



Name: 2/7/20

HansenMath™ Algebra 2: Notes on the Parabola

A parabola is the set of all points in a plane that are the same distance from a given point called the Focus, F and a given line called the directrix.

Due to this unique property, we can use the distance formula to find the equation of a parabola.

Example 1: Graph the parabola given by the equation $y = \frac{1}{4}(x + 2)^2 - 3$

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

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

① Find vertex (h, k)
 $V(-2, -3)$

② plot Focus, F

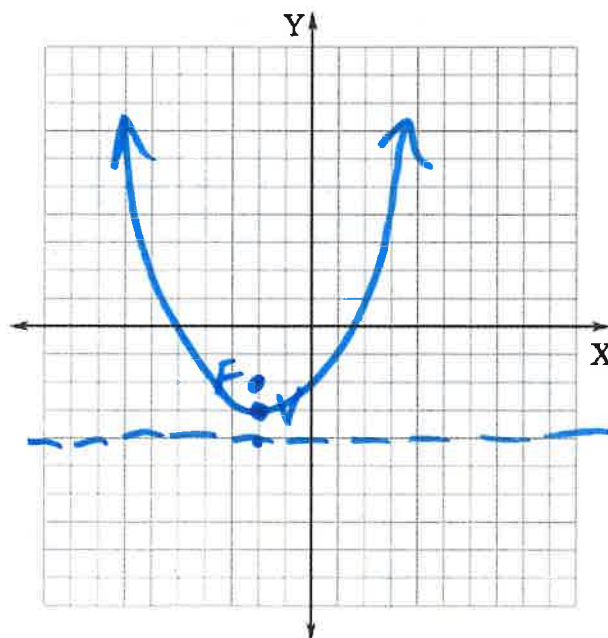
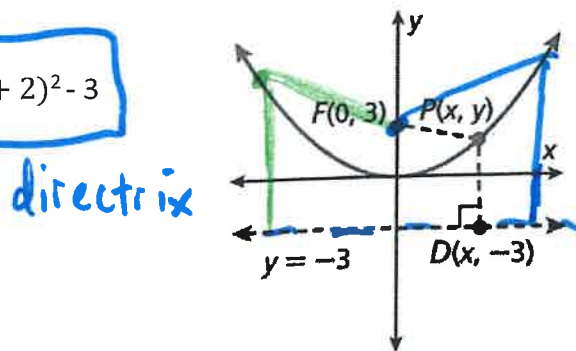
~~$$\frac{1}{4p} = \frac{1}{4}$$~~

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

$$p = 1$$

p is Distance from vertex to Focus, F. Since y = and p is positive, go up!

③ Draw directrix line
 $y = -4$



Example 2: Graph the parabola given by the equation, $y = -\frac{1}{8}(x + 3)^2 + 5$

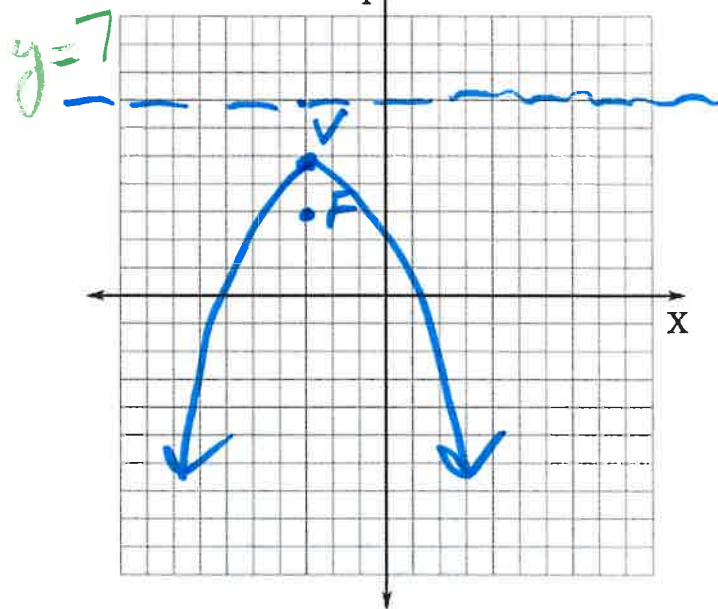
open downward ↴

Vertex: $(-3, 5)$

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

~~$\frac{-4p}{-4} = \frac{8}{-4}$~~

$p = -2$



Example 3: Graph the parabola given by the equation, $x = \frac{1}{2}(y - 4)^2 - 2$

