

# 10.1 Parabolas

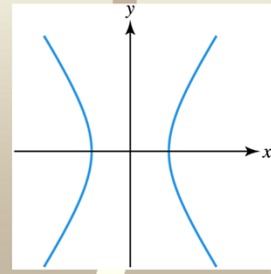
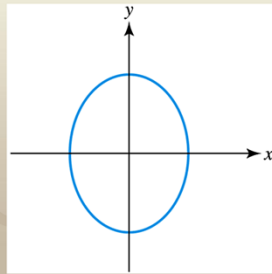
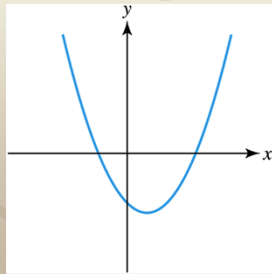
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# Conic Sections

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- Conic sections are formed when a plane intersects a cone in different ways.
- The basic conic sections are parabolas, ellipses, and hyperbolas.



From *Precalculus with Modeling and Visualization* 3<sup>rd</sup> ed. by Rockswold, 2006, p.845



## PARABOLA

A **parabola** is the set of points in a plane that are equidistant from a fixed point and a fixed line. The fixed point is called the **focus** and the fixed line is called the **directrix** of the parabola.

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## EQUATION OF A PARABOLA WITH VERTEX (0, 0)

### Vertical Axis

The parabola with a focus at  $(0, p)$  and directrix  $y = -p$  has equation

$$x^2 = 4py.$$

The parabola opens upward if  $p > 0$  and downward if  $p < 0$ .

### Horizontal Axis

The parabola with a focus at  $(p, 0)$  and directrix  $x = -p$  has equation

$$y^2 = 4px.$$

The parabola opens to the right if  $p > 0$  and to the left if  $p < 0$ .

From *Precalculus with Modeling and Visualization* 3<sup>rd</sup> ed. by Rockswold, 2006, p.845-6

## Examples

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Graph the parabola. Label the vertex, focus, and directrix.

1.  $y = -\frac{1}{8}x^2$

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





### EQUATION OF A PARABOLA WITH VERTEX $(h, k)$

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

Vertical axis; vertex:  $(h, k)$

$p > 0$ : opens upward;  $p < 0$ : opens downward

Focus:  $(h, k + p)$ ; directrix:  $y = k - p$

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

Horizontal axis; vertex:  $(h, k)$

$p > 0$ : opens to the right;  $p < 0$ : opens to the left

Focus:  $(h + p, k)$ ; directrix:  $x = h - p$

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Shifted Parabolas

From *Precalculus with Modeling and Visualization* 3<sup>rd</sup> ed. by Rockswold, 2006, p.849



## Examples

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1. Write the equation  $y^2 + 8x - 8 = 4x$  in the standard form for a parabola. Graph the parabola and label the vertex, focus, and directrix.
2. Find the equation of a parabola with Focus  $(2, 1)$  and directrix  $x = -1$ .