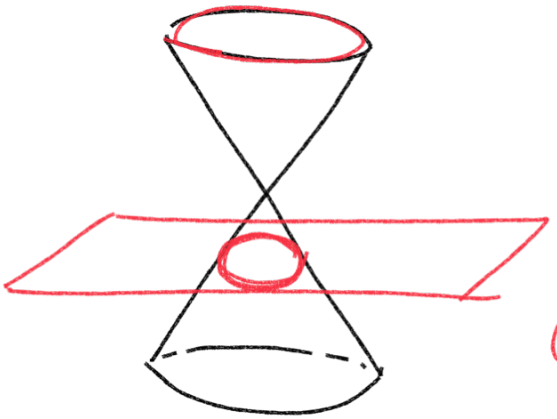
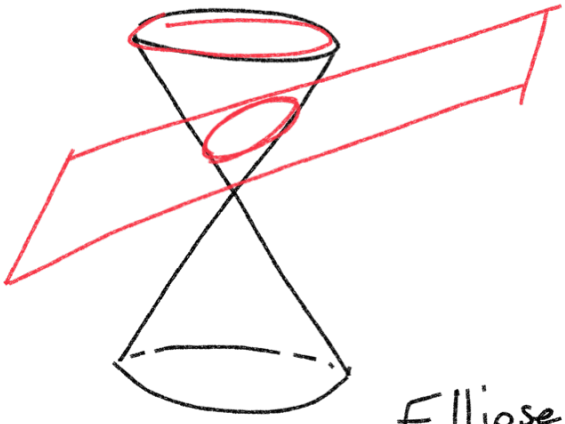
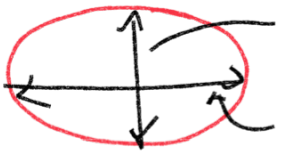
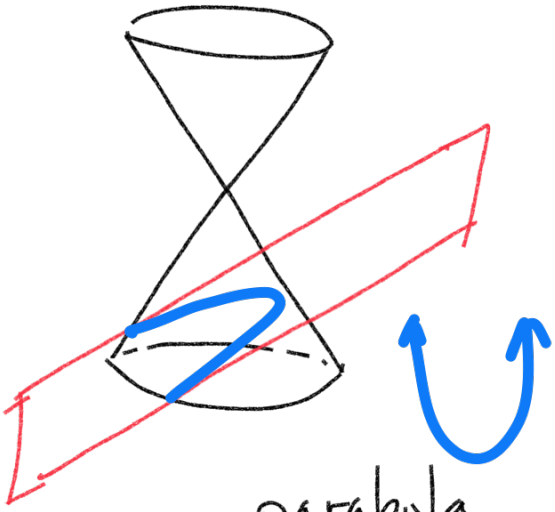
Conic Sections





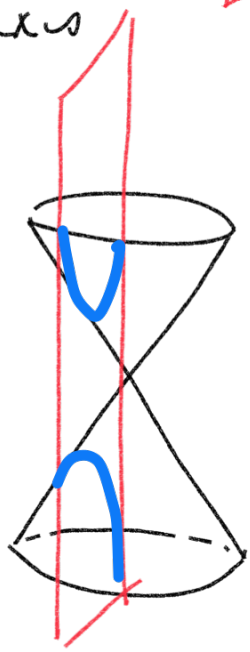
Ellipse





parabola

hyperbola



General Formula

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

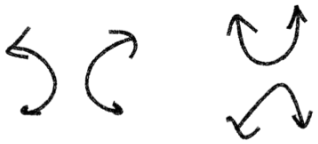
$B^2 - 4AC$

quadratic formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Discriminant

$b^2 - 4ac > 0$ ⊕ hyperbola



⊕ $b^2 - 4ac > 0$ 2 real solutions

$b^2 - 4ac = 0$ parabola

$b^2 - 4ac = 0$ 1 real solution

$b^2 - 4ac < 0$ ⊖ ellipse/circle

⊖ $b^2 - 4ac < 0$ 0 real solutions

Circle: $(x-h)^2 + (y-k)^2 = r^2$

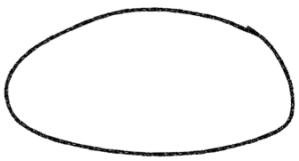
(h, k) center

r = radius

Ellipse: $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

$a \rightarrow$ horizontal axis

$b \rightarrow$ vertical axis



only difference between ellipse and hyperbola

hyperbola: $\frac{(x-h)^2}{a^2} \downarrow \frac{(y-k)^2}{b^2} = 1$

parabola: $y = a(x-h)^2 + k$ (h,k) vertex

$x = a(y-k)^2 + h$

1.) $[x^2 - 4x] + [y^2 + 2y] = 4$ Circle

2.) $\frac{5x^2}{25} + \frac{20y^2}{25} = \frac{25}{25}$ Ellipse

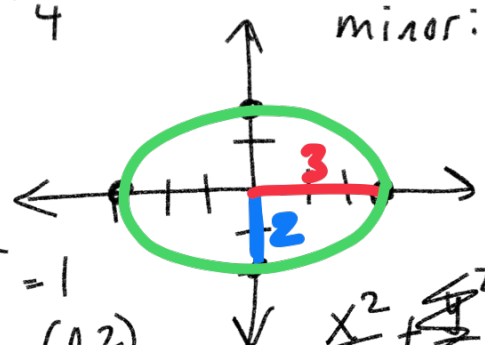
$\frac{x^2}{5} + \frac{4y^2}{5} = 1$ $\frac{x^2}{5} + \frac{y^2}{\frac{5}{4}} = 1$

