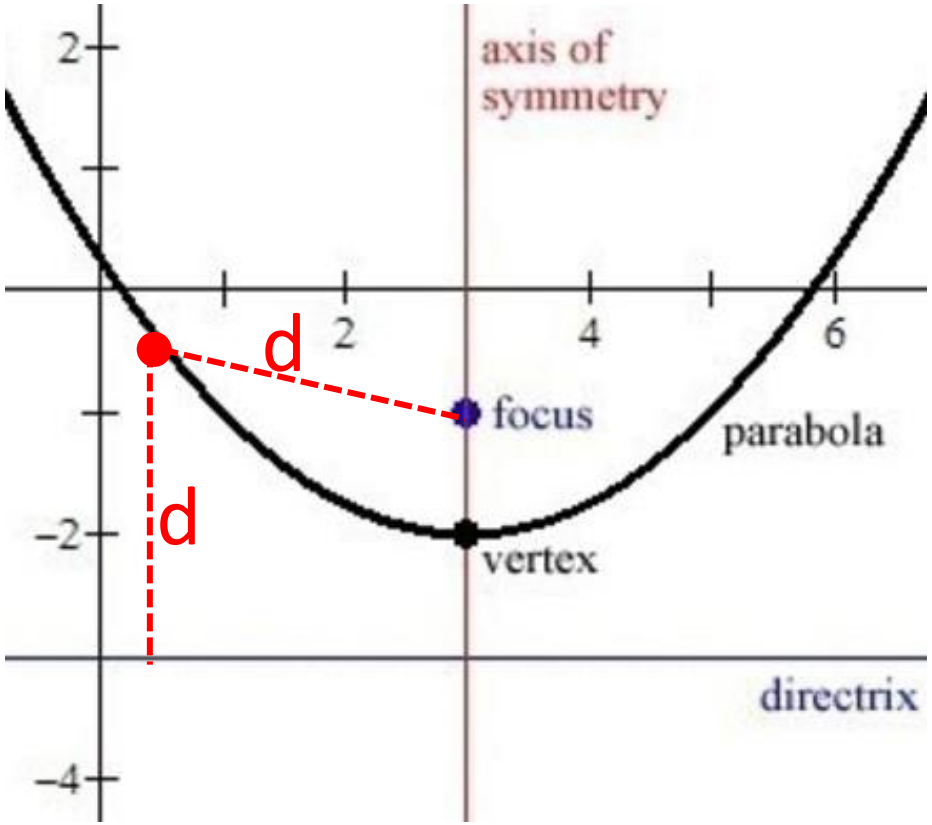
Vertical and Horizontal Parabolas

Every point on a parabola is equidistant from a point called the **<u>focus</u>** and a line called the **<u>directrix</u>**.

The vertex of a parabola is in the middle of the focus and directrix.



The focus and directrix are both “p” units away from the vertex where:

