

## Combining Transformations of a Quadratic Relation

We have learned how to vertically stretch, vertically reflect, vertically translate and horizontally translate a quadratic relation. Now we will combine these transformations. The equation will be:

$$y = a(x - h)^2 + k$$

1. Describe each of the transformations being applied to each quadratic relation. Please use proper terminology.

a.  $y = 3x^2 - 4$

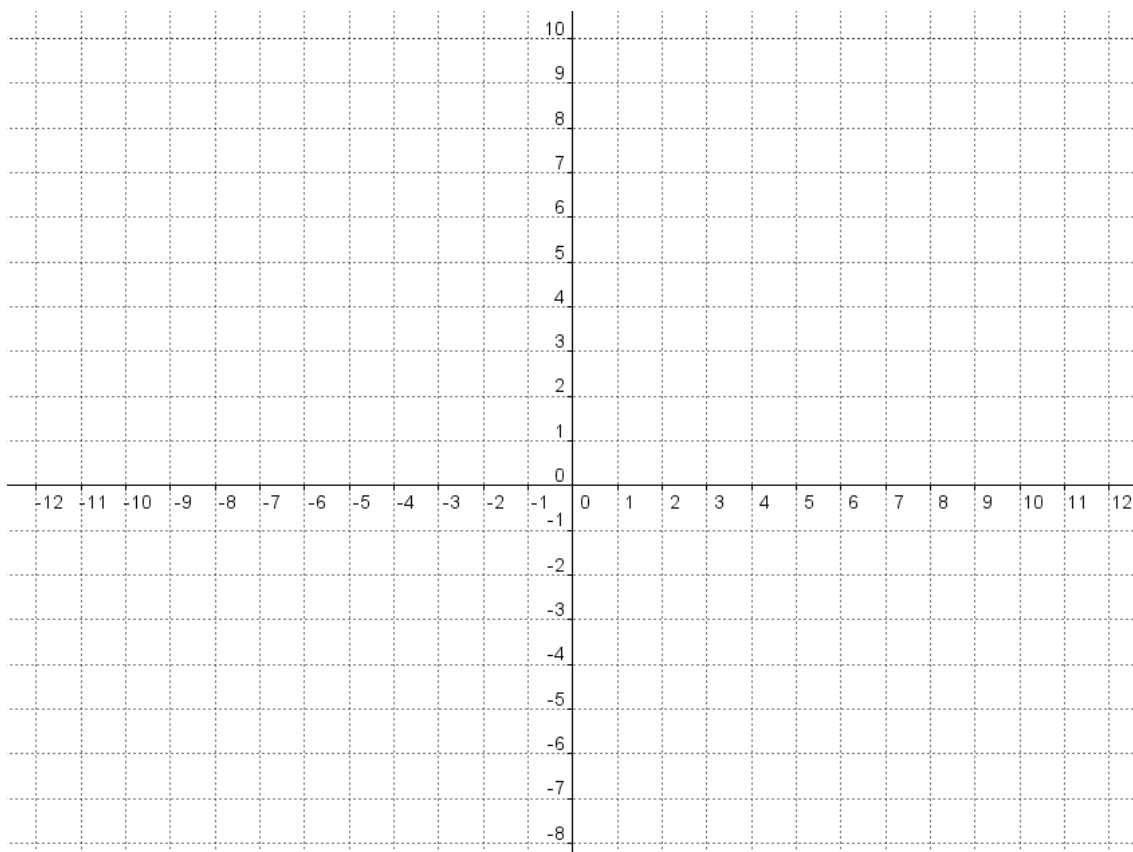
b.  $y = -2(x + 5)^2$

c.  $y = (x + 6)^2 + 1$

d.  $y = -\frac{1}{2}(x - 7)^2 + 8$

2. Summarize the properties of each quadratic relation by completing the chart and plotting all points that appear in the domain provided.

Quadratic Relation	Vertex	Over 1 Points	Over 2 Points	Max/Min Point and Value	Axis of Symmetry	Domain	Range
$y = 3x^2 - 4$							
$y = -2(x + 5)^2$							
$y = (x + 6)^2 + 1$							
$y = -\frac{1}{2}(x - 7)^2 + 8$							



Now that we are considering horizontal translations and vertical translations together, we can answer two very important questions based on the vertex **(h, k)**:

