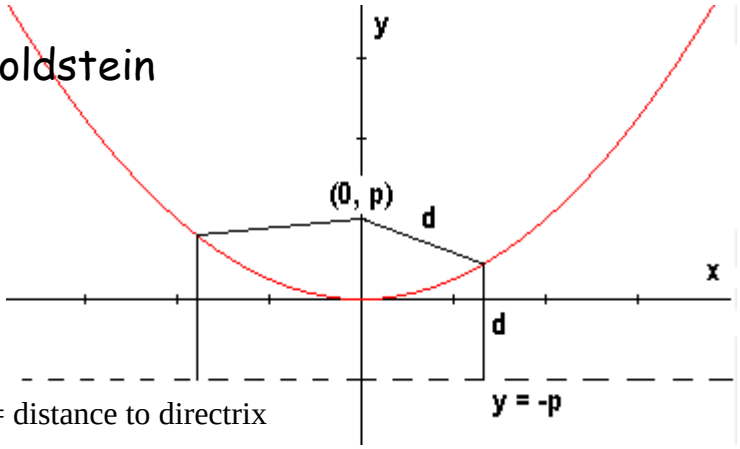
Conic Sections – Prof. Richard B. Goldstein

Parabola: $x^2 = 4py$ **p > 0** **e = 1**



focus: (0, p)

vertex: (0, 0)

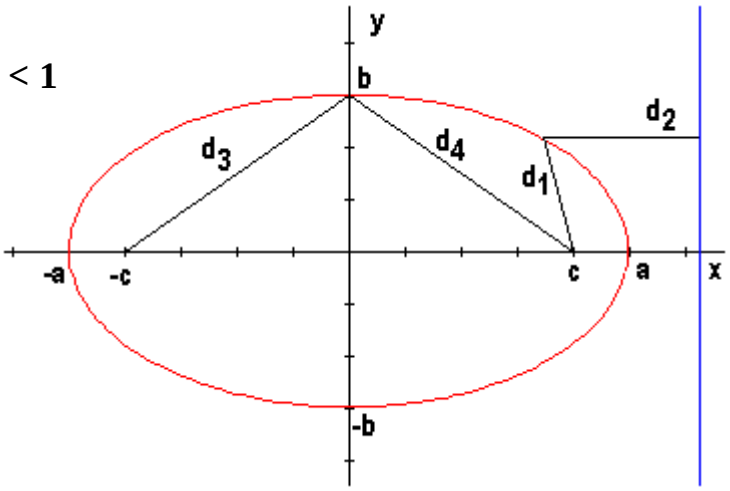
directrix: y = -p

distance from point on curve to focus = distance to directrix

p < 0 upside down

$y^2 = 4px$ results from focus : (p, 0), vertex (0, 0), and directrix: x = -p

Ellipse: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **e < 1**



foci: (c, 0) and (-c, 0)

vertices: (a, 0) and (-a, 0)

center: (0, 0)

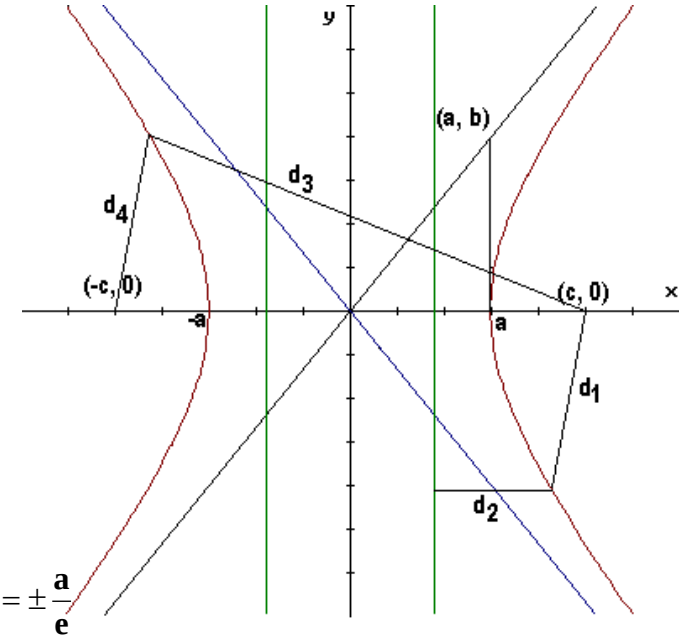
constant sum = $2a = d_3 + d_4$

$c^2 = a^2 - b^2$, $a \geq b > 0$

$\mathbf{e} = \frac{\mathbf{c}}{\mathbf{a}} = \frac{\sqrt{\mathbf{a}^2 - \mathbf{b}^2}}{\mathbf{a}} = \frac{\mathbf{d}_1}{\mathbf{d}_2}$ directrices: $\mathbf{x} = \pm\frac{\mathbf{a}}{\mathbf{e}}$

sum of distances from one focus to ellipse to second focus is constant = 2a

Hyperbola: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ **e > 1**



foci: (c, 0) and (-c, 0)

vertices: (a, 0) and (-a, 0)

center: (0, 0)

constant difference = $2a = d_3 - d_4$

$c^2 = a^2 + b^2$

asymptotes $\mathbf{y} = \pm\frac{\mathbf{b}}{\mathbf{a}}\mathbf{x}$

$\mathbf{e} = \frac{\mathbf{c}}{\mathbf{a}} = \frac{\sqrt{\mathbf{a}^2 + \mathbf{b}^2}}{\mathbf{a}} = \frac{\mathbf{d}_1}{\mathbf{d}_2}$ directrices: $\mathbf{x} = \pm\frac{\mathbf{a}}{\mathbf{e}}$