$$\sqrt{x+10} = x-2$$

How do you know you're RIGHT?

$$\sqrt{x+10} = x-2 \qquad (x-2)(x-2)$$

$$x+10 = x^2-4x+4$$

$$0 = x^2-5x-6$$

$$0 = (x-6)(x+1)$$

$x-6=0$ $\qquad$ $x+1=0$

$x=6$ $\qquad$ $x=-1$

CTS

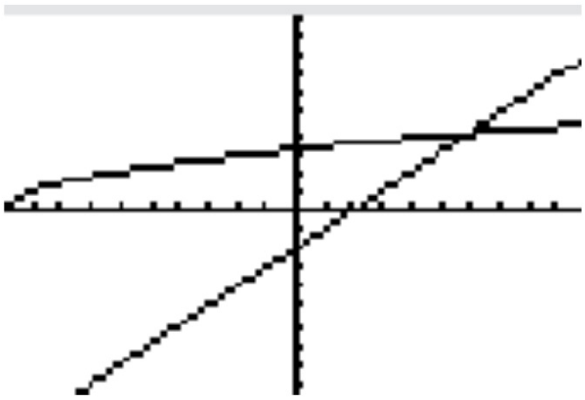
Factoring

Quad. Formula

Plot1 Plot2 Plot3

$Y_1 = \sqrt{X+10}$

$Y_2 = X-2$



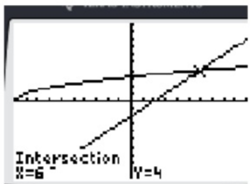
X	Y_1	Y_2
2	3.4641	0
3	3.6056	1
4	3.7417	2
5	3.873	3
6	4	4
7	4.1231	5
8	4.2426	6

X=6

X	Y_1	Y_2
-1	3	-3
0	3.1623	-2
1	3.3166	-1

CALCULATE
1:value
2:zero
3:minimum
4:maximum

CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx



$$\frac{2}{x} = \frac{3}{x-2} - 1$$

$$\frac{2}{x} = \frac{3}{x-2} - \frac{x-2}{x-2}$$

$$\frac{(x-2)}{(x-2)} \cdot \frac{2}{x} = \frac{5-x}{x-2} \frac{(x)}{(x)}$$

$$\frac{2x-4}{x(x-2)} = \frac{5x-x^2}{x(x-2)}$$

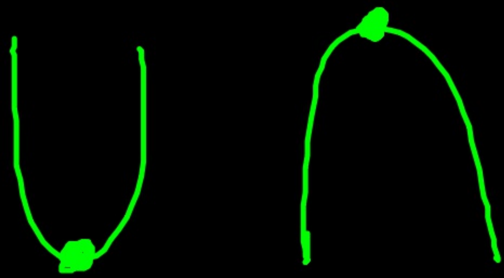
$$2x-4 = 5x-x^2$$

$$x^2-3x-4=0$$

$$(x-4)(x+1)=0$$

$$x-4=0 \qquad x+1=0$$

$$x=4 \qquad x=-1$$



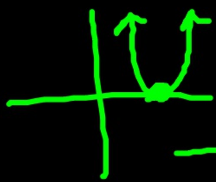
symmetry

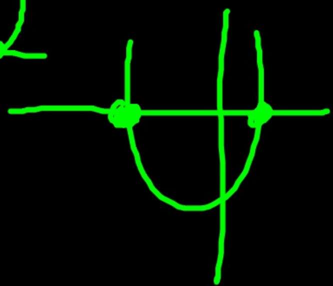
max/min

vertex

degree = 2

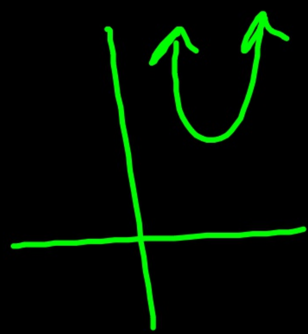
Curve





Vertex : max/min

Quadratic Formula: x-int, roots, zeros, sol'ns



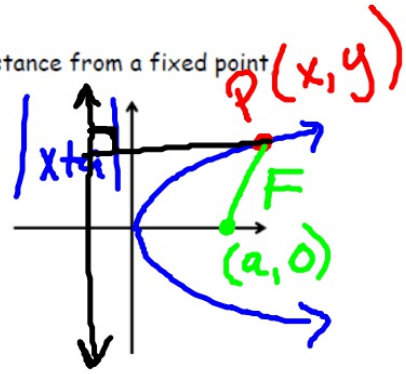
Objective: Students will understand what it means to describe, graph and write the equation of a parabola.

