

9.2: Graph and Write Equations of Parabolas

Distance Midpoint 1	Parabola 2
Circle 3	Elipse 4
Hyperbola 5	Lines of Symmetry 6

Transformational Form:

$$4p(y - k) = (x - h)^2$$

Vertex: (h, k)

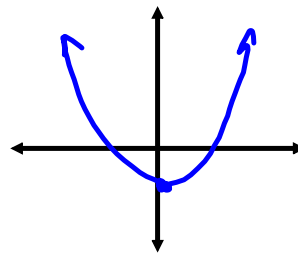
***Always switch the signs on h and k*

Axis of Symmetry: $X = h$

Focus: $(h, p + k)$

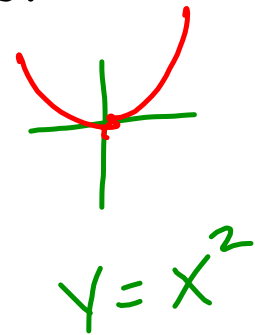
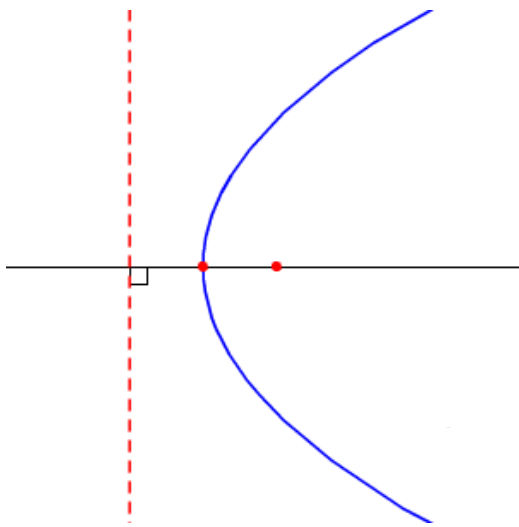
Directrix: $y = k - p$

Distance Midpoint 1	Here!! 2	
Circle 3	Ellipse 4	
Hyperbola 5	Lines of Symmetry 6	

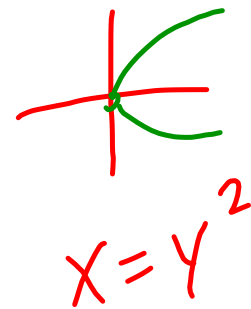


to graph: pick 2 points to the left or right of the vertex. Plug in for the x and then mirror them

How do we turn a parabola sideways?



$$y = x^2$$



$$x = y^2$$

Transformational Form:

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

Vertex: (h, k)

