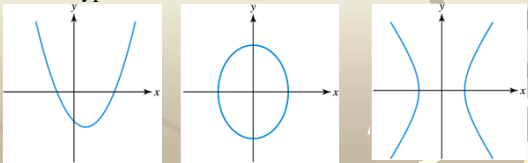


10.1 Parabolas

Conic Sections

- 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* 3rd 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.

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* 3rd ed. by Rockswold, 2006, p.845-6

Examples

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: $x = h - p$

Shifted Parabolas

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

Examples

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 $x = -1$.