major: 3

minor: 2

axis of 2

$\left\{\frac{x^2}{9\sqrt{9}} + \frac{y^2}{4\sqrt{4}} = 1\right\}$



$x = 0$ $\frac{y^2}{4} = 1$ $(0,2)$ $(0,-2)$

$4\left(\frac{y^2}{4}\right) = (1)4$

$\sqrt{y^2} = \sqrt{4}$ $y = \pm 2$

$\frac{x^2}{9} + \frac{y^2}{4} = 1$

$\frac{x^2}{9} = 1$ $\sqrt{x^2} = \sqrt{9}$ $(3,0)$ $(-3,0)$

$x = \pm 3$

Know Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

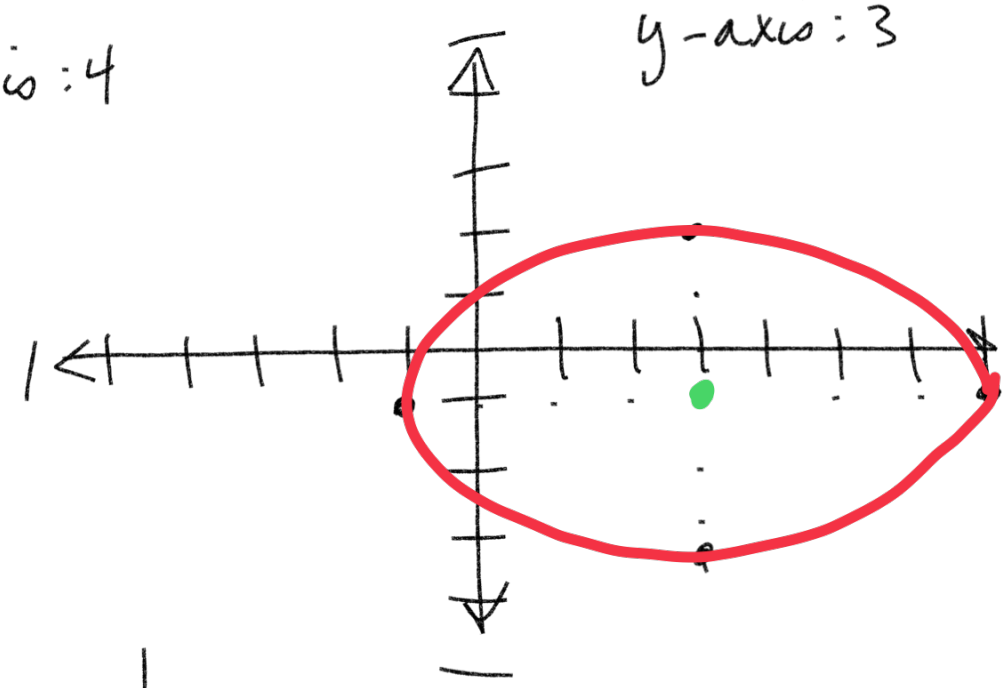
$$\frac{(x-3)^2}{16} + \frac{(y+1)^2}{9} = 1$$

$\sqrt{16}$

center: $(3, -1)$

x-axis: 4

y-axis: 3



3.) $\frac{2x^2}{2} + \frac{2y^2}{2} = \frac{10}{2}$

Circle

$x^2 + y^2 = 5$

center $\{(0,0)\}$

radius $= \sqrt{5}$

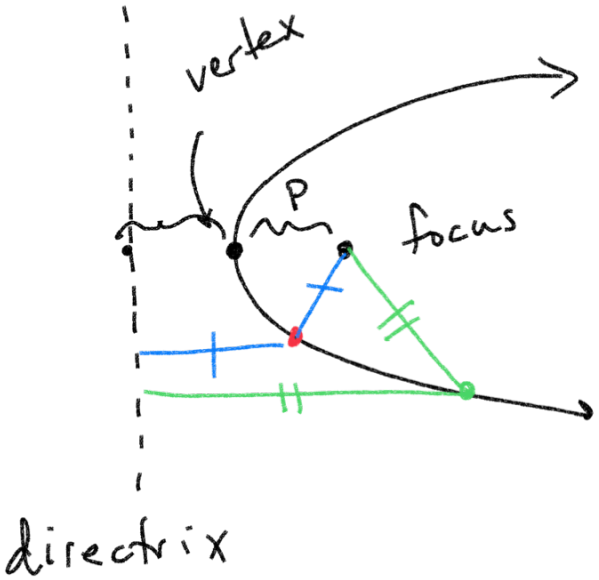
4.) $2y^2 - x^2 = 16$

hyperbola

5.) $y^2 - x = 2$

parabola

Parabola



$4xp = y^2$

p = distance between focus and vertex