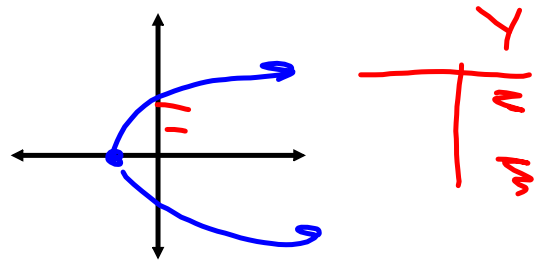
***Always switch the signs on h and k*

Axis of Symmetry: $y = k$

Focus: $(p+h, k)$

Directrix: $x = h - p$

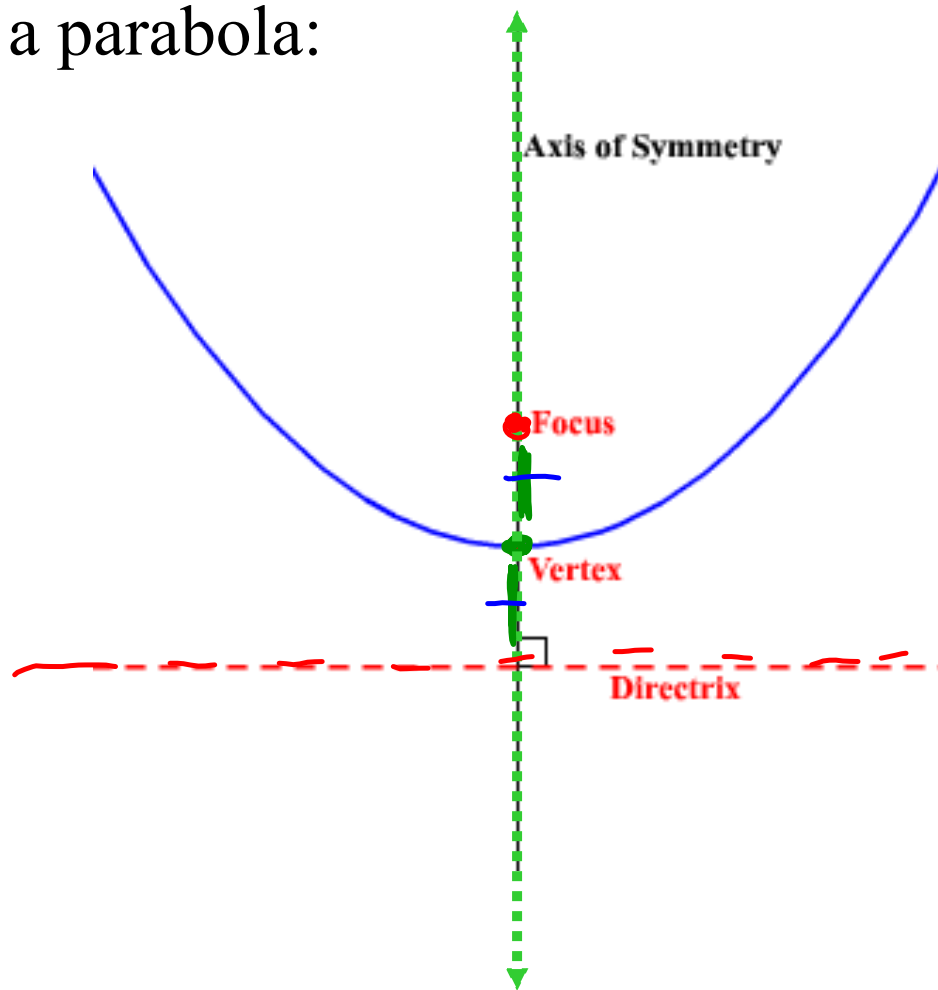
Distance Midpoint 1		Here!!
Circle 3	Elipse 4	
Hyperbola 5	Lines of Symmetry 6	



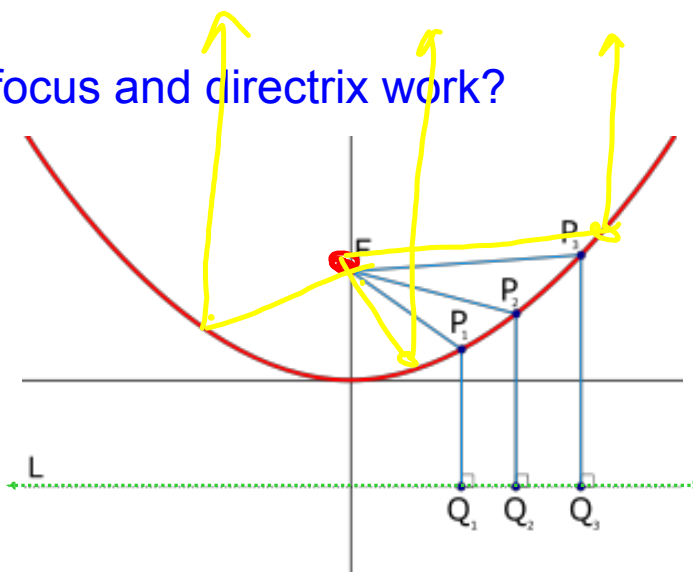
***sideways*

to graph: pick 2 points to the above or below the vertex. PLUG THEM IN FOR THE Y!!!!, and then mirror them

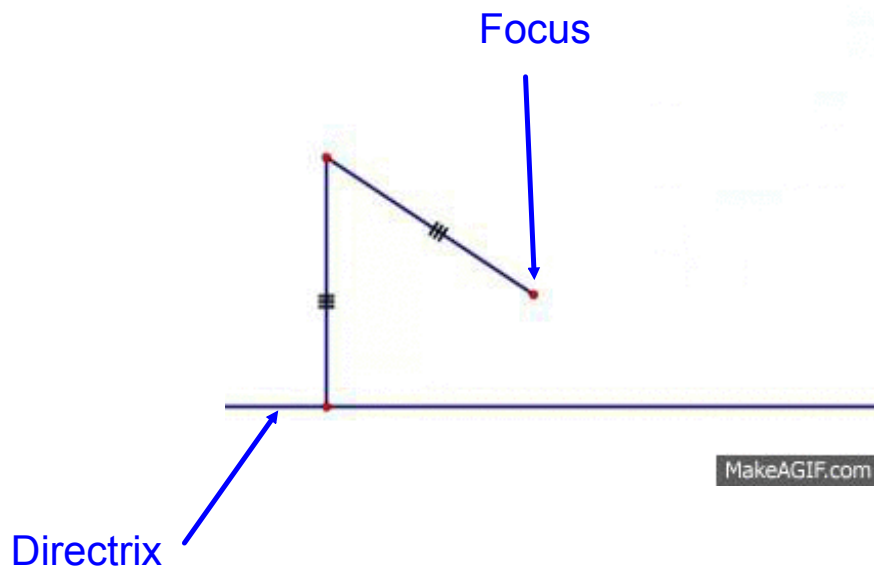
Parts of a parabola:



