

Acc PreCalc Day 6 Hyperbola Basics

1) $x^2 - 25y^2 + 25 = 0$

$x^2 - 25y^2 = -25$

$-1 [\quad]$

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

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

$a=1 \quad b=5$

ctr (0,0)

vertical f: (0, ±5)

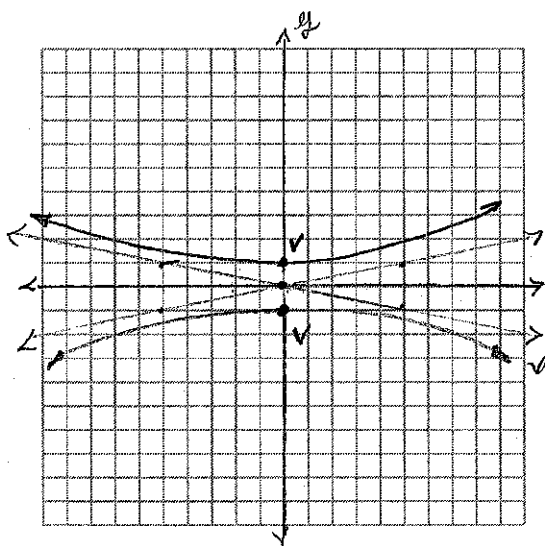
v: (0,1) (0,-1)

conjugate: (-5,0) (5,0)

• $y-0 = \frac{1}{5}(x-0)$

$y = \frac{1}{5}x$

• $y = -\frac{1}{5}x$



2) $-4x^2 + 9y^2 - 24x - 90y + 153 = 0$

$-4x^2 - 24x + 9y^2 - 90y = -153$

$-4(x^2 + 6x + 9) + 9(y^2 - 10y + 25) = -4(9) + 9(25)$

$(\frac{6}{2})^2 = 3^2 \quad (-\frac{10}{2})^2 = (-5)^2$

$-4(x+3)^2 + 9(y-5)^2 = 36$

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

vertical ctr: (-3,5)

$a=2 \quad v: (-3,7) (-3,3)$

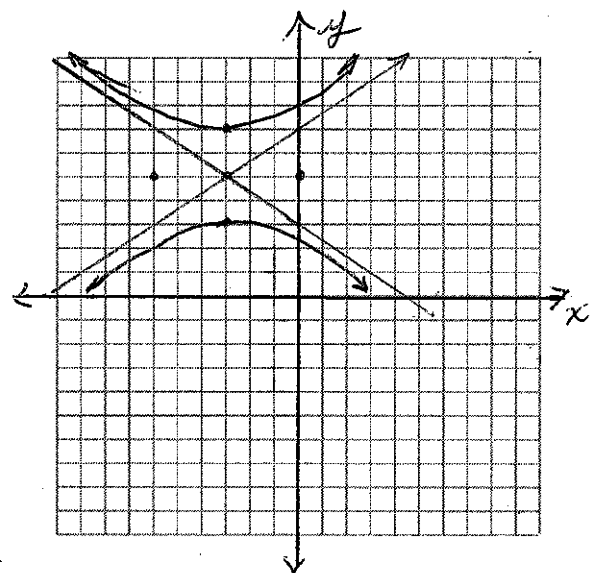
$b=3 \quad c\text{-axis: } (0,5) (-6,5)$

$m = \pm \frac{2}{3} \quad \{ f: (-3,5 \pm \sqrt{13}) \}$

$y-5 = \frac{2}{3}(x+3) \quad y-5 = -\frac{2}{3}(x+3)$

$y-5 = \frac{2}{3}x + 2 \quad = -\frac{2}{3}x - 2$

$y = \frac{2}{3}x + 7 \quad y = -\frac{2}{3}x + 3$



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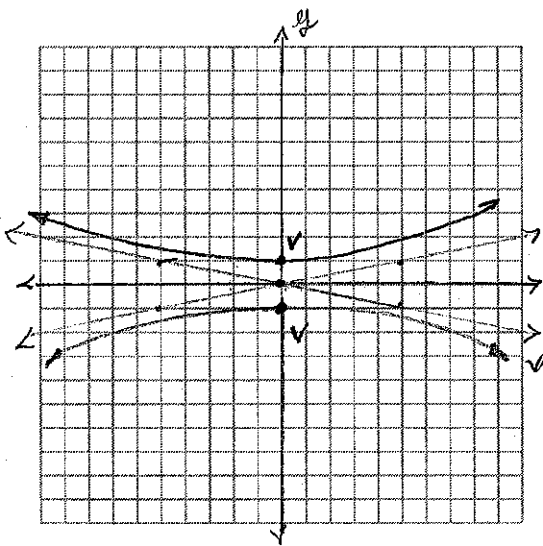
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vertical ctr: (-3,5)