Parabolas

Parabola: collection of all points P in a plane that are the same distance from a fixed point the focus F, and a fixed line, the directrix D

d(F, P) = d(P, D)

$$\sqrt{(x-a)^2+(y-0)^2} = |x+a|$$



$F(a,0)$

$P(x,y)$

$D = (\quad ,y)$

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

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

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

$$y^2= x^2+2ax+a^2-(x^2-2ax+a^2)$$

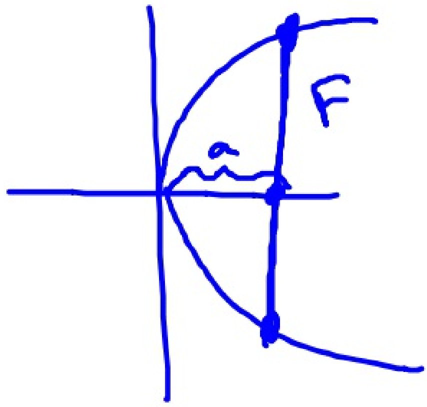
$$\boxed{y^2=4ax}$$

Vertex at (0, 0), a > 0

Opens up $x^2 = 4ay$ Focus: $(0, a)$ Directrix: $y = -a$	Opens down $x^2 = -4ay$ Focus: $(0, -a)$ Directrix: $y = a$
Opens right $y^2 = 4ax$ Focus: $(a, 0)$ Directrix: $x = -a$	Opens left $y^2 = -4ax$ Focus: $(-a, 0)$ Directrix: $x = a$

latus rectum - a segment that goes through the focus, and its endpoints are points on the parabola. The endpoints are a distance ±2a from the focus.

length of L.R. = $4a$



$$y^2 = 4ax$$
$$y^2 = 4a \cdot a$$
$$y^2 = 4a^2$$
$$y = \pm\sqrt{4a^2}$$
$$y = \pm 2a$$

Ex 1 Discuss each equation. (So, find the vertex, focus and directrix.)

a) $y^2 = 8x$

$4ax = 8x$

$a = \frac{8x}{4x}$

$a = 2$

V: $(0,0)$

F: $(2,0)$ $(a,0)$

D: $x = -2$ $x = -a$

b) $x^2 = -\frac{1}{2}y$

$-4ay = -\frac{1}{2}y$

$-4a = -\frac{1}{2}$

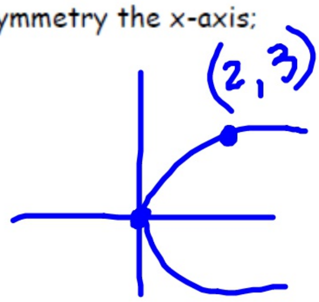
$a = \frac{1}{8}$

V: $(0,0)$

F: $(0, -1/8)$ $(0, -a)$

D: $y = \frac{1}{8}$ $y = a$

Ex 2 Find the equation of the parabola with vertex at (0, 0); axis of symmetry the x-axis; and contains the point (2, 3).



$$y^2 = 4ax$$

$$(3)^2 = 4a(2)$$

$$9 = 8a$$

$$\frac{9}{8} = a$$

① Find a

$$y^2 = 4ax$$

$$y^2 = 4\left(\frac{9}{8}\right)x$$

$$\boxed{y^2 = \frac{9}{2}x}$$

② Find general equation

Vertex at (h, k)... Use patterns to describe the focus and directrix.

Opens up $(x-h)^2 = 4a(y-k)$	Opens down $(x-h)^2 = -4a(y-k)$
Opens right $(y-k)^2 = 4a(x-h)$	Opens left $(y-k)^2 = -4a(x-h)$

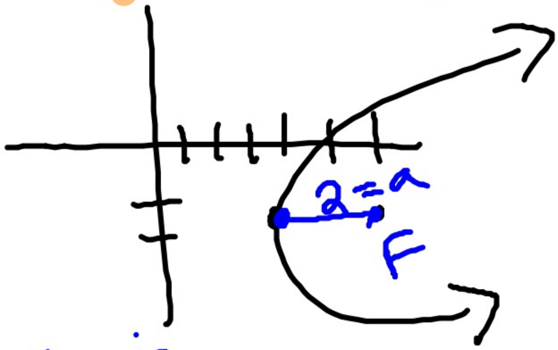
(h, k)

Ex 3 Find the equation of the parabola whose vertex is at (4, -2) and focus is at (6, -2).

$(y-k)^2 = 4a(x-h)$

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

$\boxed{(y+2)^2 = 8(x-4)}$



Why is $a=2$?

