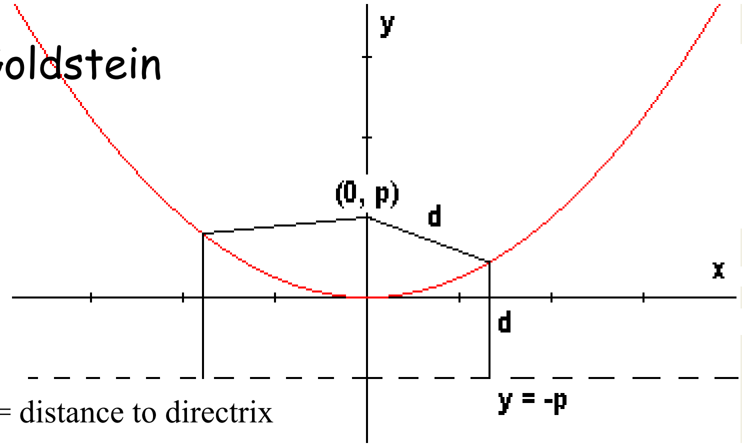
Conic Sections – Prof. Richard B. Goldstein



Parabola: $\mathbf{x^2 = 4py}$ $\quad$ $\mathbf{p > 0}$ $\quad$ $\mathbf{e = 1}$

<u>focus</u>: (0, p)

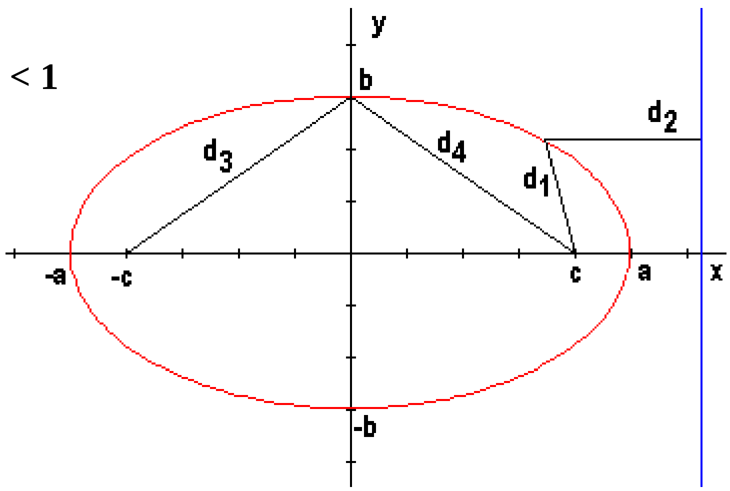
<u>vertex</u>: (0, 0)

<u>directrix</u>: y = -p

distance from point on curve to focus = distance to directrix

p < 0 upside down

$\mathbf{y^2 = 4px}$ results from <u>focus</u> : (p, 0), <u>vertex</u> (0, 0), and <u>directrix</u>: x = -p



Ellipse: $\dfrac{\mathbf{x}^2}{\mathbf{a}^2} + \dfrac{\mathbf{y}^2}{\mathbf{b}^2} = 1$ $\quad$ $\mathbf{e < 1}$

<u>foci</u>: (c, 0) and (-c, 0)

<u>vertices</u>: (a, 0) and (-a, 0)

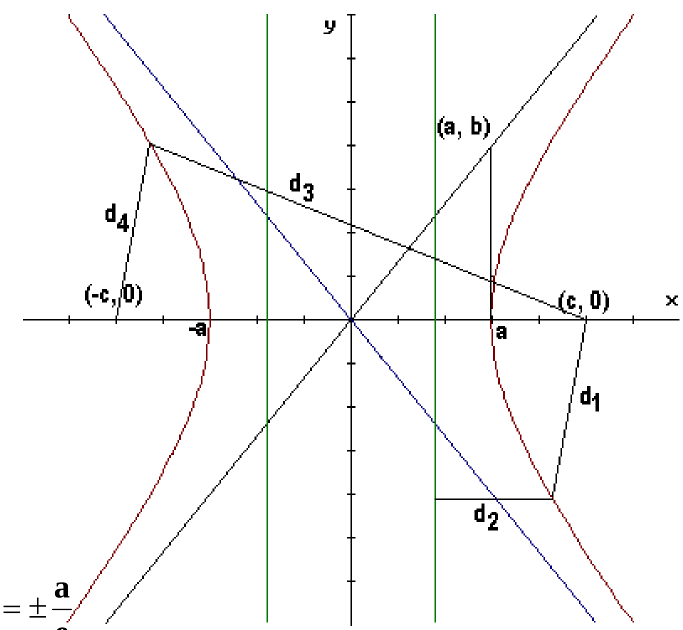
<u>center</u>: (0, 0)

constant sum = 2a = $d_3 + d_4$

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

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

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



Hyperbola: $\dfrac{\mathbf{x}^2}{\mathbf{a}^2} - \dfrac{\mathbf{y}^2}{\mathbf{b}^2} = 1$ $\quad$ $\mathbf{e > 1}$

<u>foci</u>: (c, 0) and (-c, 0)

<u>vertices</u>: (a, 0) and (-a, 0)

<u>center</u>: (0, 0)

constant difference = 2a = $d_3 - d_4$

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

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

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