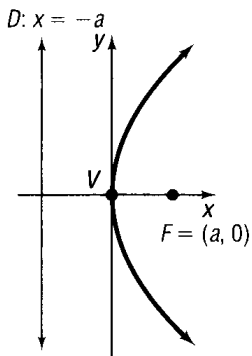
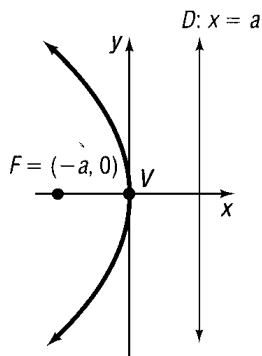
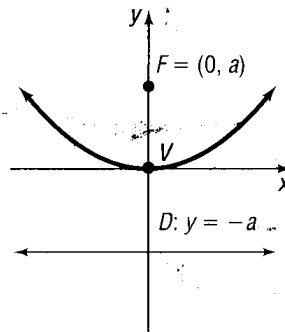
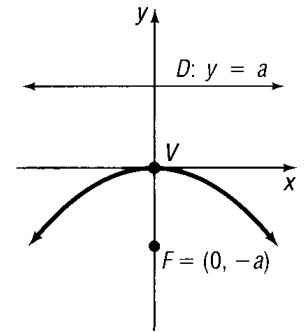


7.3 The Parabola

In this section we will be looking at the parabola in more detail. The pictures below show the four different ways a parabola can be drawn that are all centered at the origin. The V represents the vertex of the parabola. The F is called the **focus**. All rays that hit the parabola will be directed through the focus. That is why satellite dishes are made this way. The focus the incoming signals. The D is called the **directrix**, and this is always behind the parabola. Notice below that the parabola can have four different equations depending on which way it is orientated. Each formula has a letter 'a' in it. This a value is important since it will tell you how far the vertex is from the focus and how far the vertex is from the directrix.

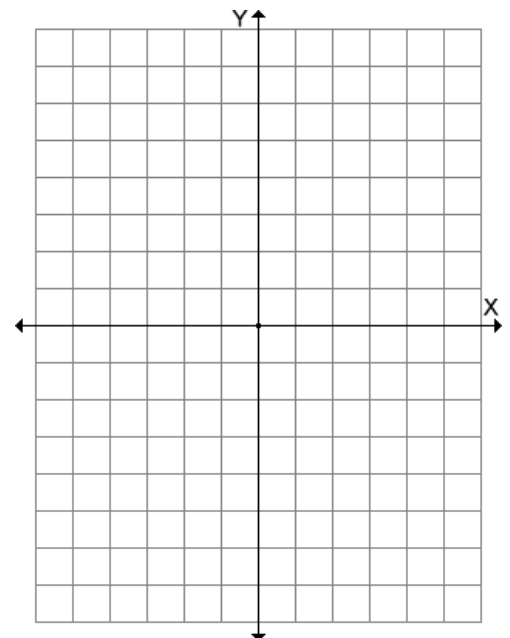
(a) $y^2 = 4ax$ (b) $y^2 = -4ax$ (c) $x^2 = 4ay$ (d) $x^2 = -4ay$

The quantity $|4a|$ is called the **focal width**. A focal width is the length of a vertical or horizontal line that passes through the focus and touches the parabola on each end.

EXAMPLE: Graph $y^2 = 8x$ and identify the directrix, focus, and focal width.

Vertex: _____ Focus: _____

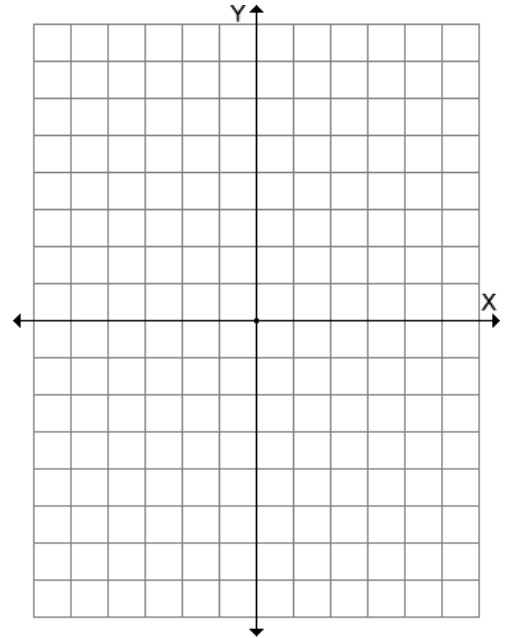
Directrix: _____ Focal Width: _____



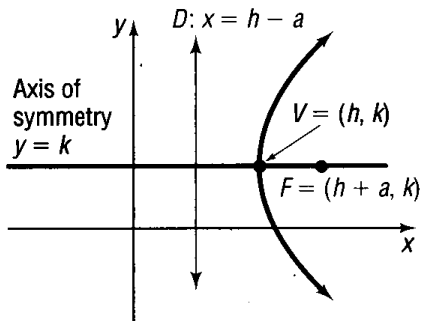
EXAMPLE: Graph $x^2 = -4y$ and identify the directrix, focus, and focal width.