Ex 4 Discuss the equation: $y^2 + 12y = -x + 1$

V, F, D, LR

$\left[\frac{1}{2}(12)\right]^2$ CTS ☺

$y^2 + 12y + 36 = -x + 1 + 36$

$(y+6)^2 = -x + 37$

want this form $\Rightarrow (y-k)^2 = 4a(x-h)$

$(y-6)^2 = -1(x-37)$

$-1 = 4a$

$-\frac{1}{4} = a$

This gets us the value of a

V: $(37, 6)$

F: $(37 - \frac{1}{4}, 6) = (36\frac{3}{4}, 6)$

D: $x = 37\frac{1}{4}$

LR: $y = \pm 2a$

$y = \pm 2(-\frac{1}{4})$

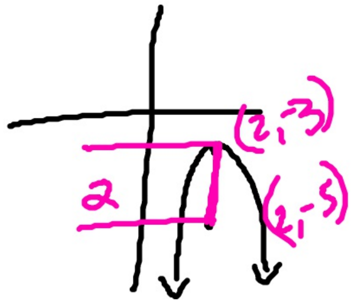
$y = \pm \frac{1}{2}$

$(\quad)$

29

$$V = (\overset{x}{2}, \overset{y}{-3})$$

$$F = (\overset{2}{2}, -5)$$



$$(x-h)^2 = -4a(y-k)$$

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

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

19 $y^2 = 16x$

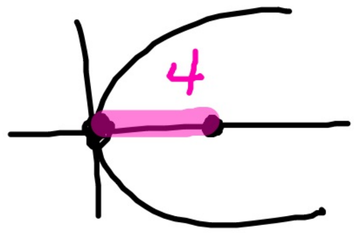
$V(0,0)$

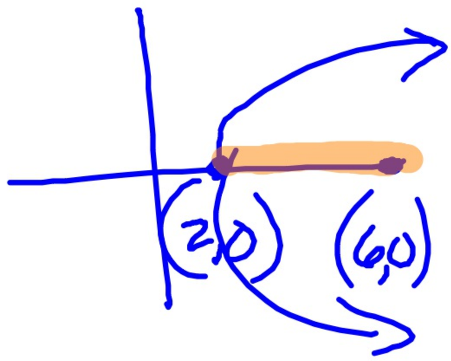
$F(4,0)$

$y^2 = 4ax$

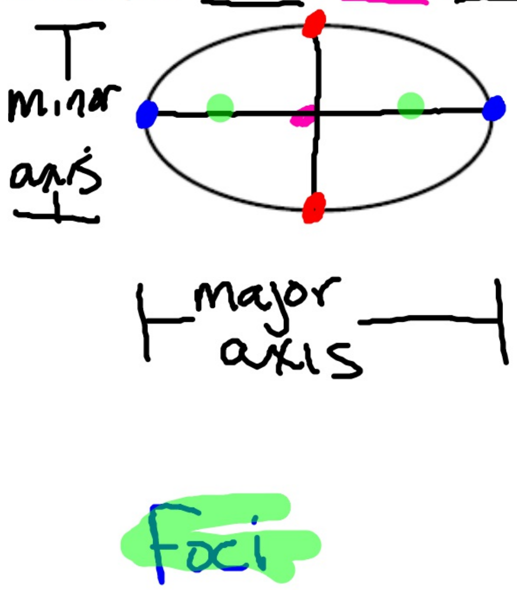
$y^2 = 4(4)x$

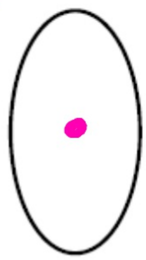
$y^2 = 16x$





Ex 1 Label the ellipse's major axis, center, minor axis, vertices and co-vertices.





Equation of an Ellipse: center @ (0, 0)

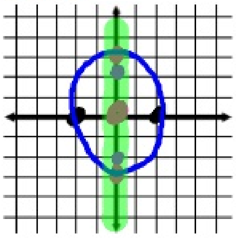
Foci @ (±c, 0) & vertices @ (±a, 0) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where a > b > 0 and $\boxed{b^2 = a^2 - c^2}$	Foci @ (0, ±c) & vertices @ (0, ±a) $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$ where a > b > 0 and $b^2 = a^2 - c^2$

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

FYI: "Discuss the equation" in ellipses means find the center, major axis, foci, vertices and co-vertices.