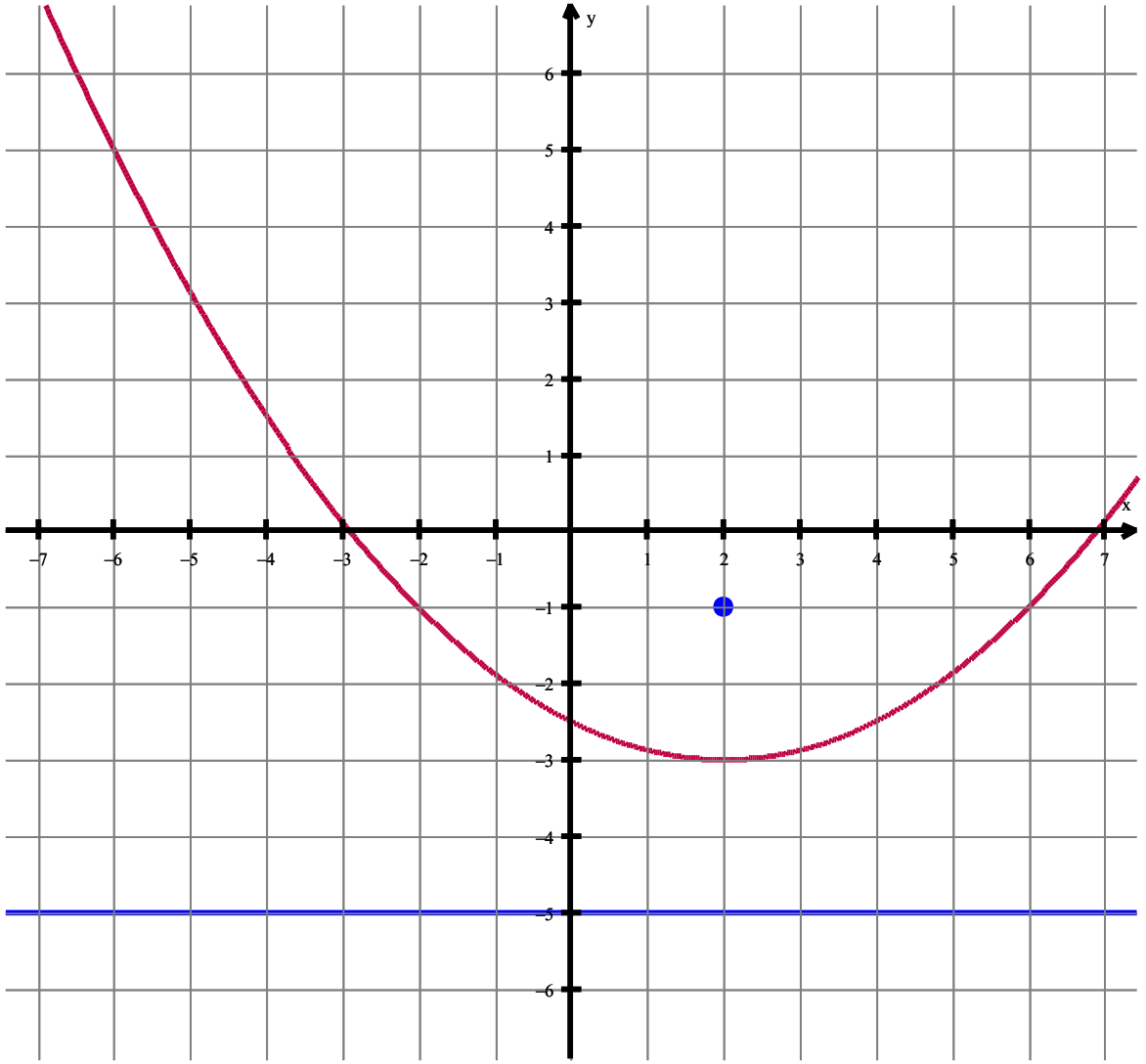
$$y = \frac{1}{4p}(x - h)^2 + k$$

So, a $= \frac{1}{4p}$ in vertex form.

Draw the graph of $y = \frac{1}{8}(x-2)^2 - 3$ including the focus and directrix.

$$\frac{1}{8} = \frac{1}{4p}$$

So, p = 2



Given the equation $y = -2(x+1)^2 + 2$, determine the focus and directrix.

$2 = \frac{1}{4p}$ So, 8p = 1, and p = $\frac{1}{8}$

The focus is the point (-1, 1.875). The graph opens downward, so the focus is below the vertex.

The directrix is the line y = 2.125

Write the equation of the parabola that has a vertex (3, 6) and a focus (3, 3)

p = 3 because the focus is three units away from the vertex.

The graph opens downward because the focus is below the vertex.

$$f(x) = \frac{-1}{12}(x-3)^2+6$$

Graph the equation $4(y - 3) = (x + 1)^2$. Include the focus and directrix.

