Course: Algebra 2
Unit: Conic Sections
Section: Parabolas

Example: Graphing a Parabola with a Vertex at (h, k)

Problem:
Graph the parabola y plus one equals negative one-twelfth times the quantity x minus three squared.

Solution:
Before we start to graph the parabola, we must decide if the parabola has a vertical or horizontal directrix and which direction the parabola opens. To do this easily, we should first write the equation in its standard form.

This equation can be rewritten in the form y minus negative one equals one divided by the product of four times negative three, times the quantity x minus three squared. Because it is in the form "y minus k equals…", this has a horizontal directrix and because the value of p is negative, negative three to be precise, the parabola opens down.

The vertex of this parabola is h, k; or three, negative one.

The directrix of this parabola is y equals k minus p, y equals negative one minus negative 3, or y equals two.

The focus of this parabola is at h, k plus p. This is the point three, negative one plus negative three; or three, negative four.

Once we have the vertex, directrix and focus, we can begin to graph. Place those three things on the graph.

Now, in order to make our graph as accurate as possible, let's plot a couple more points. Pick one point on either side of the focus. In this case, pick one point to the left, at x equals zero, for example, and one point to the right, at x equals six, for example.

When x equals zero, we can use the equation to find the value of x.

Y plus one equals negative one-twelfth times the quantity zero minus 3 squared equals negative three-fourths.

Y equals negative one point seven five.

The point zero, negative one point seven five is on the parabola.

When x equals six, we can again use the equation to find the value of x.

Y plus one equals negative one-twelfth times the quantity six minus 3 squared equals negative three-fourths.

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Y equals negative one point seven five.

The point six, negative one point seven five is on the parabola.

Now all that is left is to graph the parabola itself, using the points as a guide.

Notice that the parabola opens down around the focus.