$x = +$ open Right ↴

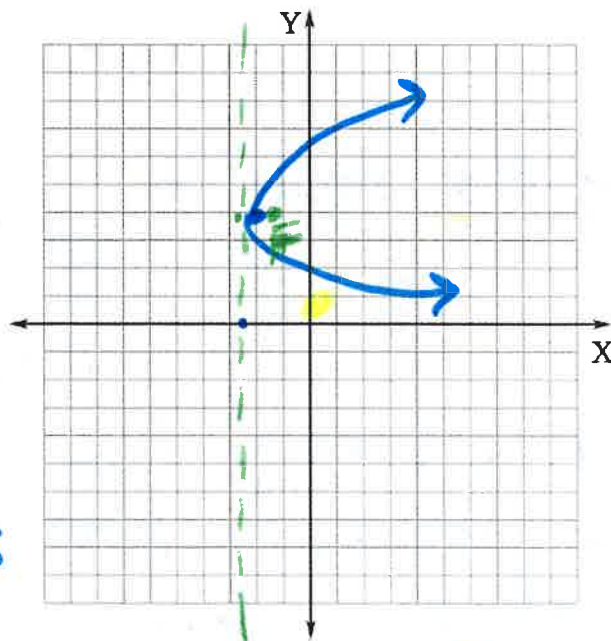
$$x = \frac{1}{4p}(y - k)^2 + h$$

Vertex: $(h, k) \rightarrow (-2, 4)$

~~$\frac{1}{4p} = \frac{1}{2}$~~

~~$\frac{4p}{4} = \frac{2}{4}$~~

$p = \frac{1}{2}$ or .5



directrix: $x = -2.5$

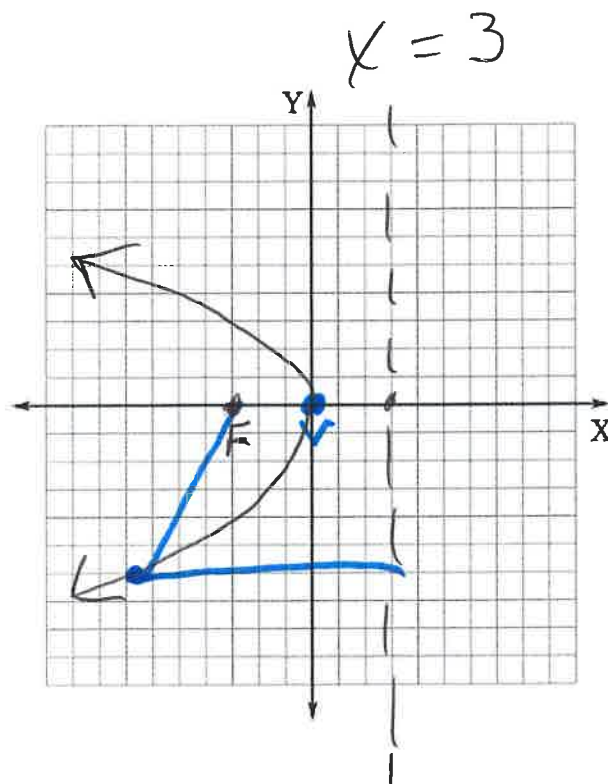
Example 4: Graph the parabola given by the equation, $x = -\frac{1}{12}y^2$

$x = -$ Left 

Vertex: $(h, k) \rightarrow (0, 0)$
origin

$$\frac{1}{4p} = -\frac{1}{12} \quad \frac{-4p}{-4} = \frac{12}{-4}$$

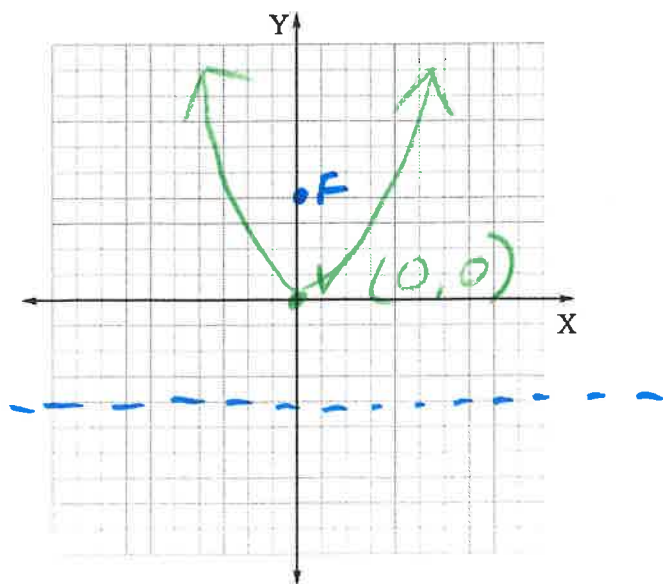
$$p = -3$$



Example 5: Write the equation of a parabola with focus $F(0, 4)$ and directrix $y = -4$