Ex 2 Graph the equation of the conic section. Find the vertices, co-vertices and foci.

$$\frac{4y^2}{36} + \frac{9x^2}{36} = \frac{36}{36}$$



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

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

$b^2 = 4$ $\quad$ $a^2 = 9$

$b = \pm 2$ $\quad$ $a = \pm 3$

$\boxed{\text{foci}}$

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

$c^2 = 9 - 4$

$c^2 = 5$

$c = \pm\sqrt{5}$

$(0, \sqrt{5})\ (0, -\sqrt{5})$

$C = (0,0)$

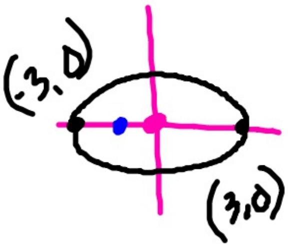
$V = (0,3)\ (0,-3)$

$CV = (2,0)\ (-2,0)$

Ex 3 Find an equation for each ellipse given…

a) Center at (0, 0); focus at (-1, 0); vertex at (-3, 0)	b) Foci at (0, ±2); major axis measures 8

(c, 0)



$$\frac{x^2}{9} + \frac{y^2}{8} = 1$$

$a = 3$

$a^2 = 9$

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

$$(-1)^2 = 9 - b^2$$

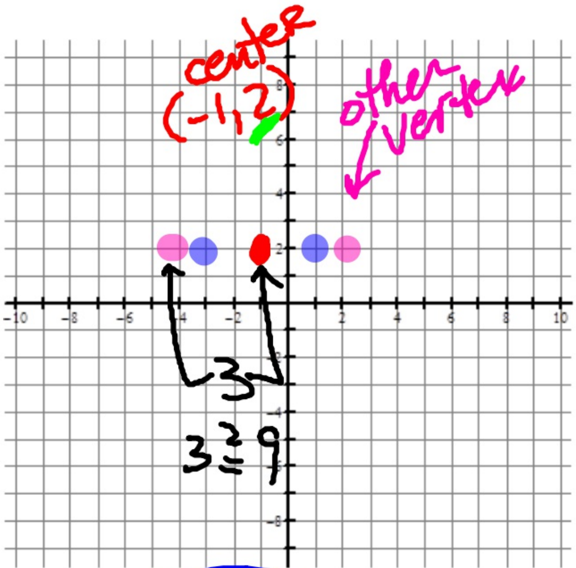
$$1 = 9 - b^2$$

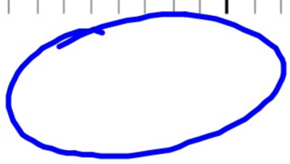
$$8 = b^2$$

Equation of an Ellipse: center @ (h, k)

Foci @ (h ± c, k) & vertices @ (h ± a, k)	Foci @ (h, k ± c) & vertices @ (h, k ± a)
$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$
where a > b > 0 and $b^2 = a^2 - c^2$	where a > b > 0 and $b^2 = a^2 - c^2$

Ex 4 Find an equation of an ellipse whose foci are (1, 2) and (-3, 2) & whose vertex is (-4, 2).





or

$$\frac{(x+1)^2}{9} + \frac{(y-2)^2}{5} = 1$$

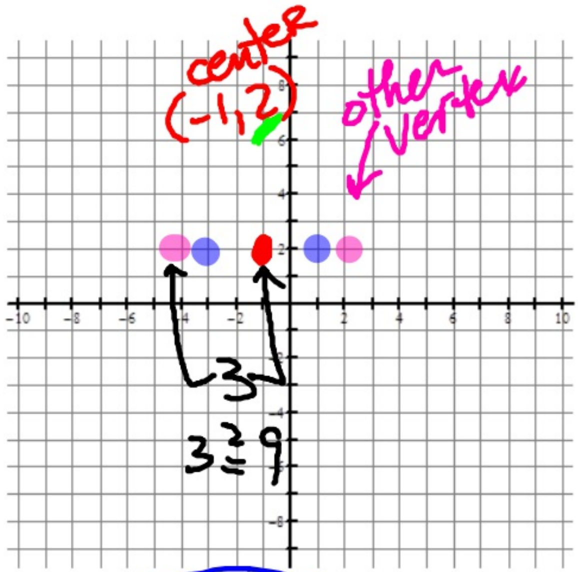
$c^2 = a^2 - b^2$

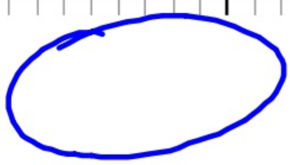
$h = -1$

Equation of an Ellipse: center @ (h, k)

Foci @ (h ± c, k) & vertices @ (h ± a, k)	Foci @ (h, k ± c) & vertices @ (h, k ± a)
$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$
where a > b > 0 and $b^2 = a^2 - c^2$	where a > b > 0 and $b^2 = a^2 - c^2$

Ex 4 Find an equation of an ellipse whose foci are (1, 2) and (-3, 2) & whose vertex is (-4, 2).





