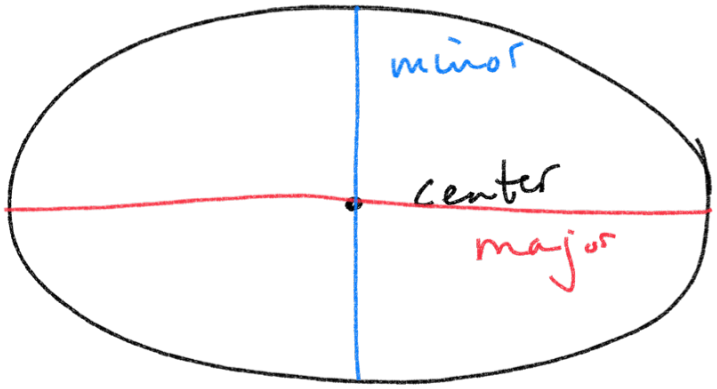
Ellipse



Horizontal Ellipse

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

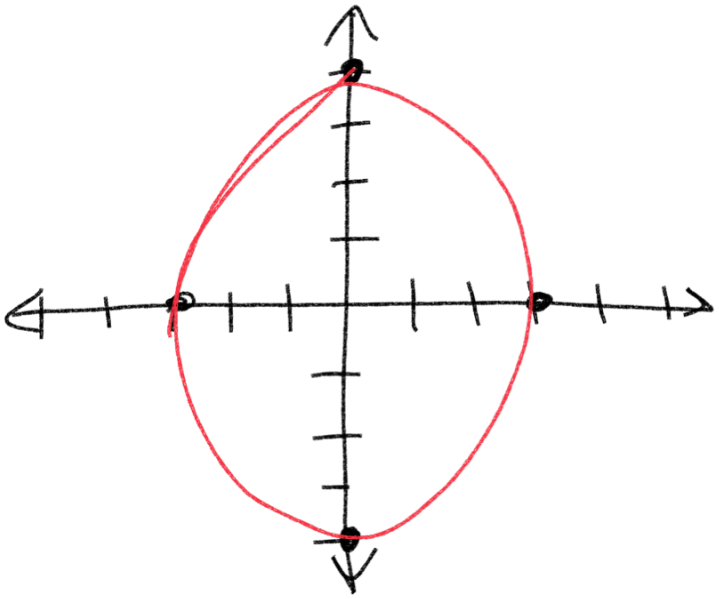
Horizontal $a > b$

Vertical $a < b$

a = horizontal axis

b = vertical axis

$$\frac{x^2}{9} + \frac{y^2}{16} = 1$$



$x = 0$

$$\frac{x^2}{9} + \frac{y^2}{16} = 1$$

$$16\left(\frac{y^2}{16}\right) = (1)16$$

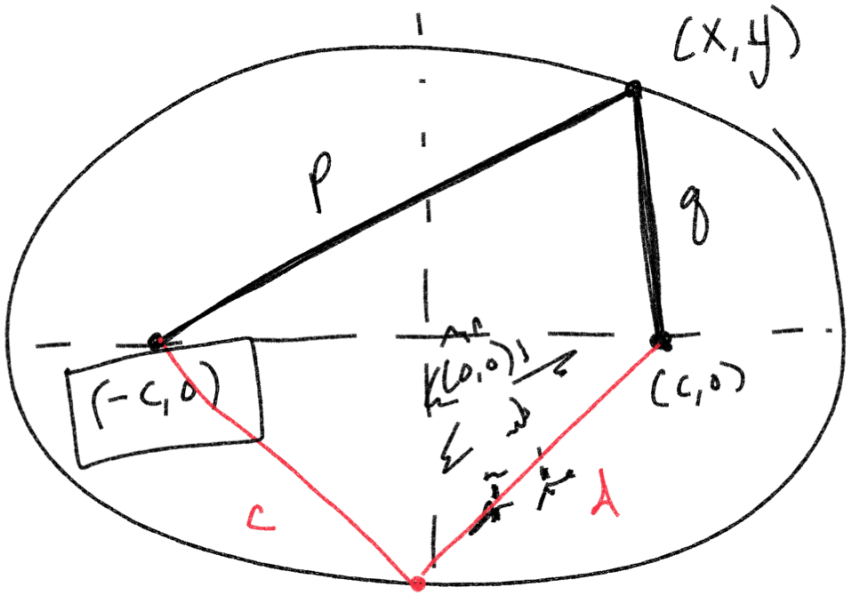
$$\sqrt{y^2} = \sqrt{16} \quad y = \pm 4$$