Vertex: _____ Focus: _____

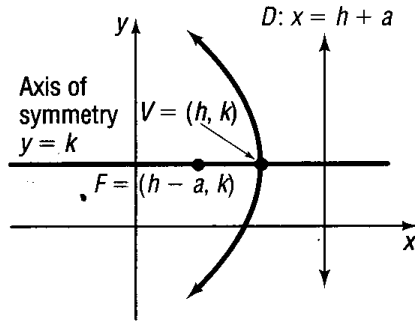
Directrix: _____ Focal Width: _____



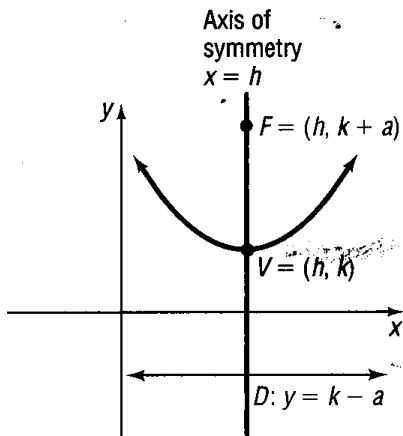
Equations for the Parabola centered at (h, k) .



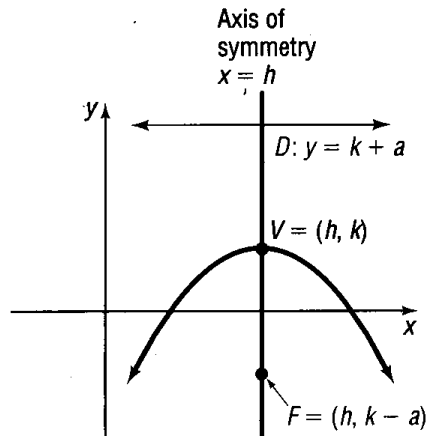
(a) $(y - k)^2 = 4a(x - h)$



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



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

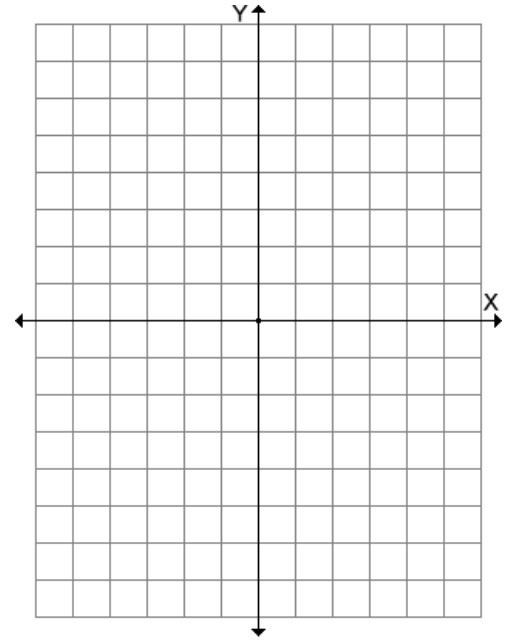


(d) $(x - h)^2 = -4a(y - k)$

EXAMPLE: Graph $(y - 3)^2 = -16(x + 2)$ and identify the directrix, focus, and focal width.

Vertex: _____ Focus: _____

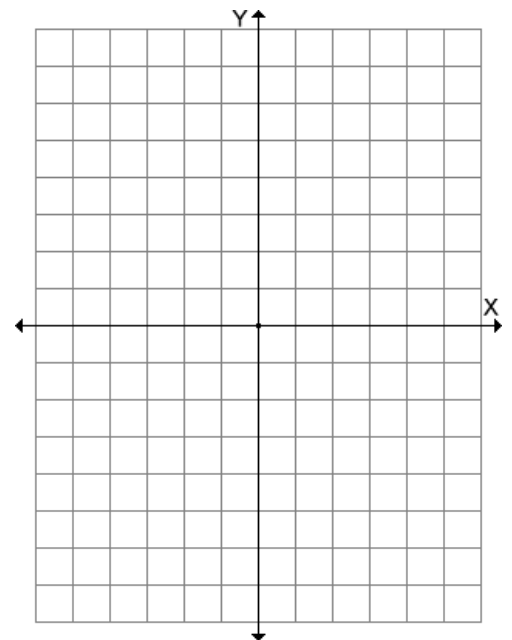
Directrix: _____ Focal Width: _____



EXAMPLE: Graph $(x - 5)^2 = 20(y - 3)$ and identify the directrix, focus, and focal width.

