

## 1. Standard Equation of a Parabola

- The standard form of the equation of a parabola with vertex  $(h, k)$  and directrix  $y = k - p$  is

$$(x - h)^2 = 4p(y - k). \quad (\text{vertical axis})$$

For directrix  $x = h - p$  the equation is

$$(y - k)^2 = 4p(x - h). \quad (\text{horizontal axis})$$

The focus lies on the axis  $p$  units from the vertex.

## 2. Standard Equation of an Ellipse

- The standard form of the equation of an ellipse, with center  $(h, k)$  and major and minor axes of length  $2a$  and  $2b$ , where  $a > b$ , is

$$\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1, \quad (\text{horizontal major axis})$$

$$\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1. \quad (\text{vertical major axis})$$

The foci lie on the major axis,  $c$  units from the center, with  $c^2 = a^2 - b^2$ . The eccentricity is  $e = c/a$ .

## 3. Standard Equation of a Hyperbola

- The standard form of the equation of a hyperbola with center at  $(h, k)$  is

$$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1 \quad (\text{horizontal transverse axis})$$

$$\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1. \quad (\text{vertical transverse axis})$$

The vertices are  $a$  units from the center, and the foci are  $c$  units from the center. Moreover,  $b^2 = c^2 - a^2$ . The eccentricity is  $e = c/a$ .

- For a horizontal transverse axis, the equations of the asymptotes are

$$y = k + \frac{b}{a}(x - h) \quad \text{and} \quad y = k - \frac{b}{a}(x - h).$$

For a vertical transverse axis, the equations of the asymptotes are

$$y = k + \frac{a}{b}(x - h) \quad \text{and} \quad y = k - \frac{a}{b}(x - h).$$