How do the focus and directrix work?



**Transformational Form of a parabola is useful in finding the focus and directrix.



Example 1: Identify the vertex, focus, axis of symmetry, and the directrix of each. Then graph.

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

Vertex: $(0, 0)$

Focus: $(0, \frac{3}{4})$

Directrix: $y = -\frac{3}{4}$

AoS: $x = 0$

Step 1: Which is it?!?



Step 2: $h =$
 $k =$

$h = 0$
 $k = 0$

Step 3: Fill in Vertex and AoS

Step 4: $P = ??$is it in the correct form?

$3y = x^2$

$\frac{4p}{4} = \frac{3}{4}$

$p = \frac{3}{4}$

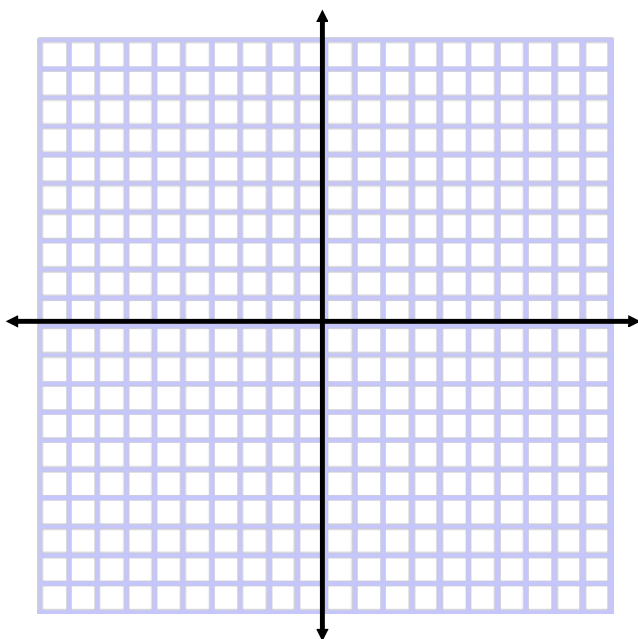
Step 5: Fill in Focus and Directrix

Focus: $(h, p+k)$
 $(0, \frac{3}{4} + 0)$
 $(0, \frac{3}{4})$

Directrix:
 $y = k - p$

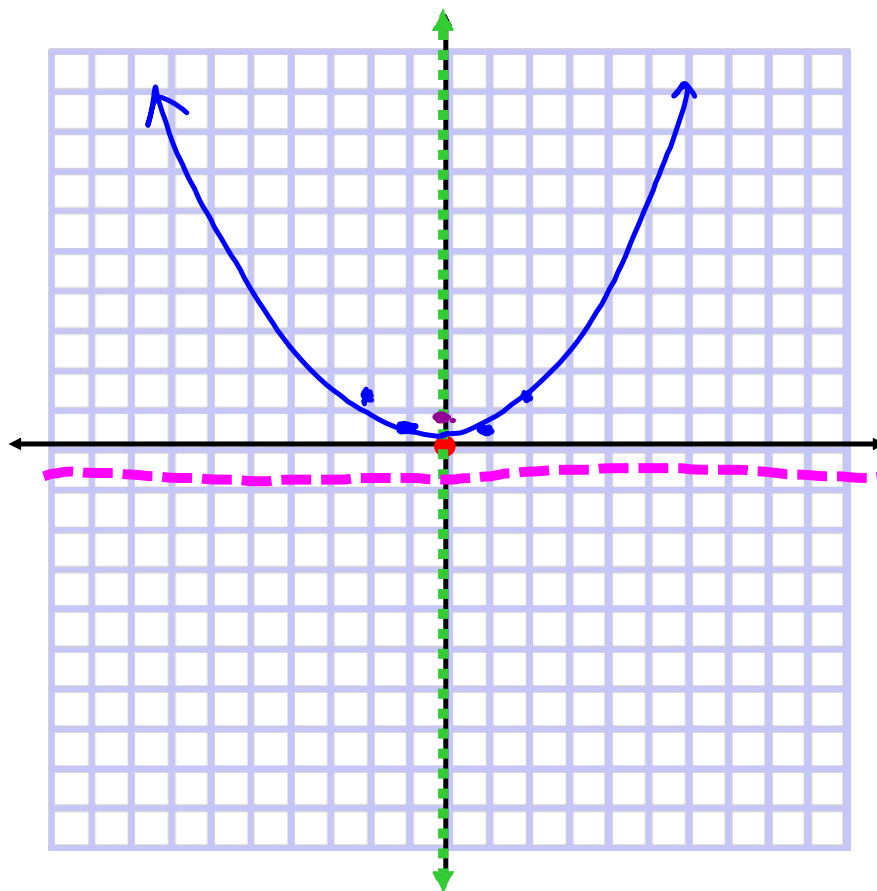
$y = 0 - \frac{3}{4}$

$y = -\frac{3}{4}$



Step 6: Pick Points

Vertex: $(0, 0)$
 Focus: $(0, \frac{3}{4})$
 Directrix: $y = -\frac{3}{4}$
