(x) = √x. On the grid provided, I have sketched the parent function, clearly labelling the key points (0,0) and (4,2) and (9,3)

(a) Graph $y = \sqrt{x+1} - 5$, clearly labelling the new locations for the original key points



Example 2b: Now let f(x) be one of our new parent functions, f(x) = √x. On the grid provided, I have sketched the parent function, clearly labelling the key points (0,0) and (4,2) and (9,3)

(b) Graph $y = 3\sqrt{x-2} + 1$, clearly labelling the new locations for the original key points



Example 3a: Now let f(x) be one of our new parent functions, f(x) = 1/x. On the grid provided, I have sketched the parent function, clearly labelling the key points (1,1) and (-1,-1) as well as the two asymptotes (on the x- and y-axis)

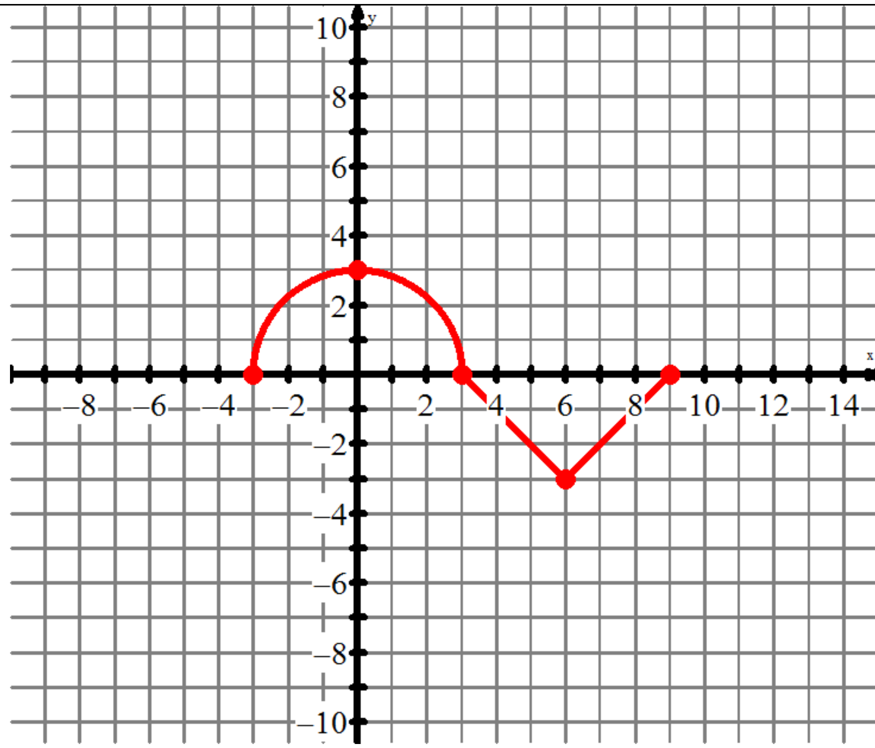
(a) Graph $y = \frac{1}{x-2} + 3$, clearly labelling the new locations for the original key points as well as the asymptotes

Example 3b: Now let f(x) be one of our new parent functions, f(x) = 1/x. On the grid provided, I have sketched the parent function, clearly labelling the key points (1,1) and (-1,-1) as well as the two asymptotes (on the x- and y-axis)

(b) Graph $y = \frac{-3}{x} + 2$, clearly labelling the new locations for the original key points as well as the asymptotes

Example 4a: Now let f(x) be a piecewise function. On the grid provided, I have sketched the parent function, clearly labelling the 5 key points.

(a) Graph $y = 2f(x-3)+1$, clearly labelling the new locations for the original key points



Example 4b: Now let f(x) be a piecewise function. On the grid provided, I have sketched the parent function, clearly labelling the 5 key points.

(b) Graph $y = -f\left(\frac{1}{2}\right)-3$, clearly labelling the new locations for the original key points