$$\frac{(x+1)^2}{9}+\frac{(y-2)^2}{5}=1$$

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

$(2)^2=9-b^2$

$-3,2$

$h \pm c, k$

$h=-1$

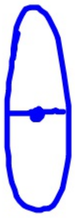
$-1 \pm c = -3$

$\pm c = -2$

Ex 5 Discuss each equation. (So, find the center, foci, vertices, co-vertices.)

a) $9(x - 3)^2 + (y + 2)^2 = 18$	b) $4x^2 + 3y^2 + 8x - 6y = 5$

$$\frac{(x-3)^2}{2} + \frac{(y+2)^2}{18} = 1$$



center: $(3, -2)$

$a = \sqrt{18} = \sqrt{9}\sqrt{2} = 3\sqrt{2}$

$b = \sqrt{2} =$

Vertices $(h, k \pm a)$

$(3, -2 + 3\sqrt{2})$

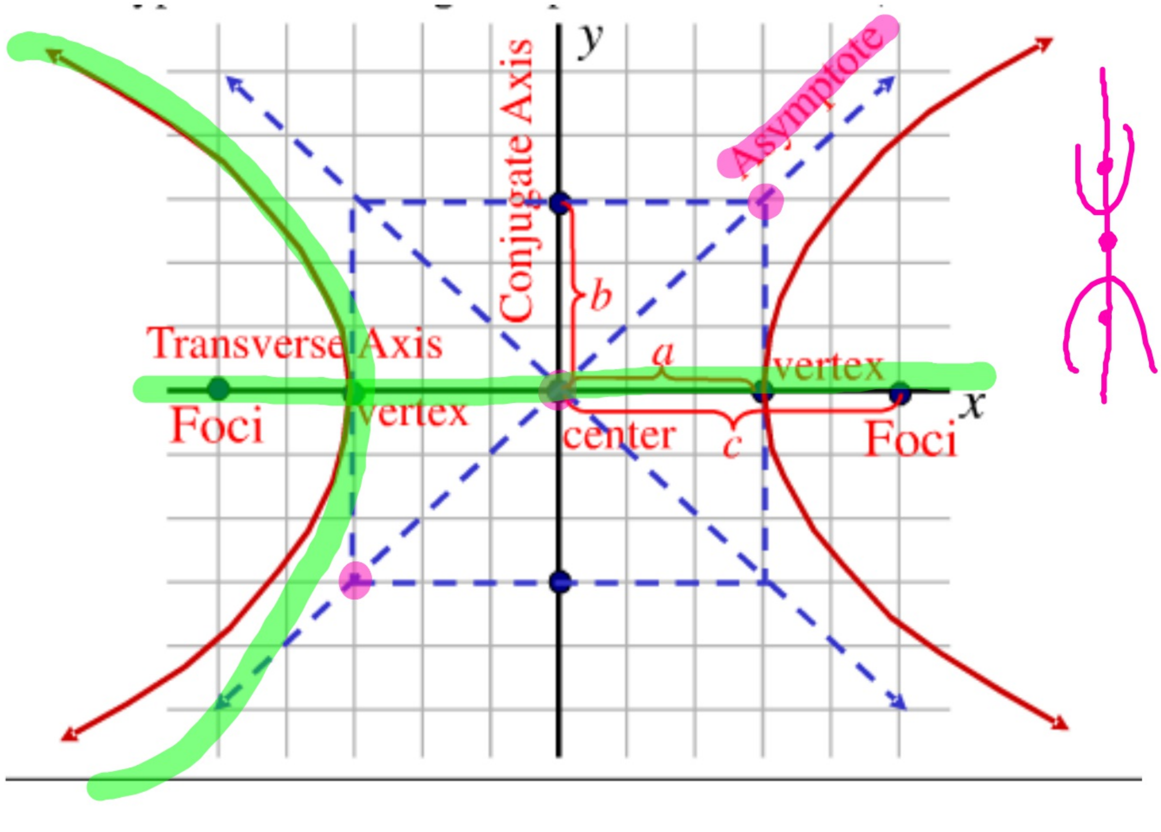
$(3, -2 - 3\sqrt{2})$

co-vertices use b

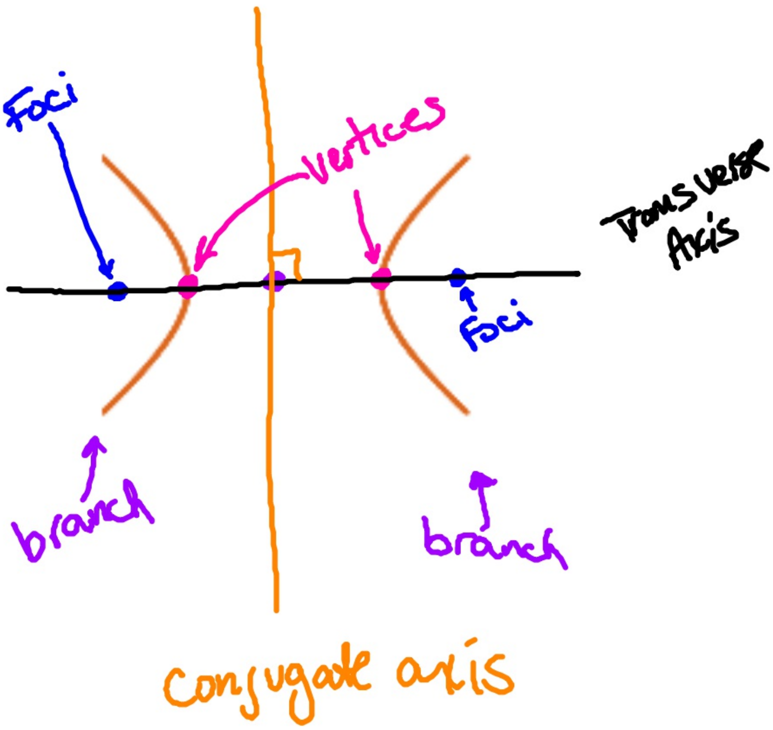
y values are same

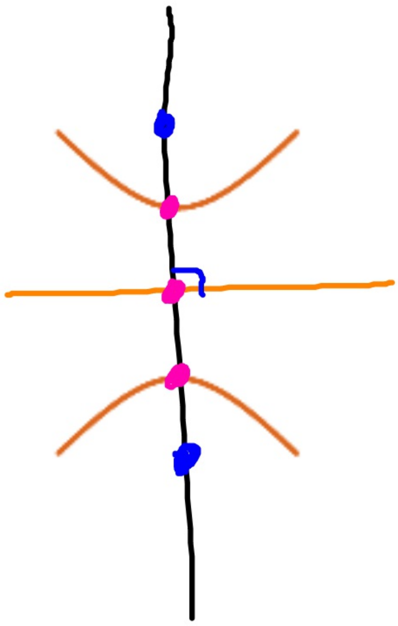
$(3 - \sqrt{2}, -2)$

$(3 + \sqrt{2}, -2)$


y
Conjugate Axis
Asymptote
b
Transverse Axis
a
vertex
Foci
vertex
center
c
Foci
x

Ex 1 Label the axes, center, branches, and vertices of the hyperbola.