 AoS: $x = 0$



Step 6: Pick Points

1	$\frac{1}{3}$
2	$1\frac{1}{3}$

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

$$\begin{aligned} & \frac{1}{3} \cdot 1^2 \\ & \frac{1}{3} \cdot 1 \\ & = \frac{1}{3} \end{aligned}$$

$$\begin{aligned} & \frac{1}{3} \cdot 2^2 \\ & \frac{1}{3} \cdot 4 \\ & \frac{4}{3} = 1\frac{1}{3} \end{aligned}$$

$$b. \quad x = -\frac{2}{7}y^2$$

$$\text{Vertex: } (0, 0)$$

$$\text{Focus: } \left(-\frac{7}{8}, 0\right)$$

$$\text{Directrix: } x = \frac{7}{8}$$

$$\text{AoS: } y = 0$$

Step 1: Which is it?!?

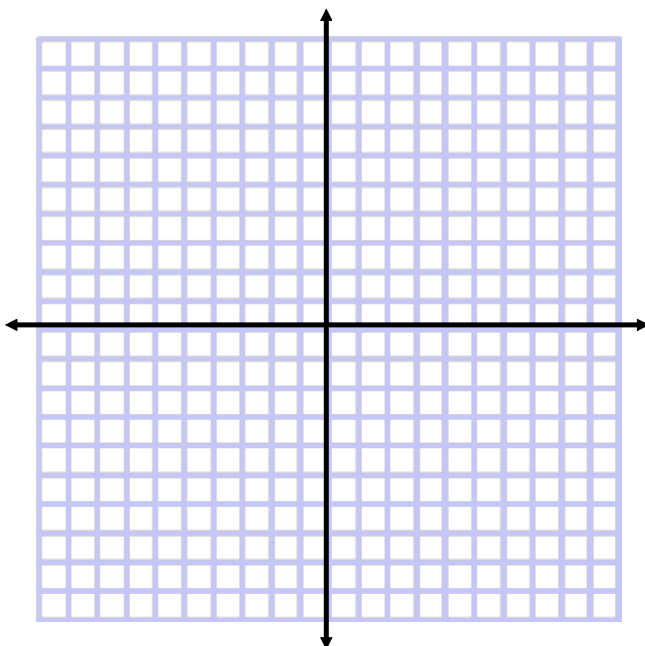


$$\text{Step 2: } \begin{array}{l} h = \\ k = \end{array} \quad \begin{array}{l} h = 0 \\ k = 0 \end{array}$$

Step 3: Fill in Vertex and AoS

Step 4: $P = ??$is it in the correct form?

$$\begin{aligned} -\frac{2}{7}x &= y^2 \\ \frac{1}{4} \cdot 4p &= -\frac{7}{2} \cdot \frac{1}{4} \\ p &= -\frac{7}{8} \end{aligned}$$



