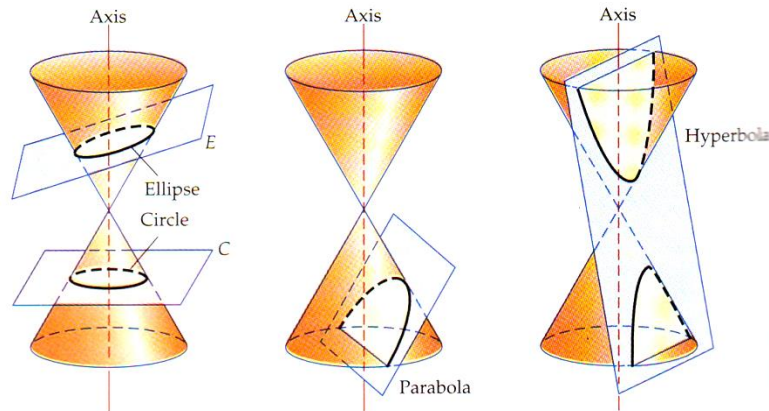# 9.2 Parabolas

The phrase conic sections stems from the fact that these are curves in which a plane intersects a cone. Hence these figures are referred to as conic sections.

A plane C perpendicular to the axis of the cone intersects the cone in a **circle**. The plane E, tilted so that it is not perpendicular to the axis, intersects the cone in an **ellipse**. The plane parallel to a line on the surface of the cone intersects the cone in a **parabola**. When the plane intersects both cones, a **hyperbola** is formed.

Besides the geometric description of a conic section just given, a conic can be defined as a set of points.

A **parabola** is the set of points in the plane that are equidistant from a fixed line l (the **directrix**) and a fixed point F (the **focus**) not on the directrix.

The line that passes through F and is perpendicular to l is called the **axis of symmetry** of the parabola. The midpoint V of the segment between F and l on the axis of symmetry is the **vertex** of the parabola.

I Standard Forms of the Equation of a Parabola with Vertex at the Origin
Suppose that the perpendicular distance from F to l is $2|p|$, V is at origin, and the axis of symmetry is the y-axis.
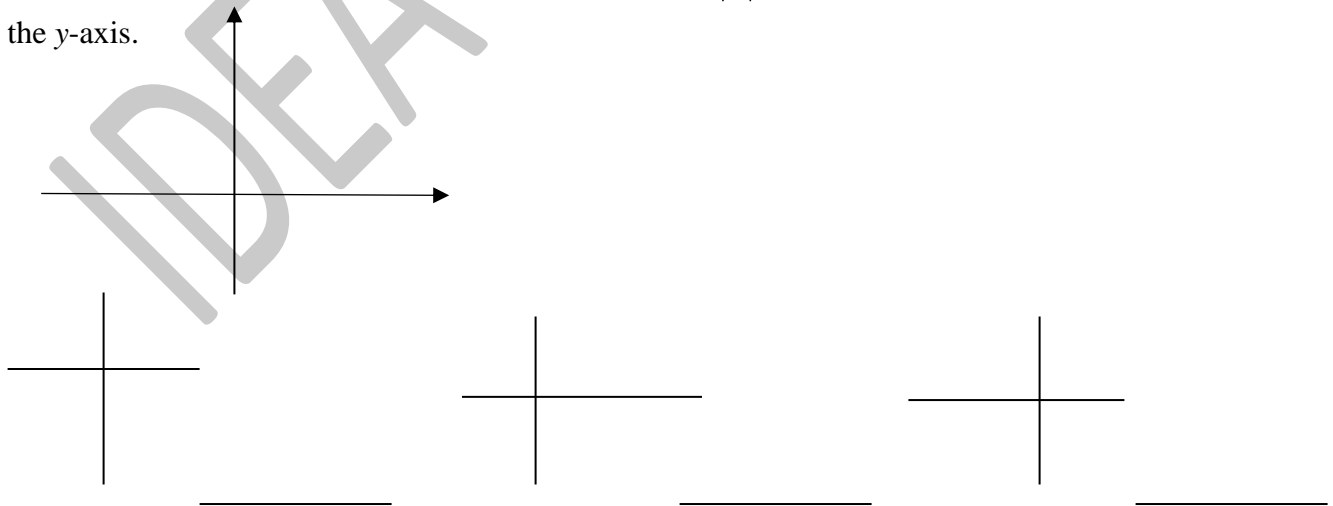
Example 1 Find F and l of the parabola given by the equation $y = -\dfrac{1}{2}x^2$.

2 Find the equation of the parabola in standard form with $V(0, 0)$ and $F(-2, 0)$.
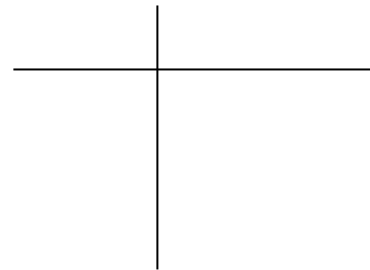
3 Write the standard form of the equation of parabola with directrix $y = 4$ and vertex at $(0, 0)$.

II Standard Forms of the Equation of a Parabola with Vertex at (h, k)
horizontal axis of symmetry _____   vertical axis of symmetry _____

4 Write an equation of the parabola whose vertex is at $(-2,1)$ and whose focus is at $(-3,1)$.

5 Find the equation of l and the coordinates of V and F of the parabola given by the equation $3x + 2y^2 + 8y - 4 = 0$.

Homework

1 Tell whether the parabola opens *up*, *down*, *left*, or *right*. (a) $x = 7y^2$ (b) $x^2 = \dfrac{4}{3}y$

2 Graph the equation. Identify the focus and directrix of the parabola. (a) $y^2 = -14x$ (b) $x^2 = 18y$

3 Write the standard form of the equation of the parabola

(a) with the focus $(-2,0)$ and vertex at $(0,0)$;   (b) with the directix $y = -3$ and vertex at $(0,0)$

4 Write an equation for the parabola with vertex at $(1,-2)$ and focus at $(1, 1)$.

5* Write the equation $y^2 - 12y + 4x + 4 = 0$ in standard form. Then graph the equation.