Equation of a Hyperbola: center @ (0, 0)

Foci @ (±c, 0) & vertices @ (±a, 0)	Foci @ (0, ±c) & vertices @ (0, ±a)
Transverse axis parallel to x-axis	Transverse axis parallel to y-axis
$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$	$$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$$
where $b^2 = c^2 - a^2$ $c^2 = a^2 + b^2$	where $b^2 = c^2 - a^2$ $a^2 + b^2 = c^2$
Note: Asymptotes are $y = \pm\frac{b}{a}x$.	Note: Asymptotes are $y = \pm\frac{a}{b}x$.

FYI: "Discuss the equation" for hyperbolas means that you'll find the center, transverse axis, foci, and vertices that hyperbola.

x	y
0	
	0

Remember: How would you find the x-intercepts and y-intercepts of a hyperbola?

(x, 0)   (0, y)

Ex 2 Graph the hyperbola. Then, find its center, foci, vertices and asymptotes.

$$\frac{x^2}{4} - \frac{y^2}{25} = 1$$

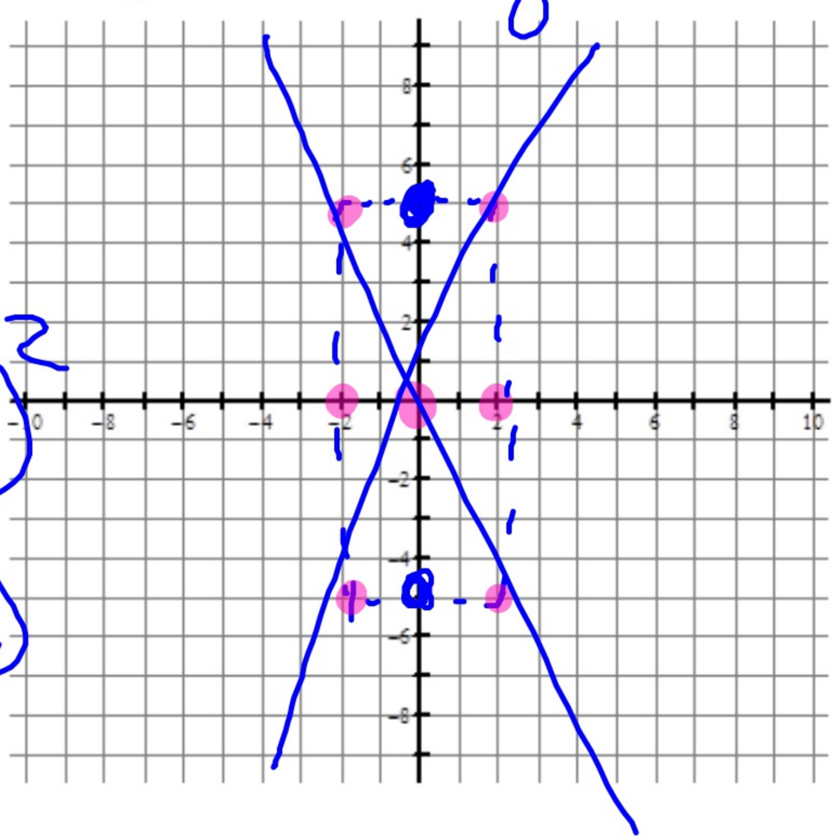
$(x - \underset{h}{0})^2 \quad (y - \underset{k}{0})^2$

