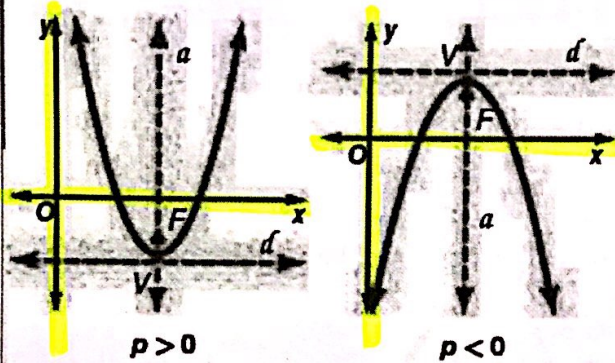


KeyConcept Standard Form of Equations for Parabolas

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



Orientation: opens vertically

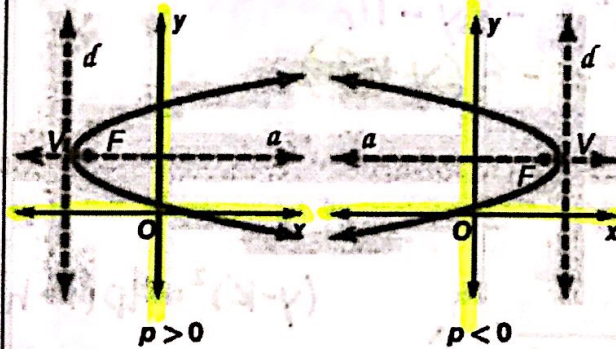
Vertex: (h, k)

Focus: $(h, k + p)$

Axis of Symmetry a : $x = h$

Directrix d : $y = k - p$

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



Orientation: opens horizontally

Vertex: (h, k)

Focus: $(h + p, k)$

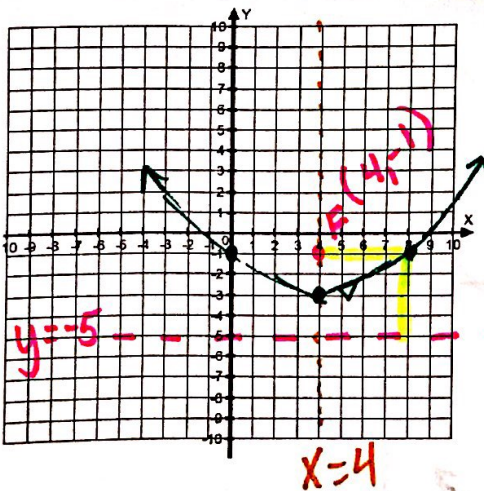
Axis of Symmetry a : $y = k$

Directrix d : $x = h - p$

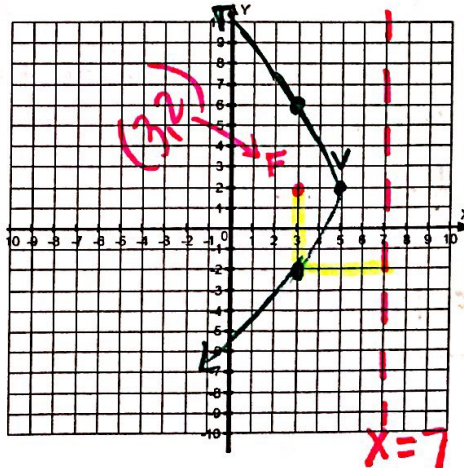
The focus is a point inside the parabola. The directrix is a line outside the parabola. All points on the parabola are equidistance from the focus and directrix. The vertex is midway between the focus and directrix.

Find the Direction, Vertex, Focus and equation of the directrix. Then sketch the graph.

Example 1: $(x - 4)^2 = 8(y + 3)$ **Vertical**
 $v: (4, -3)$
 $4p = 8$
 $p = 2$



Example 2: $(y - 2)^2 = -8(x - 5)$ **Horizontal**
 $v: (5, 2)$
 $4p = -8$
 $p = -2$



Write the equation in standard form by completing the square. State the Vertex, focus, and directrix.

Example 3: $x^2 + 2x + 8y + 17 = 0$

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

$$x^2 + 2x + 1 = -8y - 17 + 1$$

$$(x+1)^2 = -8y - 16$$

$$(x+1)^2 = -8(y+2)$$

Convert the equation to standard form. Find the Vertex, Focus and equation of the directrix. Then sketch the graph.