Step 6: Pick Points

Step 5: Fill in Focus and Directrix

$$\begin{aligned} \text{Focus: } & (p+h, k) \\ & \left(-\frac{7}{8}+0, 0\right) \\ & \left(-\frac{7}{8}, 0\right) \end{aligned}$$

$$\begin{aligned} \text{Directrix: } x &= h-p \\ & 0 - -\frac{7}{8} \\ & x = \frac{7}{8} \end{aligned}$$

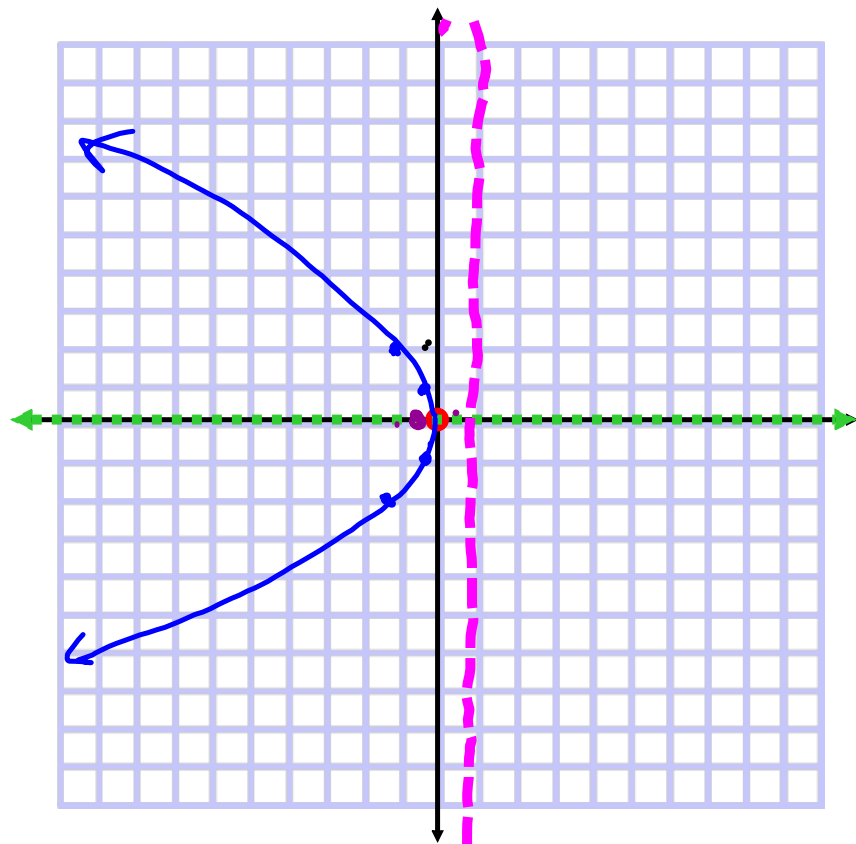
$$b. \quad x = -\frac{2}{7}y^2$$

$$\text{Vertex: } (0, 0)$$

$$\text{Focus: } \left(-\frac{7}{8}, 0\right)$$

$$\text{Directrix: } x = \frac{7}{8}$$

$$\text{AoS: } y = 0$$



$$\begin{array}{r|l} -\frac{2}{7} & 1 \\ -1\frac{1}{7} & 2 \end{array}$$

$$x = -\frac{2}{7}y^2$$

$$x = -\frac{2}{7} \cdot 1^2$$

$$-\frac{2}{7} \cdot 1$$

$$-\frac{2}{7}$$

$$x = -\frac{2}{7} \cdot 2^2$$

$$-\frac{2}{7} \cdot 4$$

$$-\frac{8}{7}$$

$$c. 3(x+5) = (y+6)^2$$

$$\text{Vertex: } (-5, -6)$$

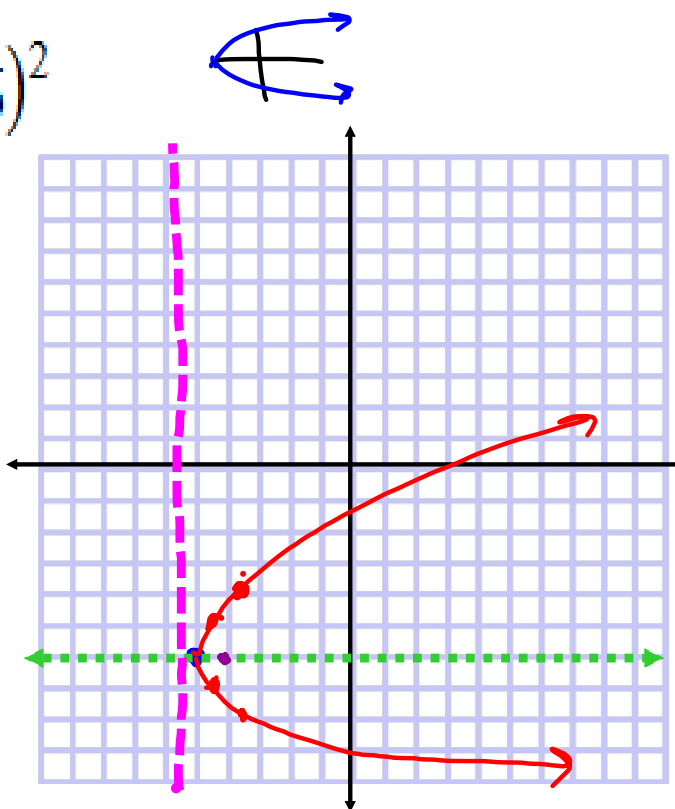
$$\text{Focus: } (-4\frac{1}{4}, -6)$$

$$\text{Directrix: } x = -5\frac{3}{4}$$

$$\text{AoS: } y = -6$$

$$4p = 3$$

$$p = \frac{3}{4}$$



Focus

$$(p+h, k)$$

$$\left(\frac{3}{4} - 5, -6\right)$$

$$\left(-4\frac{1}{4}, -6\right)$$

Directrix

$$x = h - p$$

$$x = -5 - \frac{3}{4}$$

$$x = -5\frac{3}{4}$$

$$\begin{array}{r|l} -3.7 & -4 \\ -4.7 & -5 \end{array}$$

$$3(x+5) = (-4+6)^2$$

$$3x+15 = 2^2$$

$$3x+15 = 4$$

$$3x = -11$$

$$x = -3.7$$

$$3x+15 = (-5+6)^2$$