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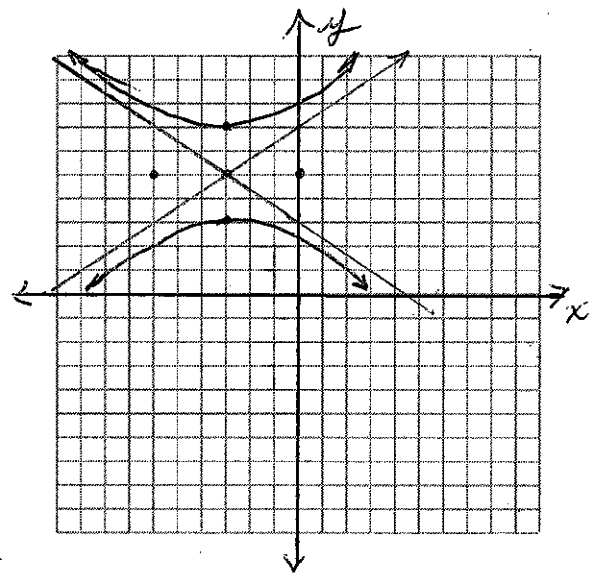
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$y-5 = \frac{2}{3}x + 2 \quad = -\frac{2}{3}x - 2$

$y = \frac{2}{3}x + 7 \quad y = -\frac{2}{3}x + 3$



$$3) x^2 - 9y^2 + 36y - 72 = 0$$

$$x^2 - 9(y^2 - 4y + 4) = 72$$

$$\left(\frac{-4}{2}\right)^2 = (-2)^2 \quad -9(4)$$

$$x^2 - 9(y-2)^2 = 36$$

$$\frac{x^2}{36} - \frac{(y-2)^2}{4} = 1$$

Horiz ctr: (0, +2), f: ($\pm 2\sqrt{10}$, 2)

a=6 v: (6, 2)(-6, 2)

b=2 c-axis: (0, 0)(0, 4)

$$4) 16y^2 - x^2 + 2x + 64y - 1 = 0$$

$$16(y^2 + 4y + 4) - (x^2 - 2x + 1) = +1$$

$$\left(\frac{4}{2}\right)^2 = (2)^2 \quad \left(\frac{-2}{2}\right)^2 = (-1)^2 \quad +16(4) \quad -1(1)$$

$$16(y+2)^2 - (x-1)^2 = 64$$

$$\frac{(y+2)^2}{4} - \frac{(x-1)^2}{64} = 1$$

Vert ctr (1, -2) f (1, -2 $\pm 2\sqrt{16}$)

a=2 v: (1, 0)(1, -4)

b=8 c-axis: (9, -2)(-7, -2)

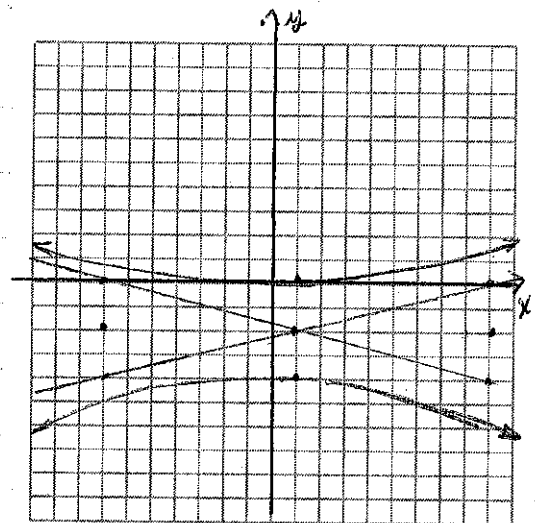
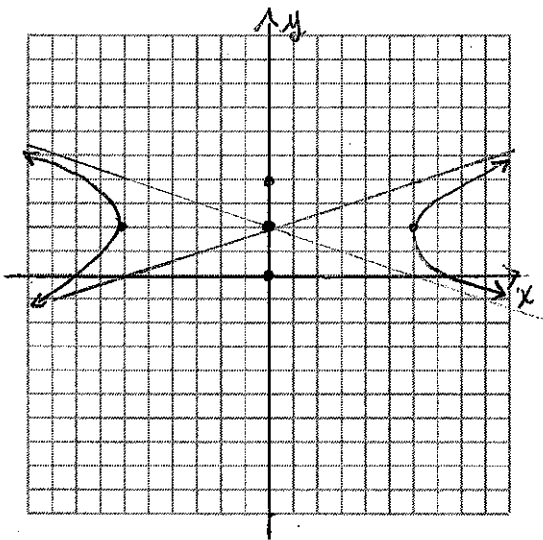
$$y-2 = \frac{2}{6}(x) \quad y-2 = -\frac{2}{6}x$$