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

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

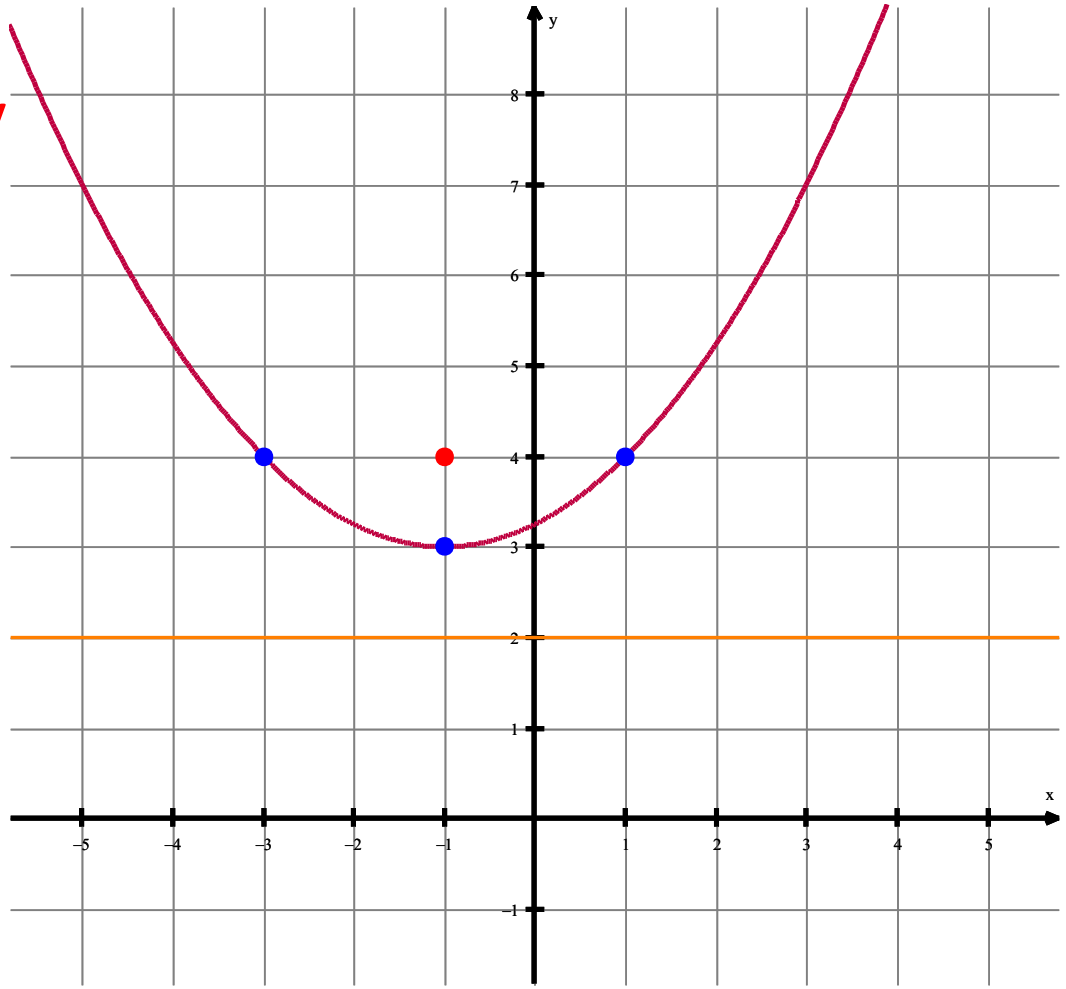
Vertex: (-1, 3)

Hor. Comp. by 1/4

$a = \frac{1}{4p}$ Solve for p

$\frac{1}{4} = \frac{1}{4p}$

p = 1



Graph the equation $-y + 4 = \frac{1}{9}(x + 2)^2$. Include the focus and directrix.

$-y = \frac{1}{9}(x + 2)^2 - 4$ Solve for y

$y = \frac{-1}{9}(x + 2)^2 + 4$

Vertex: (-2, 4)

