CONIC SECTIONS

Parabolas	Circles / Ellipse	Hyperbolas
$y = x^2$	$x^2 + y^2 = 1$	$x^2 - y^2 = 1$
$x = y^2$	$x^2 + y^2 = r^2$	$y^2 - x^2 = 1$

Lines

		Ex
$y - y_1 = m(x - x_1)$	Point - Slope (x_1, y_1), m	$y + 1 = 2(x - 3)$ Pt $(3, -1)$ $m = 2$
$y = mx + b$	Slope Intercept	$y = 2x - 7$ $b = (0, -7)$
$Ax + By = C$	General Form	$2x - y = 7$

Standard Form

$(y - k) = A(x - h)^2$

$(x - h) = A(y - k)^2$

Vertex (h, k) (A = Stretch Part)

General Form

$Ax^2 + By + Cx + D = 0$

$Ay^2 + Bx + Cy + D = 0$

Parabola

Standard Form

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

Center (h, k)

4 Vertices $(h \pm A, k)$ $(h, k \pm B)$

General Form

$Ax^2 + Ay^2 + Bx + Cy + D = 0$

circle.

$Ax^2 + By^2 + Cx + Dy + E = 0$

Ellipse

Standard Form

$\frac{(x-h)^2}{A} - \frac{(y-k)^2}{B^2} = 1$

Center (h, k)

Vertex $(h \pm A, k)$

General Form

$Ax^2 - By^2 + Cx + Dy + E = 0$

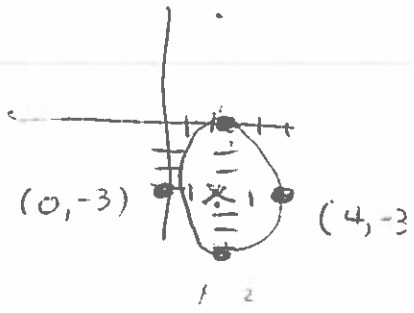
Different Signs

Ellipse in Standard Form

$$\frac{(x-2)^2}{4} + \frac{(y+3)^2}{9} = 1$$

(2^2) (3^2)

Center $(2, -3)$



Tall Ellipse

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

$(y+3)^2 = 9$

$y + 3 = \pm 3$

$y = -3 \pm 3$

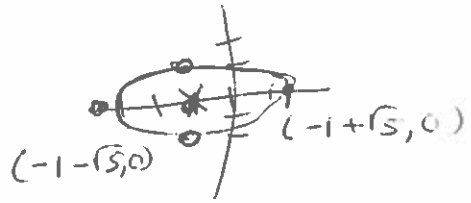
$(2, -6) \quad (2, 0)$

$-3+3 \qquad -3+3$

Ex $\frac{(x+1)^2}{5} + y^2 = 1$

$(\sqrt{5})^2$

Center: $(-1, 0)$



Wide Ellipse

General Form

$(x+1)^2 + 5y^2 = 5$

$x^2 + 2x + 1 + 5y^2 = 5$

$x^2 + 5y^2 + 2x - 4 = 0$

$y = \sqrt{1 - (x+1)^2/5}$

$y = -\sqrt{1 - (x+1)^2/5}$

$$6x^2 - 9y^2 + 4x + 3y - 5 = 0$$

Hyperbola $\longrightarrow$ Standard Form

$6x^2 + 4x$ $\quad -9y^2 + 3y$ $\quad = 5$

x's $\quad$ y's $\quad$ Numbers

Factor

$$6\left(x^2 + \frac{2x}{3} + \boxed{\frac{1}{9}}\right) - 9\left(y^2 + \frac{1}{3}y + \left(\frac{1}{36}\right)\right) = 5 \quad +6\boxed{\frac{1}{9}}$$

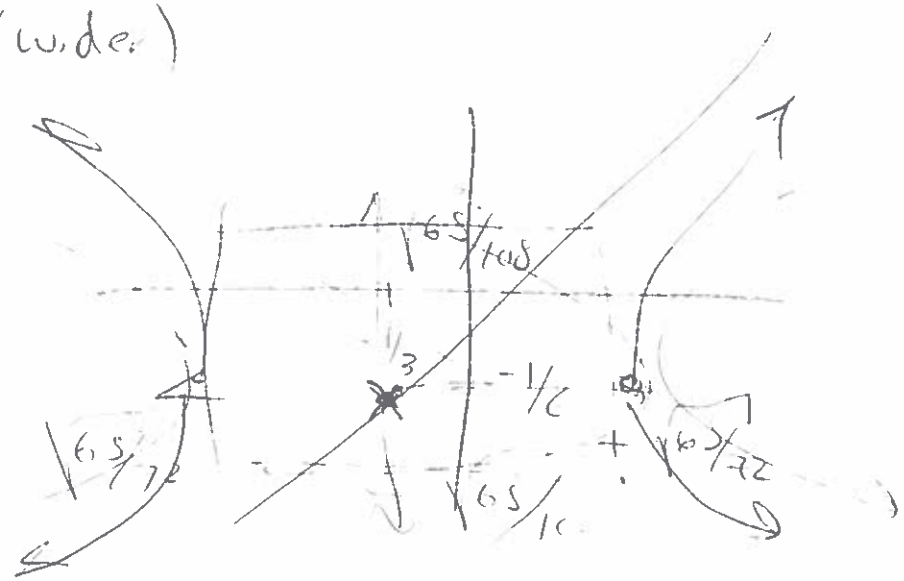
complete sq $\qquad$ sq $\Rightarrow 9\left(\frac{1}{36}\right)$