$$3x+15 = 1^2$$

$$3x+15 = 1$$

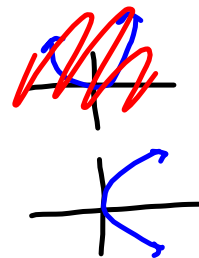
$$3x = -14$$

$$x = -4.7$$

Example 2: Use the information given to write the transformational form of each parabola.

**Figure out what type it is before starting!!

a. Vertex at origin, Focus: $\left(\frac{1}{24}, 0\right)$
 $(0, 0)$



$$4p(x-h) = (y-k)^2$$

$$4\left(\frac{1}{24}\right)(x-0) = (y-0)^2$$

$$\frac{1}{6}x = y^2$$

$$p+h = \frac{1}{24}$$

$$p+0 = \frac{1}{24}$$

$$p = \frac{1}{24}$$

b. Vertex: $(-9, 3)$, Focus: $(-9, \frac{5}{2})$ $\leftarrow p+k$

$$(\underline{h}, k) \quad (\underline{h}, k+p)$$

$$4p(y-k) = (x-h)^2$$

$$4p(y-3) = (x+9)^2$$

$$p+k = \frac{5}{2}$$

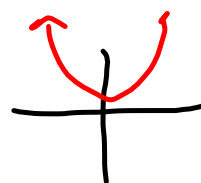
$$p+3 = \frac{5}{2}$$

$$-3 \quad +3$$

$$p = -\frac{1}{2}$$

$$-2(y-3) = (x+9)^2$$

c. Vertex at origin, Directrix: $y = \frac{1}{64}$
 $(0, 0)$



$$y = k - p$$

$$\frac{1}{64} = 0 - p$$

$$\frac{1}{64} = -p$$

$$p = -\frac{1}{64}$$

$$4p(y - k) = (x - h)^2$$

$$4\left(-\frac{1}{64}\right)(y - 0) = (x - 0)^2$$

$$-\frac{1}{16}y = x^2$$

d. Vertex: $(7, -7)$, Directrix: $x = \frac{29}{4}$



$$x = h - p$$

$$\frac{29}{4} = 7 - p$$

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

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

$$4p(x-h) = (y-k)^2$$

$$4\left(-\frac{1}{4}\right)(x-7) = (y+7)^2$$

$$-(x-7) = (y+7)^2$$