MPM 2D Handout/Activity
5.2 Exploring Translations of Quadratic Relations

This is the complete version of the handout. My answers are in red!

Instructions:

Use the Desmos graphing calculator (free app or website) to complete the activity outlined below. Record your answers on this sheet or on a separate sheet if you cannot print. A grid has been provided to draw the graphs. You can also do this on your own graph paper or you can save your graphs from Desmos if you are using the website.

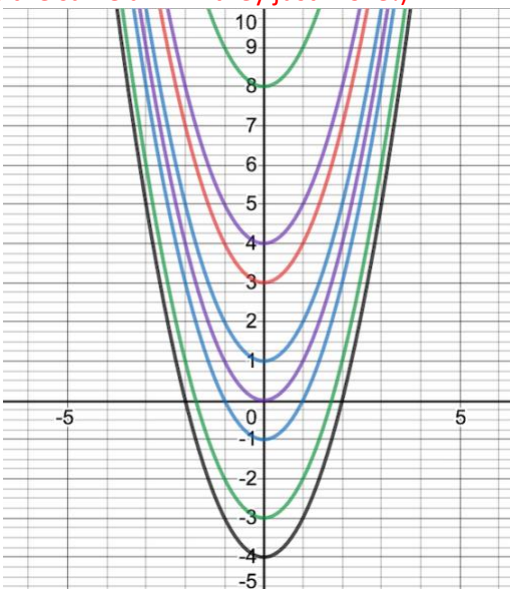
Activity: (adapted from your text book)

1) Graph $y = x^2$, $y = x^2 + 1$ and $y = x^2 - 3$ using Desmos. Complete the table below.

Equation	Value of 'k'	Distance and Direction from $y = x^2$	Vertex
$y = x^2$	0	Not applicable	(0, 0)
$y = x^2 + 1$	+1	Moves up 1 unit from $y = x^2$	(0, 1)
$y = x^2 - 3$	-3	Moves down 3 units	(0, -3)
$y = x^2 + 4$	+4	Moves up 4 units	(0, 4)
$y = x^2 - 4$	-4	Moves down 4 units	(0, -4)
$y = x^2 + 3$	+3	Moves up 3 units	(0, 3)
$y = x^2 - 1$	-1	Moves down 1 unit	(0, -1)
$y = x^2 + 8$	+8	Moves up 8 units	(0, 8)

2) Make up five more equations of the form $y = x^2 + k$ and add them to your table from number 1. Graph them in Desmos and fill in the remaining columns. (Remember that you made these up so they probably aren't the same as mine!)

3) Sketch your graphs on the grid provided. (The shape is the same a = 1 – they just move!)



Note: For equations of the form $y = x^2 + k$, you are squaring x and then adding a constant to that value.

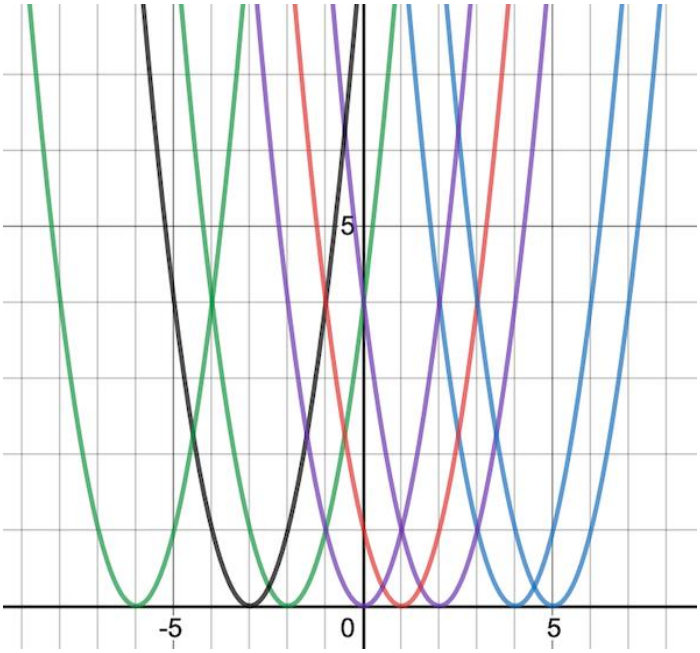
Now let's see what happens if we add a number to x BEFORE we square it. We are going to look at equations of the form $y = (x - h)^2$.

4) Graph $y = x^2$, $y = (x - 4)^2$ and $y = (x + 2)^2$ using Desmos. Note that we have put a value INSIDE the brackets this time! Complete the table below.

Equation	Value of 'h'	Distance and Direction from $y = x^2$	Vertex
$y = x^2$	0	Not applicable	(0, 0)
$y = (x - 4)^2$	4	Moves four units right from $y = x^2$.	(4, 0)
$y = (x + 2)^2$	-2	Moves 2 units LEFT	(-2, 0)
$y = (x - 2)^2$	2	Moves 2 units RIGHT	(2, 0)
$y = (x + 3)^2$	-3	Moves 3 units LEFT	(-3, 0)
$y = (x - 1)^2$	1	Moves 1 unit RIGHT	(1, 0)
$y = (x - 5)^2$	5	Moves 5 units RIGHT	(5, 0)
$y = (x + 6)^2$	-6	Moves 6 unit LEFT	(-6, 0)

5) Make up 5 more equations of the form $y = (x - h)^2$ and add them to the table above. Graph them in Desmos and fill in the remaining columns. (remember that yours probably won't match mine here!)

6) Sketch your graphs on the grid provided. (again, a = 1 so the graphs just move side to side. What was strange about the direction of movement? Why did this happen?)



Putting it All Together (these equations are of the form $y = (x – h)^2 + k$ – so they move side to side and up and down!!)

Complete the table provided as best you can. Use Desmos to check your graphs and to help you figure out missing information.

Equation	Value of h	Value of k	Relationship to $y = x^2$		Vertex
			Left/Right	Up/Down	
$y = x^2$	0	0	None	None	(0, 0)
$y = (x – 2)^2 + 4$	2	4	Right 2 units	Up 4 units	(2, 4)
$y = (x + 5)^2 - 1$	-5	-1	Left 5 units	Down 1 unit	(-5, -1)
$y = (x + 3)^2 + 6$	-3	6	Left 3 units	Up 6 units	(-3, 6)
$y = (x +6)^2 + 9$	-6	9	Left 6 units	Up 9 units	(-6, 9)

Summarizing Your Findings

- When an equation has the form $y = (x + h)^2$, my graph moves to the __left h units___.
- When an equation has the form $y = (x - h)^2$, my graph moves to the ___right h units_____.
- When an equation has the form $y = x^2 + k$, my graph moves ____up k units_____.
- When an equation has the form $y = x^2 - k$, my graph moves ____down k units_____.
- The h value is always _INSIDE__ the brackets, while the k value is always __OUTSIDE_the brackets.

When you are stating these transformations, you can say that the graph was translated h or k units in the appropriate direction. You can also replace translated with shifted if you want.