3. Predict how the graphs of each of the following equations will be the same or different from the graph of $y = x^2$.

	Similarities to the graph of $y = x^2$	**Differences from the graph of $y = x^2$**
$y = 5x^2$	Same vertex	stretch of 5 created a steeper slope
$y = (x + 5)^2$	Same slope	Left 5
$y = (5x)^2$		
$y = x^2 + 5$		up 5

4. Optima decided to test her ideas using technology. She thinks that it is always a good idea to start simple, so she decides to go with $y = x^2 + 5$. She graphs it along with $y = x^2$ in the same window. Test it yourself and describe what you find.

V: 5 points higher
o/c $f(x)+5$ moves up 5

5. Knowing that things make a lot more sense with more representations, Optima tries a few more examples like $y = x^2 + 2$ and $y = x^2 - 3$, looking at both a table and a graph for each. What conclusion would you draw about the effect of adding or subtracting a number to $y = x^2$? Carefully record the tables and graphs of these examples in your notebook and explain why your conclusion would be true for any value of k, given, $y = x^2 + k$.

translating up or down by k

+ up

− down

6. After her amazing success with addition in the last problem, Optima decided to look at what happens with addition and subtraction inside the parentheses, or as she says it, "adding to the x before it gets squared". Using your technology, decide the effect of h in the equations: $y = (x + h)^2$ and $y = (x - h)^2$. (Choose some specific numbers for h.) Record a few examples (both tables and graphs) in your notebook and explain why this effect on the graph occurs.

$y=(x+h)^2$ vertex left

$y=(x-h)^2$ vertex right

$-h$

7. Optima thought that #6 was very tricky and hoped that multiplication was going to be more straightforward. She decides to start simple and multiply by -1, so she begins with $y = -x^2$. Predict what the effect is on the graph and then test it. Why does it have this effect?

↳ Reflect X-axis

8. Optima is encouraged because that one was easy. She decides to end her investigation for the day by determining the effect of a multiplier, a, in the equation: $y = ax^2$. Using both positive and negative numbers, fractions and integers, create at least 4 tables and matching graphs to determine the effect of a multiplier.

$-3x^2$

↳ Dilate by a
↳ depends... if negative

2.2 Transformers: More Than Meets the y's

A Solidify Understanding Task

Write the equation for each problem below. Use a second representation to check your equation.

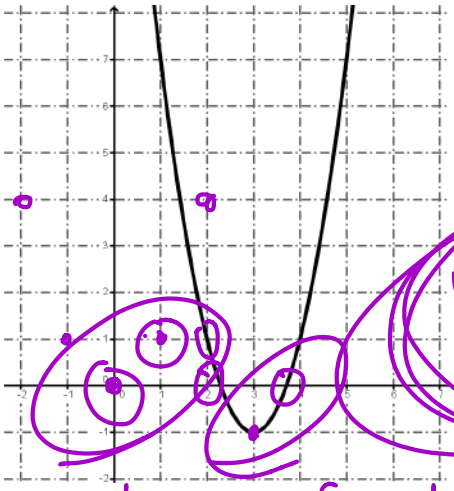
1. The area of a square with side length x, ~~where the side length is decreased~~ by 3, the area is ~~multiplied~~ by 2 and then 4 ~~square units are added to the area~~.

left

Dilated up

$y = 2(x+3)^2 + 4$

2.



$y = 2(x-3)^2 - 1$

$y = 2x^2 - 12x + 17$

x	y
1	7
2	1
3	-1
4	1
5	7

If not over 1 up 1 from vertex it had to be dilated

$(x-3)(x-3)$

$2x^2 - 6x + 9$

$2x^2 - 12x + 18$

-1

$y = 2(x-3)^2 - 1$

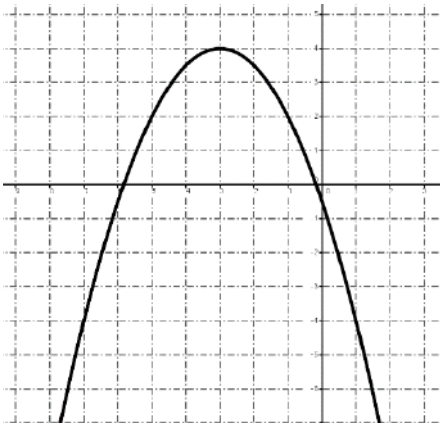
3.

x	*f(x)*
-4	7
-3	2
-2	-1
-1	-2
0	-1
1	2
2	7
3	14
4	23

$y = (x+1)^2 - 2$

$y = x^2 + 2x - 1$

4.



$y = -.5x^2 - 3x - .5$