*“Where will the maximum or minimum value of the parabola occur?”*

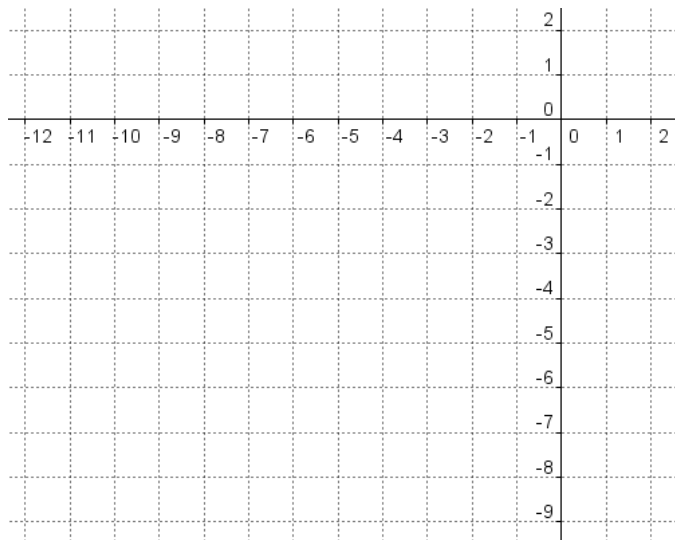
*“What will be the maximum or minimum value of the parabola?”*

Once we have located the vertex, we can plot other points on the parabola by following the step pattern, which is based on the vertical stretch and reflection, **a**.

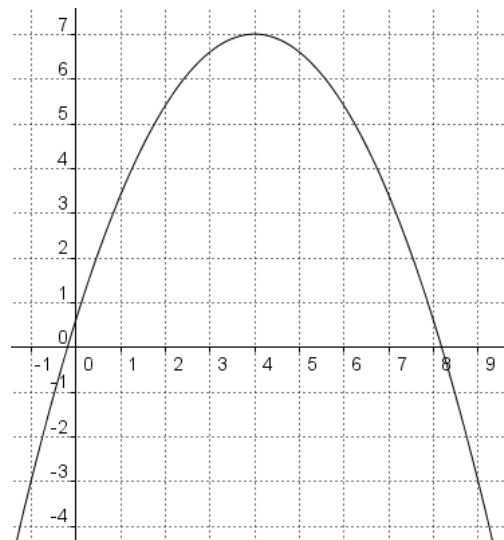
Example – Graph  $y = \frac{1}{4}(x + 5)^2 - 8$  by plotting its vertex and following its step pattern.

Include all points that appear in the domain provided.

x over	y up/down
1	
2	
3	
4	
5	
6	

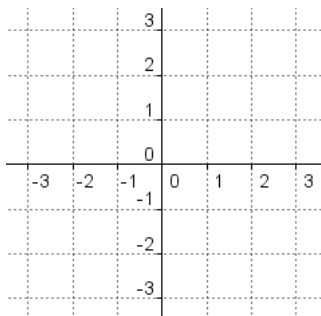


Example – Determine an equation for the following quadratic relation. Justify your answer.

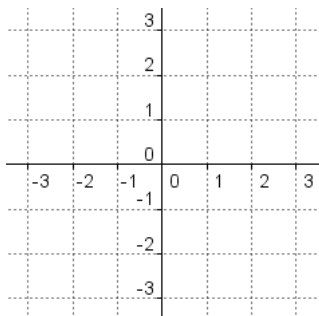


Homework – Plot each quadratic relation and describe its transformation(s).

