

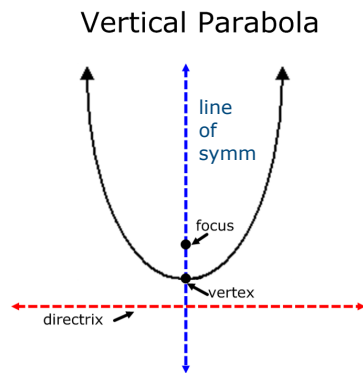
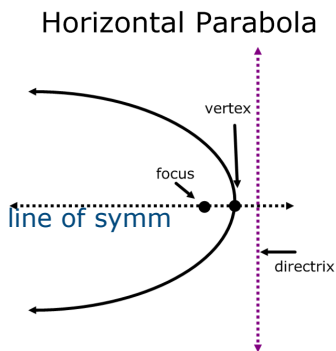
4.3 Parabolas

Objectives:

- Write the standard equation of a parabola and its axis of symmetry.
- Graph a parabola and identify its focus, directrix, and axis of symmetry.

Parabola - the set of points in a plane equidistant from a given point (focus) and a given line (directrix).

Recall from yesterday the parts of the parabola.



Vertex: (h, k)

Line of Symmetry:

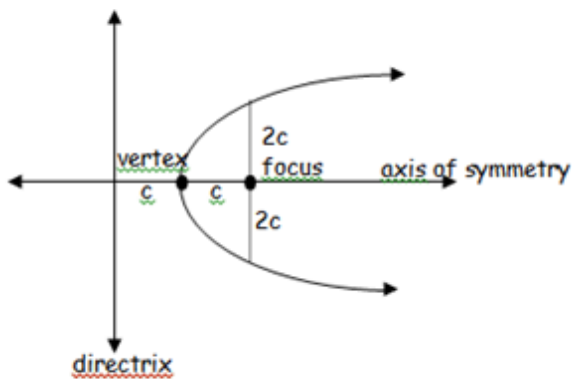
$x = \#$ or $y = \#$

Focus: $(\#, \#)$

Directrix

$y = \#$ or $x = \#$

Horizontal Parabolas



Equation:

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

$x =$

Vertex (h, k)

If a is positive the parabola opens **RIGHT**.

If a is negative the parabola opens **LEFT**.

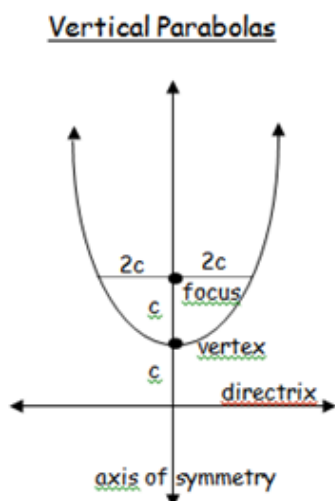
C is the distance from the vertex to the focus and the the vertex to the directrix.

$$a = \frac{1}{4c}$$

The width of the parabola is $4c$, $2c$ each way from the focus.

Axis of symm: $y = k$

Directrix $x = \#$



Equation:
$y = a(x - h)^2 + k$
<p>y =</p> <p>Vertex (h, k)</p> <p>If a is positive the parabola opens UP.</p> <p>If a is negative the parabola opens DOWN.</p> <p>C is the distance from the vertex to the focus and the <u>the</u> vertex to the directrix.</p> $a = \frac{1}{4c}$ <p>The width of the parabola is 4c, 2c each way from the focus.</p> <p>Axis of Symm: $x = h$</p> <p>Directrix: $y = \#$</p>

Steps for Graphing:

1. Put in Standard form (solve for x or y).
2. Vertical or Horizontal? x = horizontal, y = vertical
3. Plot Vertex, (h, k).
4. Find " c " $a = \frac{1}{4c}$
5. Count "c" units from vertex (in both directions) and plot focus (point, inside curve) and draw directrix (line, outside curve) If horizontal, count left and right. If vertical, count up and down.
6. The width of the parabola will be "2c" units in both directions from focus.