$$y = \frac{1}{3}x + 2 \quad y = -\frac{1}{3}x + 2$$

$$y+2 = \frac{2}{8}(x-1) \quad y+2 = -\frac{2}{8}(x-1)$$

$$= \frac{1}{4}x - \frac{1}{4} \quad = -\frac{1}{4}x + \frac{1}{4}$$

$$y = \frac{1}{4}x - 2\frac{1}{4} \quad y = -\frac{1}{4}x - 1\frac{3}{4}$$

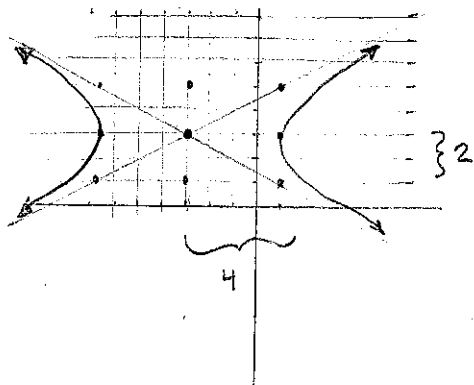


5) ctr: $(-3, 3)$

V: $(-7, 3)$ $(1, 3)$

C-axis endpt $(-3, 5)$

$a=4$ $b=2$



$$\frac{(x+3)^2}{16} - \frac{(y-3)^2}{4} = 1$$

$$16 [\quad] 16$$

$$(x+3)^2 - 4(y-3)^2 = 16$$

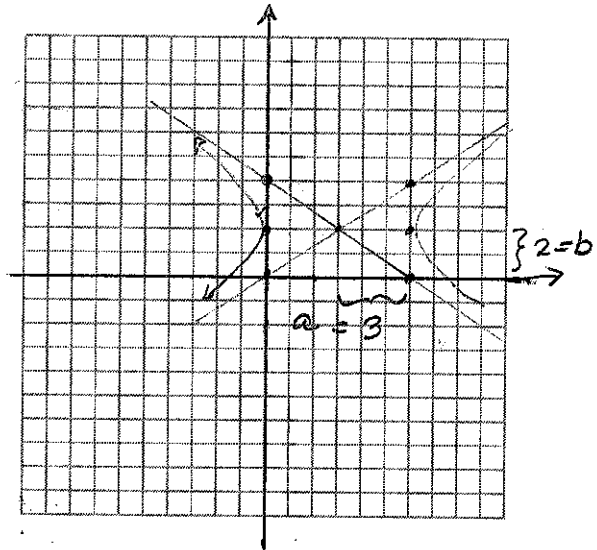
$$x^2 + 6x + 9 - 4(y^2 - 6y + 9) = 16$$

$$x^2 + 6x + 9 - 4y^2 + 24y - 36 - 16 = 0$$

$$x^2 - 4y^2 + 6x + 24y - 43 = 0$$

6) V: $(0, 2)$ $(6, 2)$ $y = \frac{2}{3}x$
 $y = 4 - \frac{2}{3}x$

ctr = $(3, 2)$, horiz
 $a=3$ $b=2$



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

$$36 [\quad]$$

$$4(x^2 - 6x + 9) - 9(y^2 - 4y + 4) = 36$$

$$4x^2 - 24x + 36 - 9y^2 + 36y - 36 - 36 = 0$$

$$4x^2 - 9y^2 - 24x + 36y - 36 = 0$$

7) $V: (2, 3) (2, -3)$

$f: (2, 5) (2, -5)$



vertical, ctr (2, 0)

$$\frac{(y-0)^2}{9} - \frac{(x-2)^2}{16} = 1$$

$$16y^2 - 9(x^2 - 4x + 4) = 144$$

$$-9x^2 + 16y^2 + 36x - 180 = 0$$

8) $V: (2, 3) (2, -3)$

passing thru (0, 5)

$$\frac{(y-0)^2}{3^2} - \frac{(x-2)^2}{b^2} = 1$$

← insert (0, 5)
and solve
for b^2

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

$$\left[\frac{y^2}{9} - \frac{4(x-2)^2}{9} = 1 \right] 9$$

$$9y^2 - 36(x-2)^2 = 9$$

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

$$9y^2 - 36x^2 + 144x - 144 = 9$$

$$-36x^2 + 9y^2 + 144x - 153 = 0$$