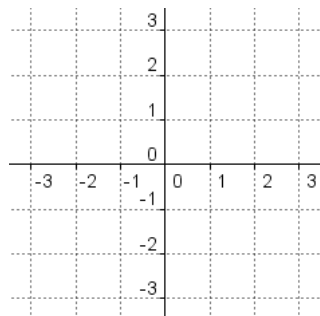
$$y = 3x^2$$



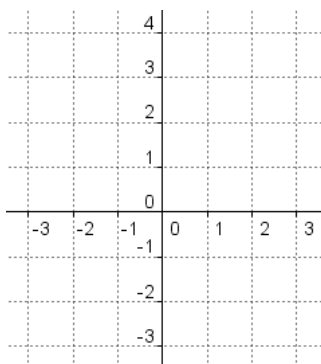
$$y = -3x^2$$



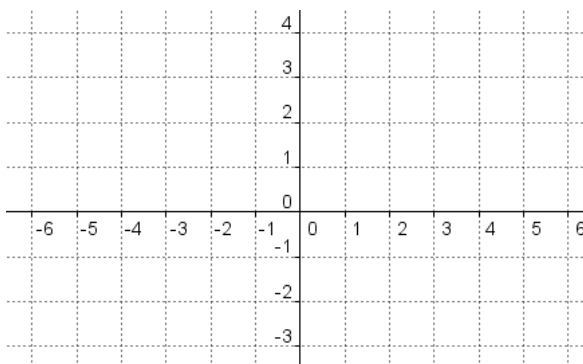
$$y = \frac{1}{3}x^2$$



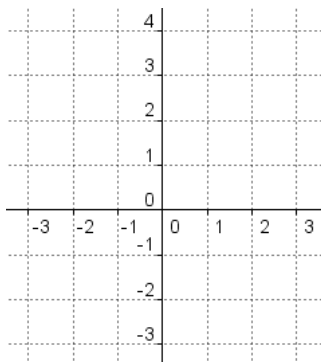
$$y = x^2 + 3$$



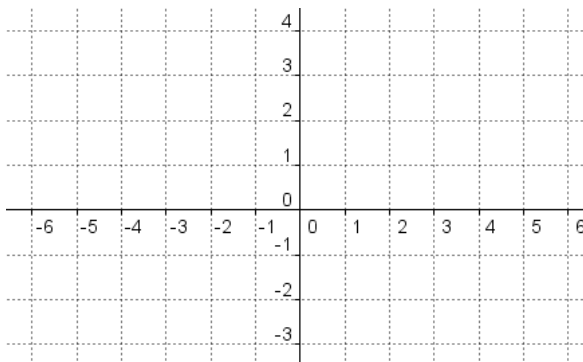
$$y = (x + 3)^2$$



$$y = x^2 - 3$$

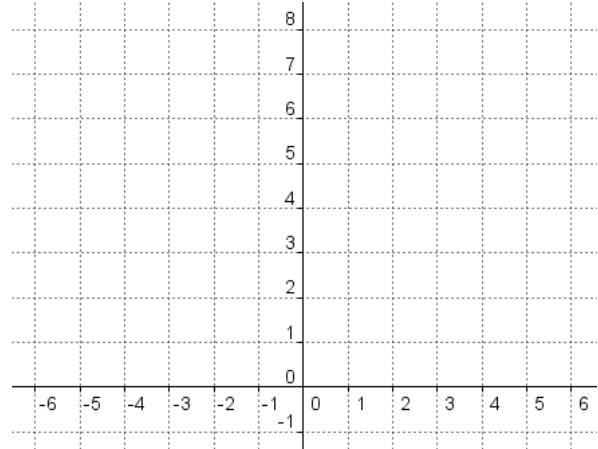


$$y = (x - 3)^2$$

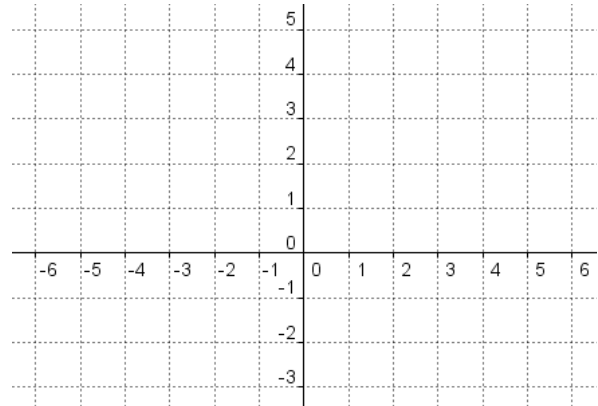


Homework – Identify each vertex and step pattern. Then plot each quadratic relation.

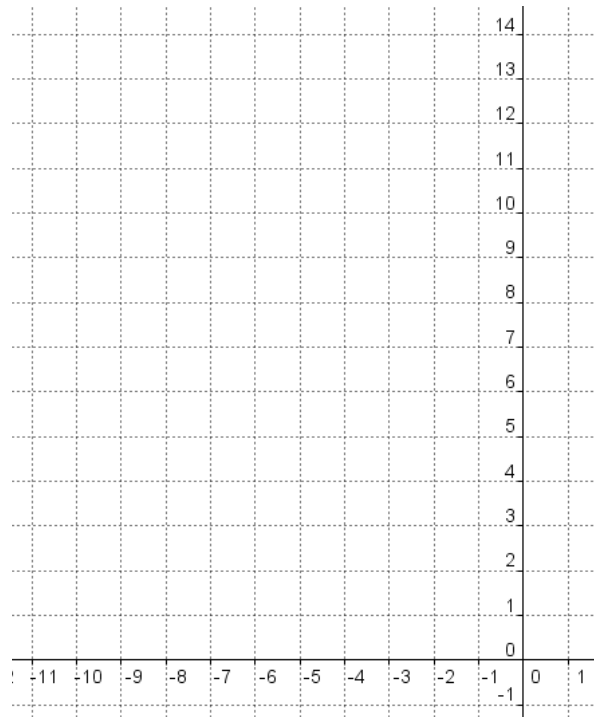
$$y = -(x - 2)^2 + 8$$



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



$$y = \frac{3}{4}(x + 5)^2 + 1$$



Homework – Determine an equation for each quadratic relation. Justify your answers.

