Writing Equations of Hyperbola Notes

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

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

Hyperbolas – Writing Equations

Example 5:

Write the equation of the hyperbola in standard form.

$9x^2 - y^2 + 36x + 2y + 26 = 0$

$9x^2 + 36x - y^2 + 2y = -26$

$9(x^2 + 4x + \underline{4}) - 1(y^2 - 2y + \underline{1}) = -26 + \underline{36} + \underline{-1}$

$(\frac{4}{2})^2 = 4 \qquad (\frac{-2}{2})^2 = 1$

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

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

Example 6:

Write the equation of the hyperbola in standard form.

$3x^2 - 2y^2 - 24x - 8y + 34 = 0$

$3x^2 - 24x - 2y^2 - 8y = -34$

$3(x^2 - 8x + \underline{16}) - 2(y^2 + 4y + \underline{4}) = -34 + 48 - 8$

$(\frac{-8}{2})^2$

$\frac{3(x-4)^2}{6} - \frac{2(y+2)^2}{6} = \frac{6}{6}$

$(\frac{4}{2})^2$

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

Writing Equations of Hyperbola Notes

Horizontal

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

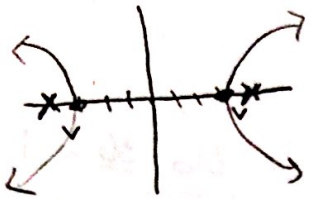
Vertical

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

Example 7:

Write the standard form of the equation of the specified hyperbola.

a. vertices (±3, 0); foci (±4, 0)



c: (0,0)

a = 3

c = 4

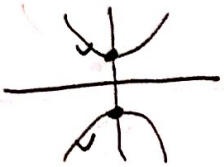
$\frac{x^2}{9} - \frac{y^2}{7} = 1$

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

$16 = 9 + b^2$

$7 = b^2$

b. vertices (0, ±1); asymptotes y = ± ½x $\quad y = \pm \frac{a}{b} x$



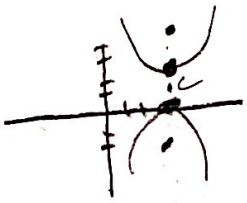
c: (0,0)

a = 1

b = 2

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

c. vertices (3, 0) and (3, 2); foci (3, –2) and (3, 4)



c: (3, 1) (h, k)

a = 1

c = 3

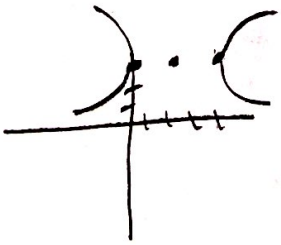
$(y-1)^2 - \frac{(x-3)^2}{8} = 1$

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

$9 = 1 + b^2$

$b^2 = 8$

d. vertices (0, 3) and (4, 3); asymptotes y – 3 = ±1(x – 2) $\quad y - k = \pm \frac{b}{a}(x-h)$



c: (2, 3) (h, k)

a = 2

slope $= \frac{1}{1} = \frac{2}{2}$

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