$x^2 \quad y^2$

a b

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

$(h, k) \quad (-3, 2)$



Ex 2 Graph the hyperbola. Then, find its center, foci, vertices and asymptotes.

$(x-0)^2 \quad (y-k)^2$

$$\frac{x^2}{4} - \frac{y^2}{25} = 1$$

)(

center: (0, 0)

$a^2 = 4 \Rightarrow a = 2$

$b^2 = 25 \Rightarrow b = 5$

vertices: (-2, 0) (2, 0)

$\boxed{\text{foci}}$ $c^2 = a^2 + b^2$

$c^2 = 4 + 25$

$c^2 = 29$

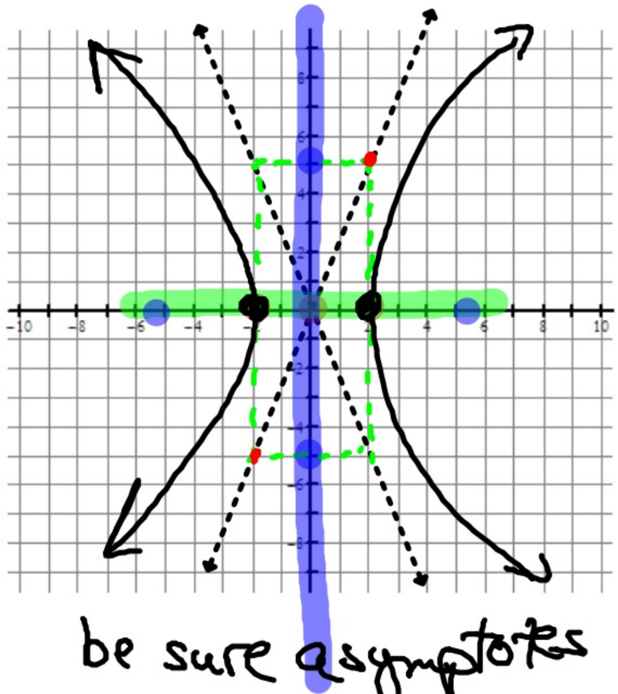
$c = \pm\sqrt{29}$

$(\sqrt{29}, 0)$

$(-\sqrt{29}, 0)$

$\boxed{\text{Asymptotes}}$

$y = \pm\frac{5}{2}x$



be sure asymptotes are dashed :)

start from center

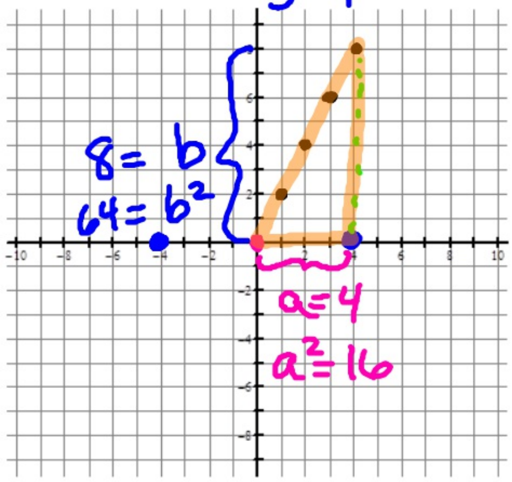
Equation of a Hyperbola: center @ (h, k)

Foci @ (h ± c, k) & vertices @ (h ± a, k)	Foci @ (h, k ± c) & vertices @ (h, k ± a)
Transverse axis parallel to x-axis	Transverse axis parallel to y-axis
$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
where $b^2 = c^2 - a^2$	where $b^2 = c^2 - a^2$
Note: Asymptotes are $(y-k) = \pm\frac{b}{a}(x-h)$.	Note: Asymptotes are $(y-k) = \pm\frac{a}{b}(x-h)$.