$$6\left(x + \frac{1}{3}\right)^2 - 9\left(y + \frac{1}{6}\right)^2 = 5 + \frac{2}{3} - \frac{1}{4}$$

$$\frac{72}{65}\left(x + \frac{1}{3}\right)^2 - \frac{108}{65}\left(y + \frac{1}{6}\right)^2 = \frac{65}{12} \cdot \frac{12}{65}$$

$$\frac{\left(x + \frac{1}{3}\right)^2}{65/72} - \frac{\left(y + \frac{1}{6}\right)^2}{65/108} = 1$$

bisser. (wide)



Hyperbola

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

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

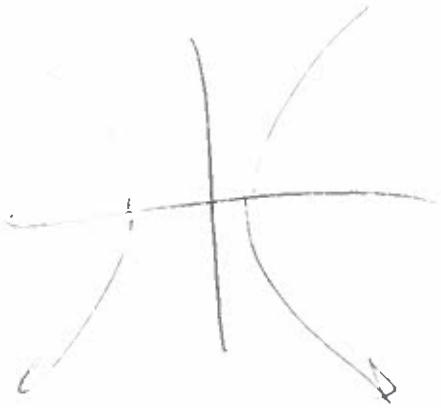
$$\sqrt{\frac{(x+2)^2}{4} - 1} = \frac{y-1}{3}$$

$$y = 1 - 3\sqrt{\frac{(x+2)^2}{4} - 1}$$

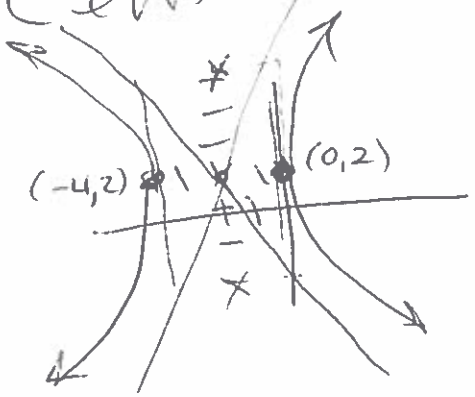
In calculator

$Y_1 = 1 - 3\sqrt{(1 + (x+2)^2/4)}$

$Y_2 = 1 + 3\sqrt{(1 + (x+2)^2/4)}$



Center: $(-2, 1)$



$$9(x+2)^2 - 4(y-1)^2 = 36$$

$$9(x^2+4x+4) - 4(y^2-2y+1) = 36$$

$$9x^2 - 4y^2 + 36x + 8y - 4 = 0$$ General Form

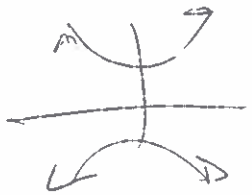
Hyperbola because different signs

$$-9x^2 + 4y^2 - 36x - 8y + 4 = 0$$

$$x^2 - y^2 + 7x + 5y - 7 = 0$$

Hyperbola

$$y^2 - x^2 = 1$$



$$= x^2 = y^2 - 6x - 7y - 12 = 0$$

Circle

$$x^2 + y^2 = 0$$

$(0,0)$

$$x^2 + y^2 = -4$$

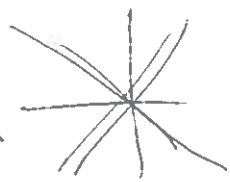
Not real graph

$$x^2 + x + y - 7 = 0$$

Parabola

$$x^2 - y^2 = 0$$

$y^2 = x^2 \quad y = \pm x$



Couple of Lies

Standard Forms

Parabola

Ex $\frac{(x-2)}{3} = \blacksquare\frac{(y+4)^2}{1}$

vertex: $(2, -4)$

$\boxed{x = y^2}$

side/side Parabola

$\sqrt{x} = y_1$

$-\sqrt{x} = y_2$

$+\sqrt{\frac{x-2}{3}} - 4 = y_1$

$-\sqrt{\frac{x-2}{3}} - 4 = y_2$

Ex $\frac{(x+1)^2}{-2} = \frac{(y)^2}{4}$

vertex $(-1, 0)$

because $-2, +4$

$$x - 2 = 3(y+4)^2$$

$$x - 2 = 3(y^2 + 8y + 16)$$

$$x - 2 = 3y^2 + 24y + 48$$

$$0 = 3y^2 - x + 24y + 50$$ General Form

Given.

$$3y^2 - x + 24y + 50 = 0$$ Find Standard Form

$$3y^2 + 24y \quad - x \quad = -50$$

y x Numbers.

$$3(y^2 + 8y + \square) - x = -50 + 3\square$$

Factored out 3.

Complete Square by adding

$$3(y^2 + 8y + \boxed{16}) - x = -50 + 3 \cdot \boxed{16}$$

$+2$ $+2$ $+48$

$$3(y+4)^2 - x = -2$$

$$(y+4)^2 = \frac{x-2}{3}$$