Ex. 1 $y = \frac{1}{8}(x-3)^2 - 4$ $a = \frac{1}{4c} = \frac{1}{8} \rightarrow 4c = 8 \rightarrow c = 2$

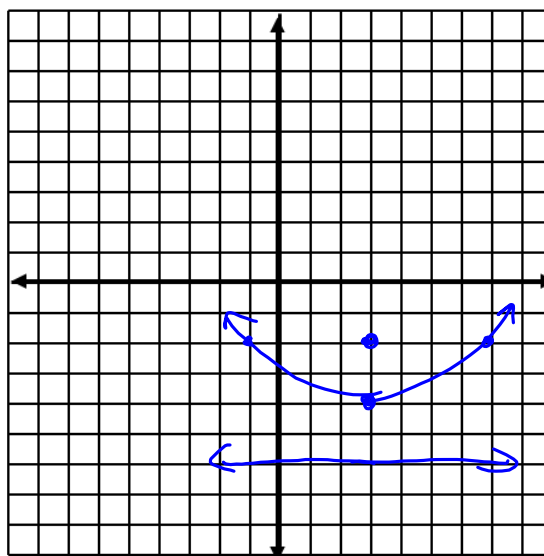
Equation \nearrow

Vertex $(3, -4)$

Axis of Symm $x = 3$

Focus $(3, -2)$

Directrix $y = -6$



Ex. 2 $x = \frac{1}{3}(y+4)^2 + 5$

$a = \frac{1}{4c} = \frac{1}{3} \rightarrow 4c = 3$
 $c = \frac{3}{4}$

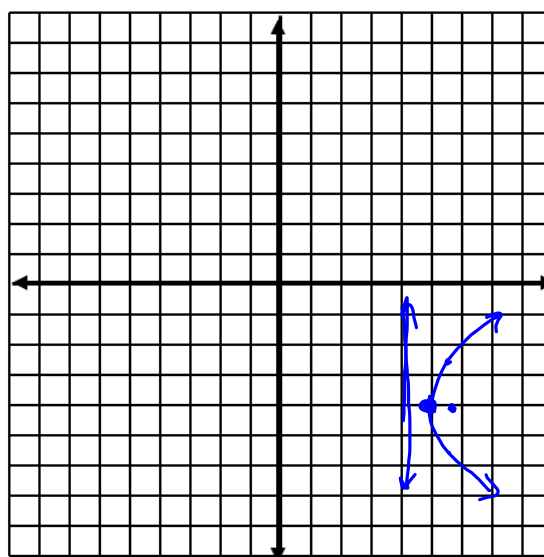
Equation \nearrow

Vertex $(5, -4)$

Axis of Symm $y = -4$

Focus $(5\frac{3}{4}, -4)$

Directrix $x = 4\frac{1}{4}$



Ex. 3 $8y + 16 = -(x - 3)^2 \rightarrow 8y = -(x - 3)^2 - 16$

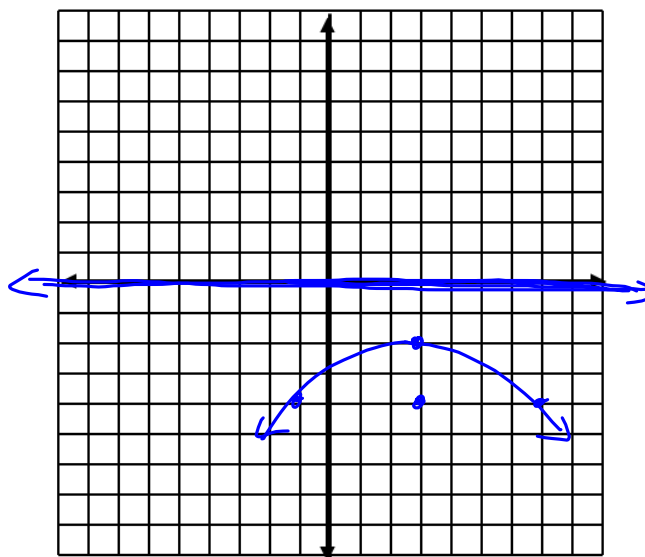
Equation $y = -\frac{1}{8}(x - 3)^2 - 2$

