Vertically Translating a Quadratic Relation

We can vertically translate the base graph of a quadratic relation by adding a constant to all of the y-values. The equation would be $y = x^2 + k$.

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

$y = x^2 + 4$

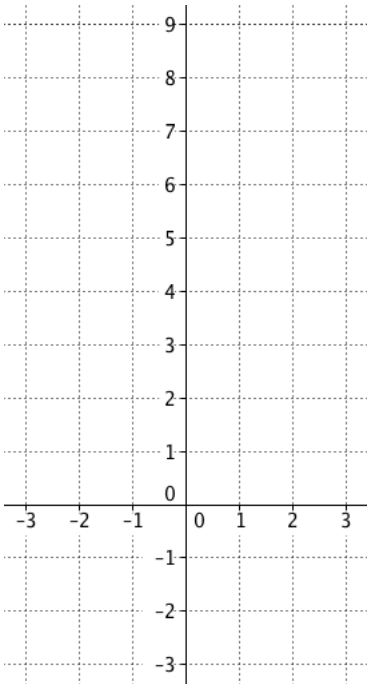
x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			

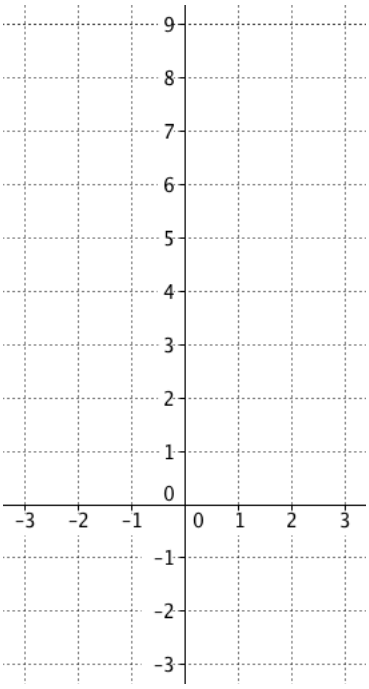
$y = x^2$

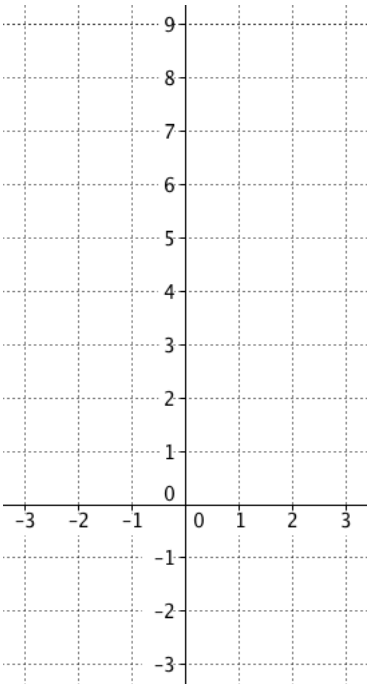
x	y	1st	2nd
-3			
-2			
-1			
0			
1			
2			
3			

$y = x^2 - 3$

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





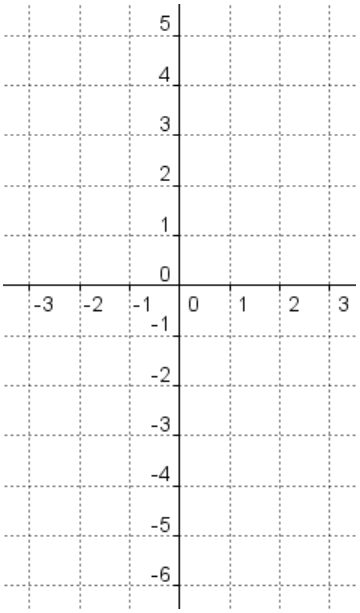


Vertical stretches, vertical reflections and vertical translations can all be applied to the base graph of a quadratic relation. The equation would be $y = ax^2 + k$.

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

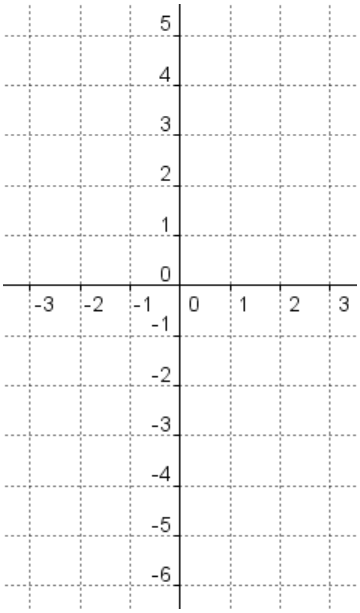
$y = -x^2 + 4$

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



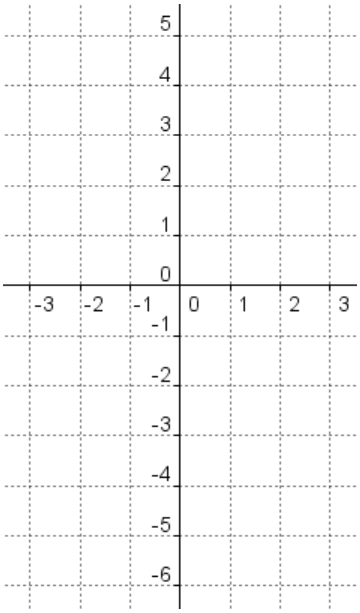
$y = -x^2 - 2$

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



$y = 2x^2 - 3$

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



Summary of Transformations for $y = ax^2 + k$

Recall that **a** can tell us if the graph opens up and has a minimum or opens down and has a maximum. It also tells us if there is a vertical stretch applied to the relation.

If $k > 0$

If $k < 0$

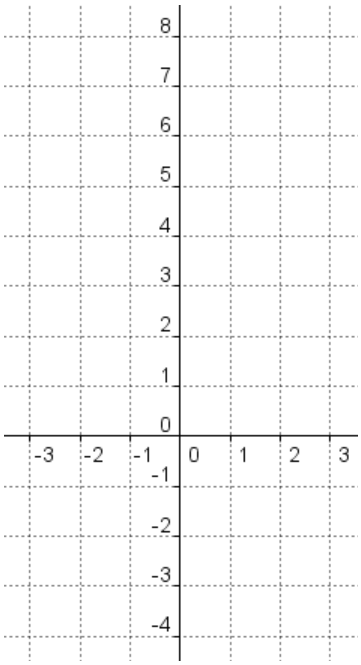
There is one x-intercept if

There are two x-intercepts if

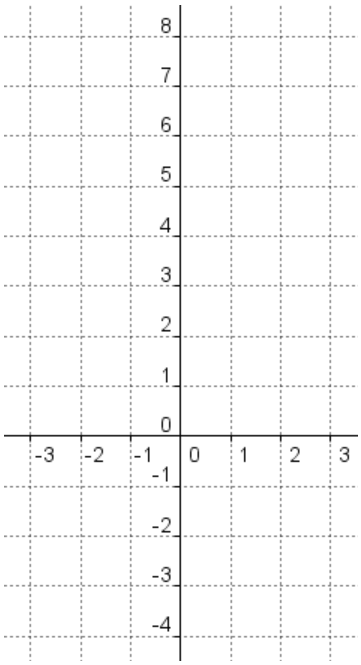
There are no x-intercepts if

Example – Graph each relation using the step pattern instead of a table of values. Include all points that appear in the domain provided.

$y = 3x^2 - 4$



$y = -\frac{1}{2}x^2 + 5$



Homework – Complete Part B on "The Quadratic Relation Homework Handout"

– Determine the equation for each parabola below in the form $y = ax^2 + k$.