$y = 0$

$$9\left(\frac{x^2}{9}\right) = (1)9$$

$$\sqrt{x^2} = \sqrt{9}$$

$$x = \pm 3$$



$p + q = c + d$

$p + q = 2a$ (x_b, y_b)

$$p = \frac{\sqrt{(x_2 - x_1)^2 - (y_2 - y_1)^2}}{\sqrt{(x - (-c))^2 - (y - 0)^2}} = \sqrt{(x+c)^2 - y^2}$$

$$q = \sqrt{(x-c)^2 - (y-0)^2} = \sqrt{(x-c)^2 - y^2}$$

$$\sqrt{(x+c)^2 - y^2} + \sqrt{(x-c)^2 - y^2} = 2a$$

$$- \sqrt{(x-c)^2 - y^2} \quad - \sqrt{(x-c)^2 - y^2}$$

$$\sqrt{(x+c)^2 - y^2} = 2a - \sqrt{(x-c)^2 - y^2}$$

$$\left(\sqrt{(x+c)^2-y^2}\right)^2=\left(2a-\sqrt{(x-c)^2-y^2}\right)^2$$

$$(x+c)^2-y^2=\left(2a-\sqrt{(x-c)^2-y^2}\right)\left(2a-\sqrt{(x-c)^2-y^2}\right)$$

$$(x+c)^2-y^2=4a^2-2a\sqrt{(x-c)^2-y^2}-2a\sqrt{(x-c)^2-y^2}+(x-c)^2-y^2$$

$(x+c)(x+c)$ $\qquad$ $(x-c)(x-c)$

$$x^2+2cx+c^2-y^2=4a^2-4a\sqrt{(x-c)^2-y^2}+x^2-2cx+c^2-y^2$$

$+2cx$ $\qquad$ $-4a^2$ $\qquad$ $+2cx$

$-4a^2$

$$\frac{4cx-4a^2}{-4}=\frac{-4a\sqrt{(x-c)^2-y^2}}{-4}$$

$$\left(a^2-cx\right)^2=\left(a\sqrt{(x-c)^2-y^2}\right)^2$$

$$(a^2-cx)(a^2-cx)=a^2\left((x-c)^2-y^2\right)$$

$$a^4-2a^2cx+c^2x^2=a^2\left(x^2-2cx+c^2-y^2\right)$$

$$a^4-2a^2cx+c^2x^2=a^2x^2-2a^2cx+a^2c^2-a^2y^2$$

$+2a^2cx$ $\qquad$ $-c^2x^2$ $\qquad$ $+2a^2cx$ $\qquad$ $-c^2x^2$

$-a^2c^2$ $\qquad$ $-a^2c^2$

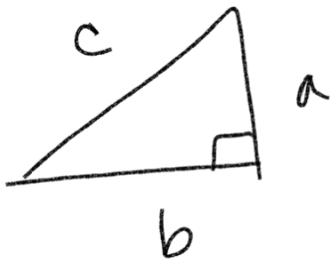
$$a^4-a^2c^2=a^2x^2-c^2x^2-a^2y^2$$

$$a^2(a^2-c^2)=x^2(a^2-c^2)-a^2y^2$$

$$\frac{a^2(a^2-c^2)}{a^2-c^2} = \frac{x^2(a^2-c^2)}{a^2-c^2} - \frac{a^2y^2}{a^2-c^2} \qquad a^2-c^2 \neq 0$$

$$a^2 \neq c^2$$

$$a^2 = x^2 - \frac{a^2y^2}{a^2-c^2}$$



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

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

$$-c^2 \quad -c^2$$

$$a^2-c^2+b^2=0$$

$$-b^2 \quad -b^2$$

$$a^2-c^2=-b^2$$

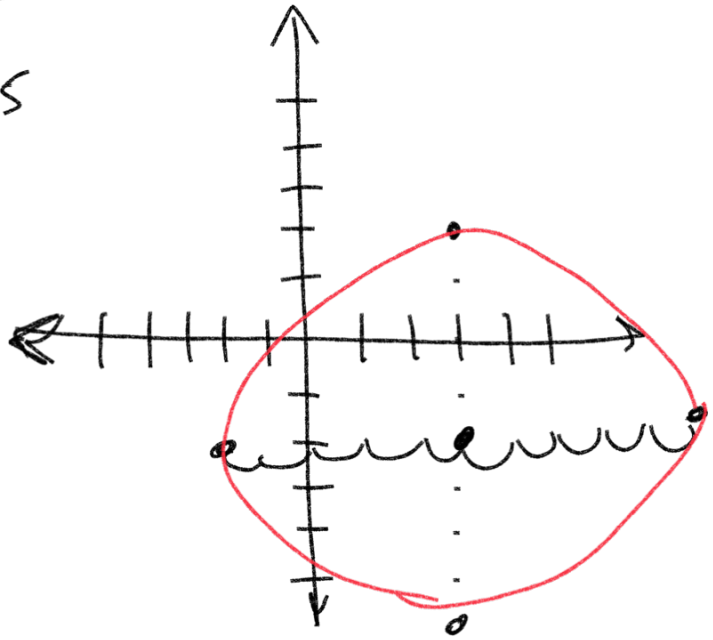
$$\frac{a^2}{a^2} = \frac{x^2}{a^2} + \frac{a^2y^2}{b^2/a^2}$$

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

Center (h,k)

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

$$\frac{(x-3)^2}{25} + \frac{(x+2)^2}{16} =$$

$\sqrt{16}$

$\sqrt{25} = \pm 5$