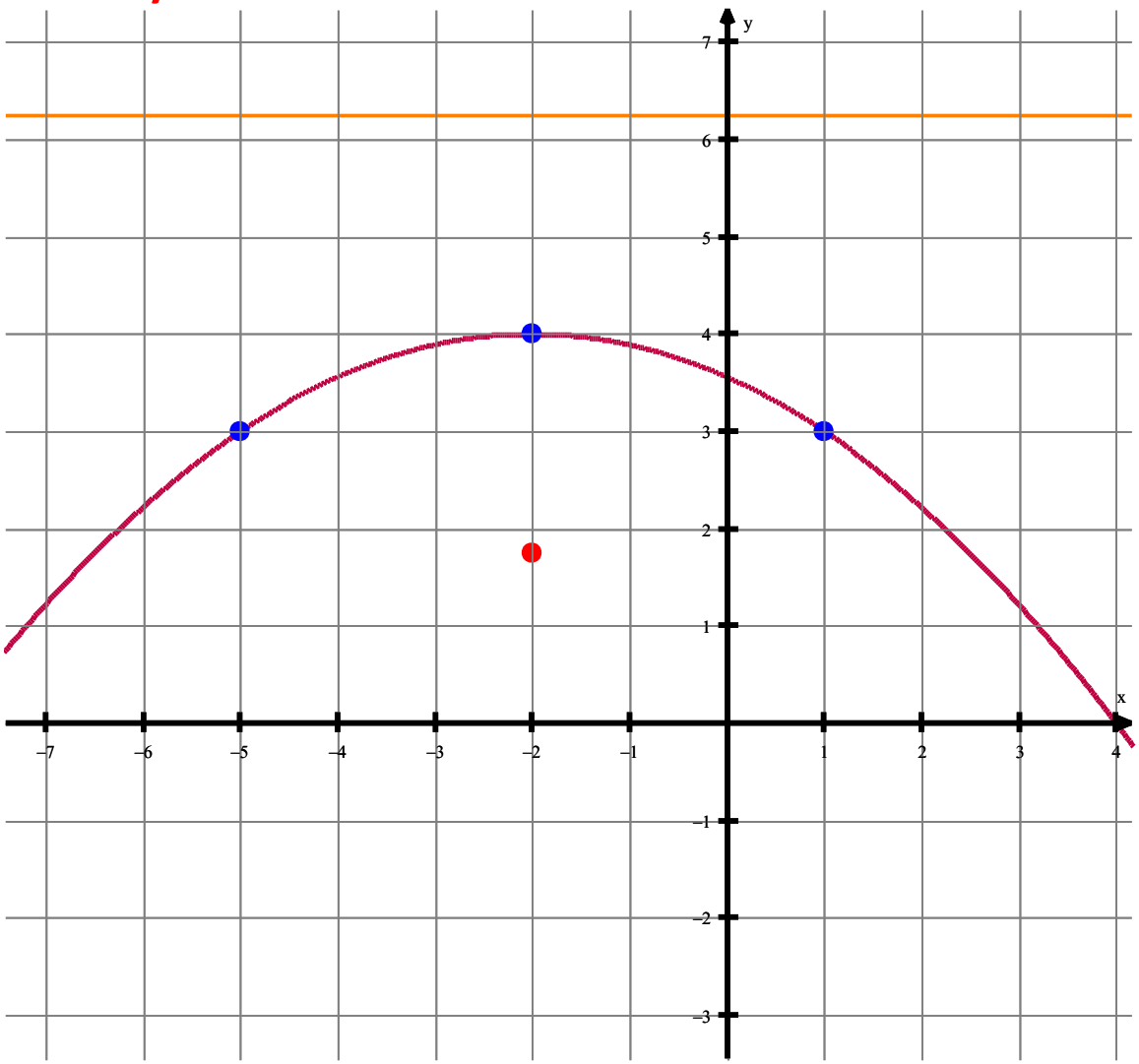
Hor. Comp. by 1/9

$a = \frac{1}{4p}$ Solve for p

$\frac{1}{9} = \frac{1}{4p}$

$4p = 9$

$p = 2.25$



Parabolas can open left and right.

Equation for a horizontal parabola:

$$x = \frac{1}{4p}(y - k)^2 + h$$

Where k is the vertical shift (use opp. sign) and h is the horizontal shift.