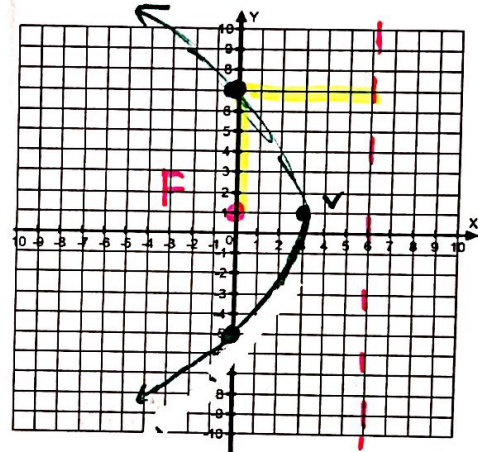
Example 4: $y^2 - 2y + 12x - 35 = 0$

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

$$y^2 - 2y + 1 = -12x + 35 + 1$$

$$(y-1)^2 = -12x + 36$$

$$(y-1)^2 = -12(x-3)$$



v: (3, 1)

4p = -12

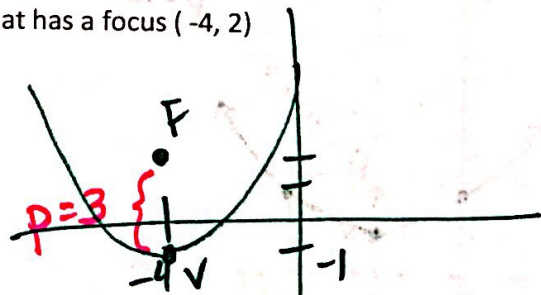
p = -3

Example 5: Write the equation of a parabola with vertex (-4, -1) that has a focus (-4, 2)

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

$$(x+4)^2 = 4 \cdot 3(y+1)$$

$$(x+4)^2 = 12(y+1)$$

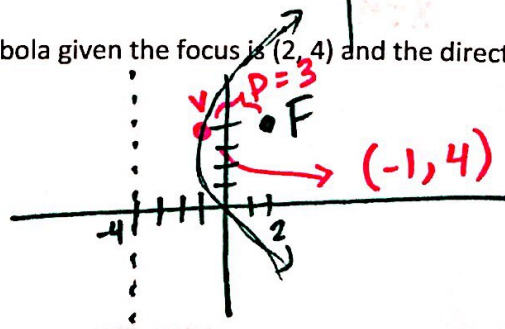


Example 6: Find the standard form of the equation of the parabola given the focus is (2, 4) and the directrix is x = -4

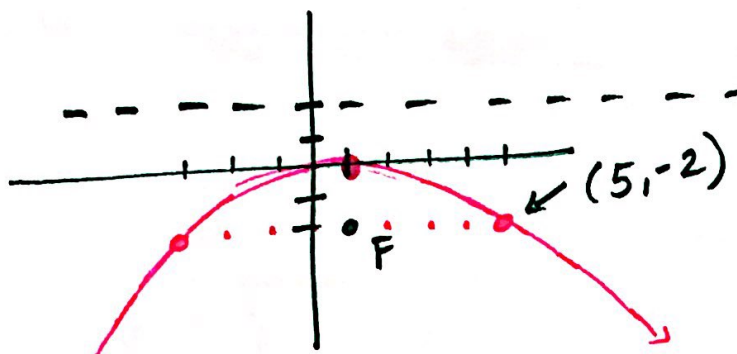
$$(y-k)^2 = 4p(x-h)$$

$$(y-4)^2 = 4 \cdot 3(x+1)$$

$$(y-4)^2 = 12(x+1)$$



Example 7: A parabola has its focus at $(1, -2)$ and its directrix at $y = 2$. Does the point $(5, -2)$ lie on the parabola?



yes!

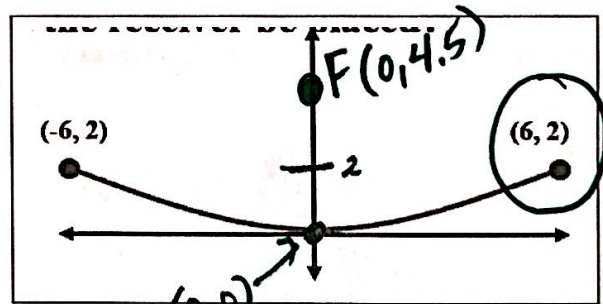
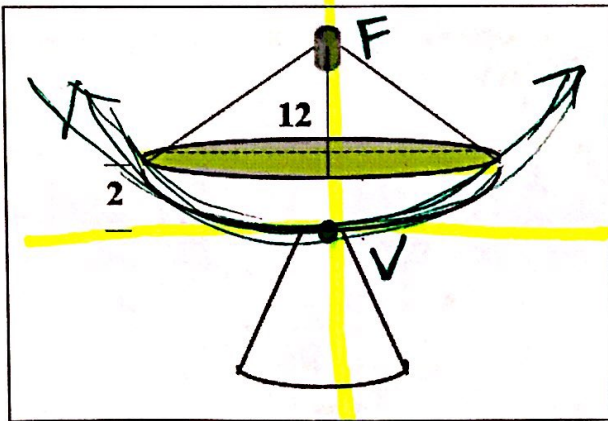
$$(x-1)^2 = -8y$$

$$(5-1)^2 = -8(-2)$$

$$16 = 16$$

yes!

Example 8: A satellite dish is in the shape of a parabolic surface. The dish is 12 ft in diameter and 2 ft deep. How far from the base should the receiver be placed?



$$x^2 = 4py$$

$$(6)^2 = 4 \cdot p \cdot 2$$

$$36 = 8p$$

$$4.5 = p$$

ft
from the base