JC

<u>Ex 4</u> Find an equation for a hyperbola whose vertices are (4, 0) and (-4, 0) and has an asymptote of $y = 2x$. Then state its foci

$y = \frac{2}{1}x$



$$\frac{x^2}{16} - \frac{y^2}{64} = 1$$

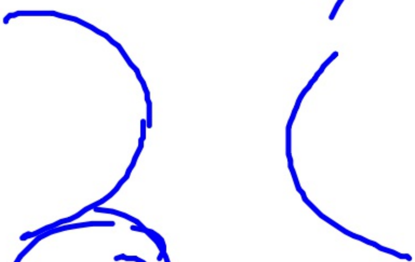
$\boxed{\text{Foci}}$

$$c^2 = a^2 + b^2$$
$$c^2 = 16 + 64$$
$$c^2 = 80$$
$$c = \pm\sqrt{80} = \pm\sqrt{16}\sqrt{5}$$
$$c = \pm 4\sqrt{5}$$

$(4 + 4\sqrt{5}, 0)$

$(-4 - 4\sqrt{5}, 0)$

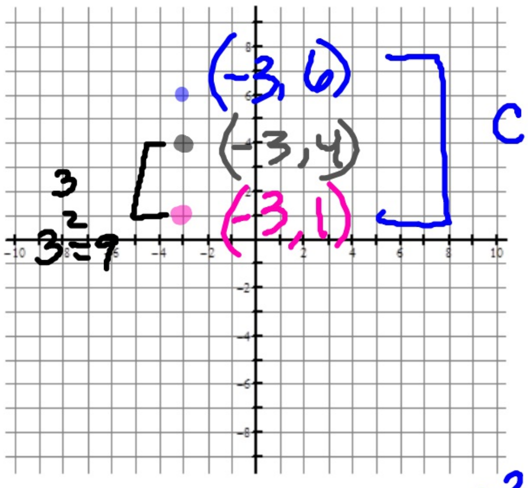
$$\frac{x^2}{} - \frac{y^2}{} = 1$$



$x^2 - y^2$

Ex 5 Find an equation for a hyperbola whose center is at (-3, 1), focus is at (-3, 6) and whose vertex is at (-3, 4).

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



$c = 5$

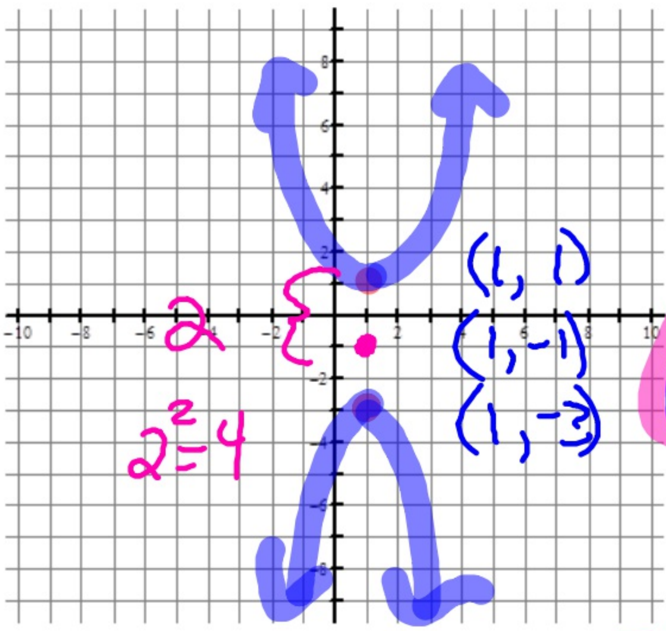
$c^2 = 25$

$$c^2 = a^2 + b^2$$
$$25 = 9 + b^2$$
$$16 = b^2$$
$$4 = b$$

Ex 6 Find an equation for a hyperbola whose vertices are at (1, -3) and (1, 1) and whose asymptote is $y+1=\frac{3}{2}(x-1)$.

(h, k)

(1, -1)



$$\frac{(y+1)^2}{4}-\frac{(x-1)^2}{16/9}=1$$

$\boxed{\text{ERROR}}$ $\frac{a}{b} \Rightarrow \begin{matrix} a=3 \\ b=2 \end{matrix}$

$$\frac{a}{b}=\frac{3}{2}$$

Substitute 2 for 'a'

$$\frac{2}{b}=\frac{3}{2}$$

$$3b=4$$

$$b=\frac{4}{3}$$

$$b^2=\frac{16}{9}$$