The “a” value represents a horizontal stretch/compression

Determine the vertex for the equations:

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

Vertex: (-1, -3)

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

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

Vertex: (3, 1)

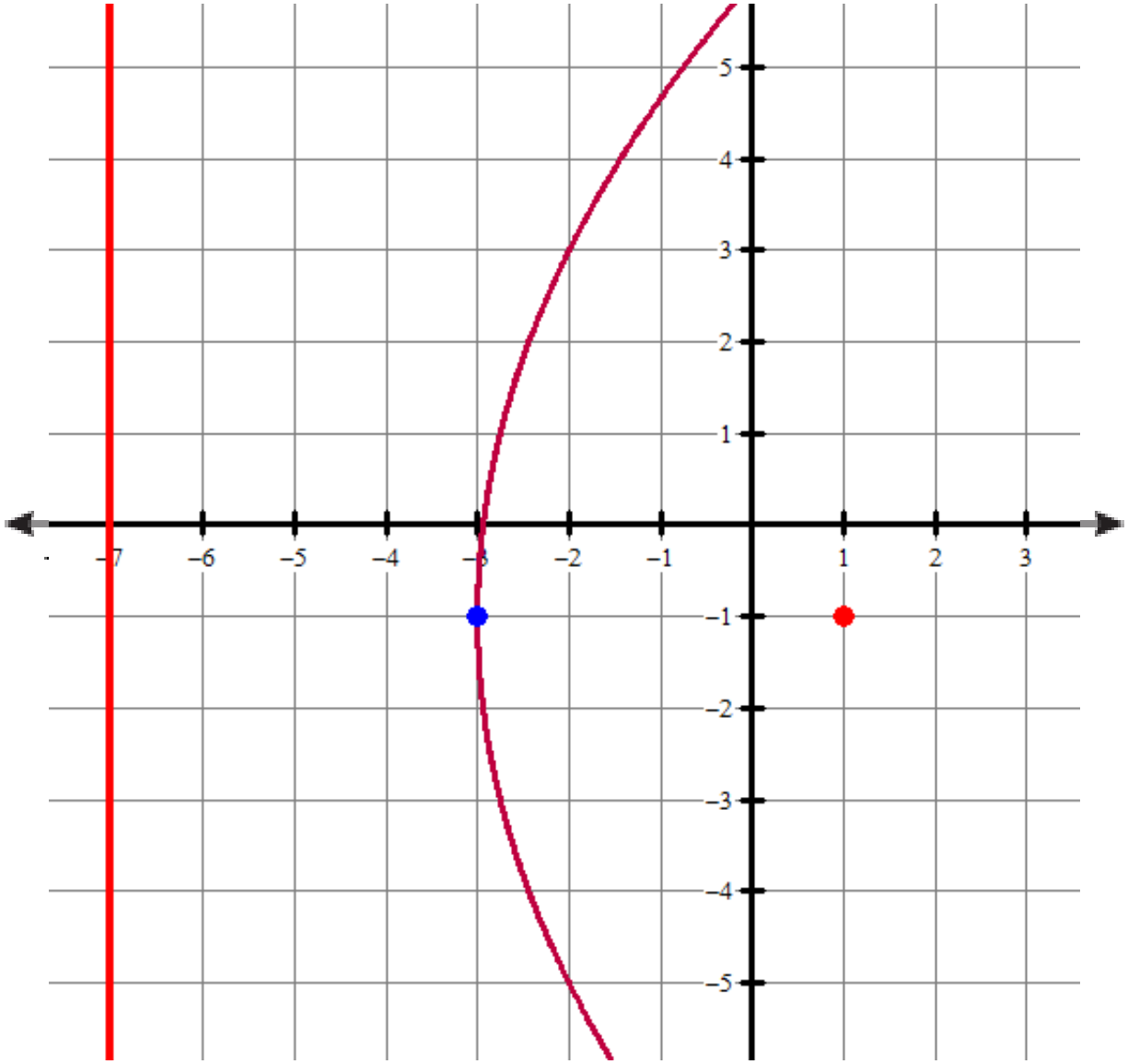
3) $5x - 25 = (y + 2)^2$

$5x = (y + 2)^2 + 25$

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

Vertex: (5, -2)

Graph the equation $x = \frac{1}{16}(y + 1)^2 - 3$



Graph the equation $-8x + 16 = (y + 3)^2$