Vertically Stretching and Reflecting a Quadratic Relation

We can vertically stretch the base graph of a quadratic relation by multiplying all of the y–values by a constant or numerical coefficient ($y = ax^2$).

Example – Complete each table of values and finite differences, plot each quadratic relation and compare each graph to the base graph.

$y = 3x^2$

x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			

$y = x^2$

x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			

$y = 0.5x^2$

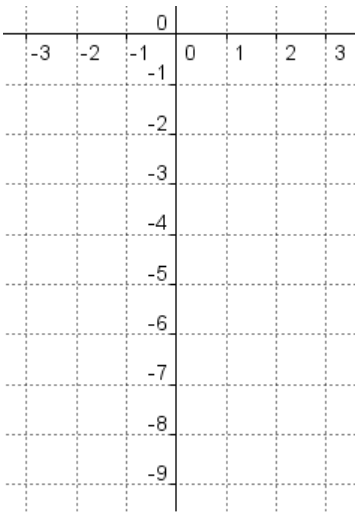
x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			

We can vertically reflect the base graph of a quadratic relation by multiplying all of the y–values by a negative number.

Example – Complete each table of values and finite differences, plot each quadratic relation and compare each graph to the base graph.

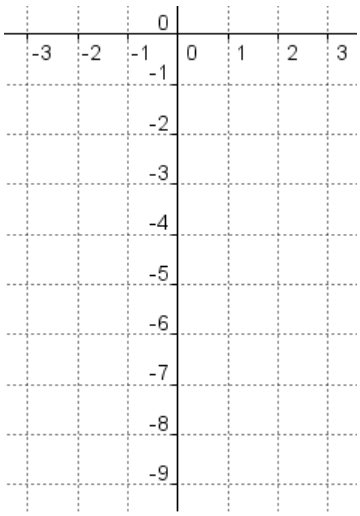
$y = -2x^2$

x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			



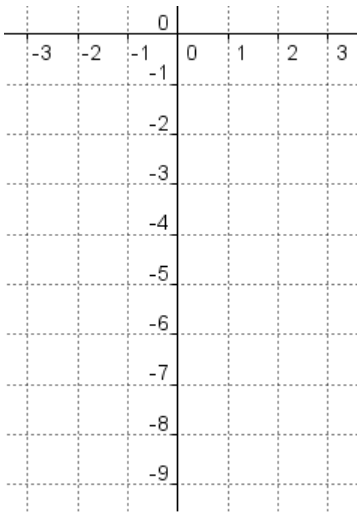
$y = -x^2$

x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			



$y = -\frac{1}{4}x^2$

x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			



Summary of Transformations for $y = ax^2$

If $a > 0$

If $a < 0$

If $|a| > 1$

If $0 < |a| < 1$

Let's investigate the step pattern. The step pattern can be used to help you graph a quadratic relation without using a table of values.

x	$y=x^2$
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

x	$y=2x^2$
-3	18
-2	8
-1	2
0	0
1	2
2	8
3	18

x	$y=0.5x^2$
-3	4.5
-2	2
-1	0.5
0	0
1	0.5
2	2
3	4.5

Complete the following table (start at the vertex).

x *over*	y *up/down*
1	
2	
3	

x *over*	y *up/down*
1	
2	
3	

x *over*	y *up/down*
1	
2	
3	

For the base curve, $y = x^2$:

x *over*	$y = x^2$ *up/down*
1	1
2	4
3	9

For $y = ax^2$:

x *over*	$y = ax^2$ *up/down*
1	1a
2	4a
3	9a

Graph $y = 2x^2$ using the step pattern.

x *over*	$y = ax^2$ *up/down*
1	
2	
3	

Graph $y = -0.5x^2$ using the step pattern.

x *over*	$y = ax^2$ *up/down*
1	
2	
3