Vertex: _____ Focus: _____

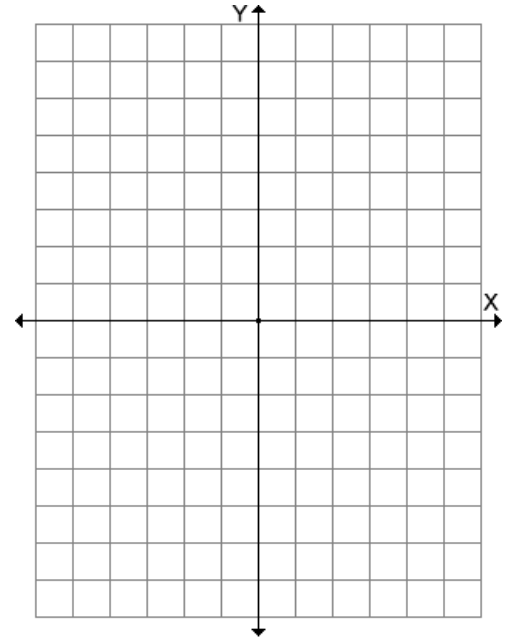
Directrix: _____ Focal Width: _____



EXAMPLE: Graph $y^2 + 4y - 12x + 40 = 0$ and identify the directrix, focus, and focal width.

Vertex: _____ Focus: _____

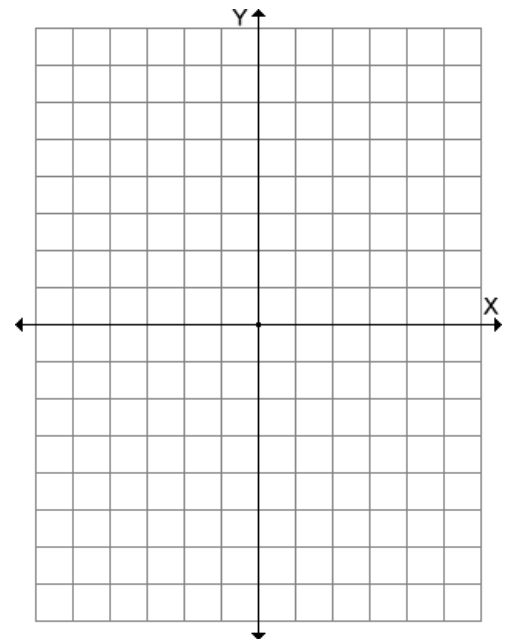
Directrix: _____ Focal Width: _____



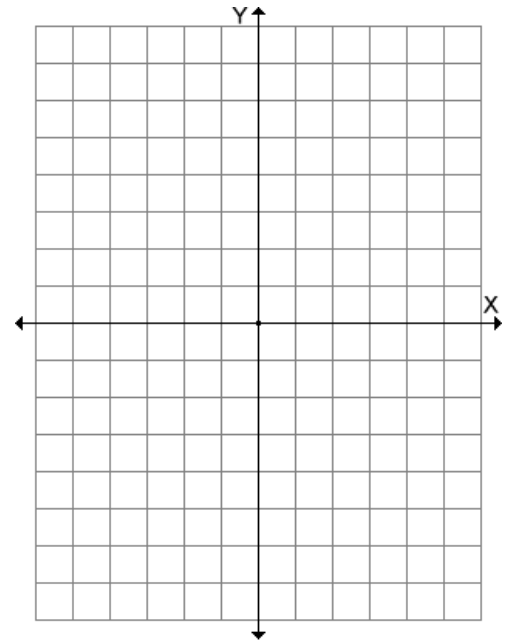
EXAMPLE: Graph $2x^2 + 4x + 20y - 38 = 0$ and identify the directrix, focus, and focal width.

Vertex: _____ Focus: _____

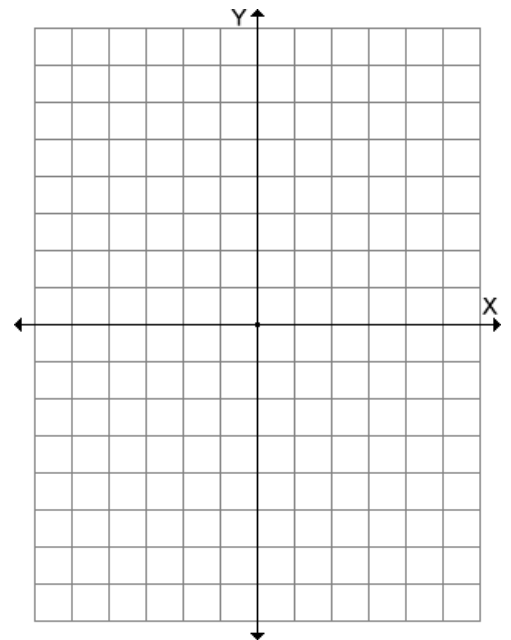
Directrix: _____ Focal Width: _____



EXAMPLE: Find the equation of the parabola if it is known the focus is $(-4, 0)$ and the vertex is $(0, 0)$.



EXAMPLE: Find the equation of the parabola if it is known the focus is $(2, 4)$ and the directrix is at $x = -4$.



EXAMPLE: Find the equation of the parabola if it is known the vertex is $(3, 0)$ and the directrix is at $y = 2$.