$$y = \boxed{\frac{1}{16}} (x)^2$$

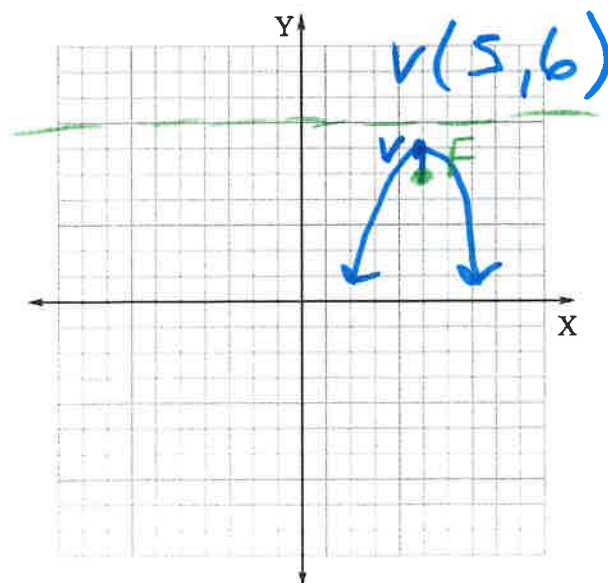
$$\frac{1}{4p} \rightarrow \frac{1}{4(4)} = \frac{1}{16}$$



Example 6: Write the equation of a parabola with focus $F(5, 5)$ and directrix $y = 7$

$$y = \boxed{-\frac{1}{4}} (x-5)^2 + 6$$

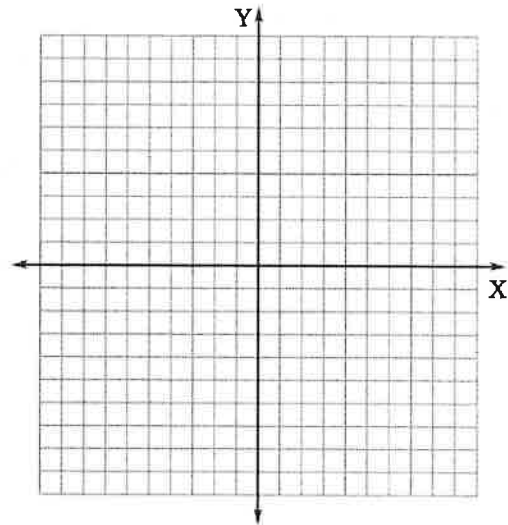
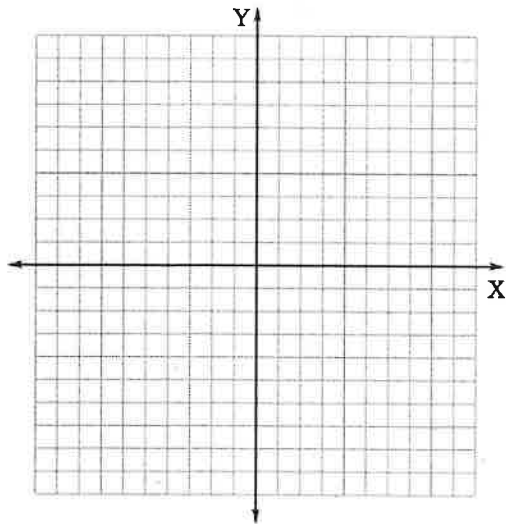
$$\frac{1}{4p} = \frac{1}{4(1)} = -\frac{1}{4}$$



Graph the parabola, including the vertex, focus, directrix, and axis of symmetry

1.) $y = -\frac{1}{4}(x + 6)^2 + 4$

2.) $x = \frac{1}{12}(y + 1)^2 + 1$



Write an equation of a parabola with vertex at the origin and:

3.) Focus $F(0, 4)$

4.) Focus $(-6, 0)$

Write an equation of a parabola with vertex at the origin and:

5.) directrix $y = 5$

6.) directrix $x = -4$

Write an equation of a parabola with:

7.) focus $F(0, 2)$ and directrix $y = -2$

8.) focus $F(0, -10)$ and directrix $y = 10$