Vertex $(3, -2)$

Axis of Symm $x = 3$

Focus $(3, -4)$

Directrix $y = 0$



Ex. 4 $x = \frac{1}{16}y^2$ $\frac{1}{16} = \frac{1}{4a}$
 $a = 4$

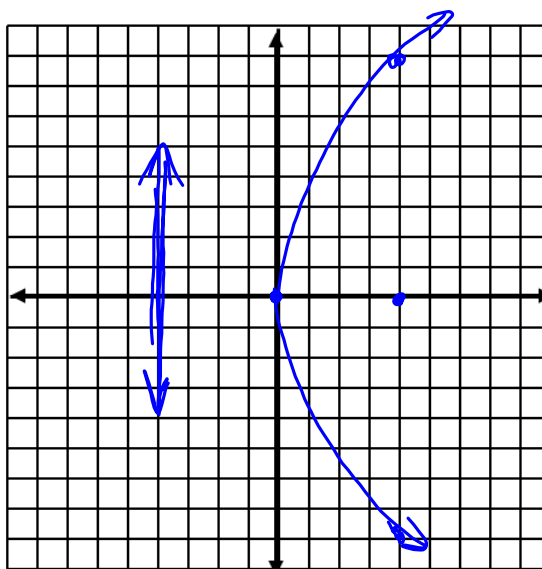
Equation $x = \frac{1}{16}y^2$

Vertex $(0, 0)$

Axis of Symm $y = 0$

Focus $(4, 0)$

Directrix $x = -4$



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Ex. 5 $y = x^2 + 4x + 4$

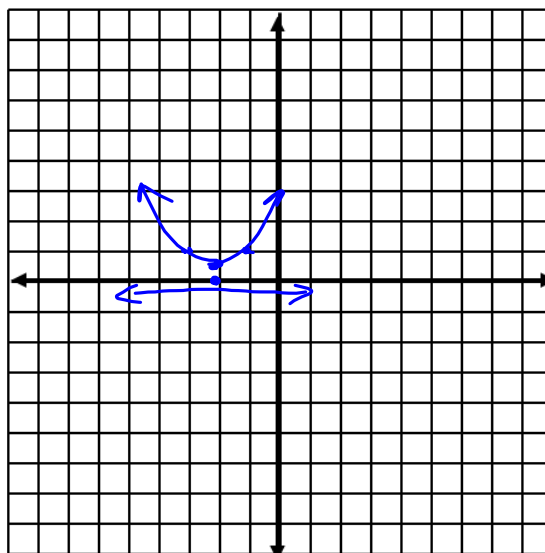
Equation $y = (x + 2)^2$

Vertex $(-2, 0)$ $1 = \frac{1}{4a}$ $a = \frac{1}{4}$

Axis of Symm $x = -2$

Focus $(-2, \frac{1}{4})$

Directrix $y = -\frac{1}{4}$



Ex. 6 $-5x = y^2 + 10y + 15 \rightarrow -5x = y^2 + 10y + 25 + 15 - 25$

Equation $x = -\frac{1}{5}(y + 5)^2 + 2$ $-5x = (y + 5)^2 - 10$

Vertex $(2, -5)$

Axis of Symm $y = -5$

Focus $(\frac{3}{4}, -5)$

Directrix $x = 3\frac{1}{4}$

$-\frac{1}{5} = \frac{1}{4a} \rightarrow 4a = 5$
 $a = \frac{5}{4}$

