Hyperbola Writing Equations WS Name Key

Write the equation of the Hyperbola in standard form.

1. $9x^2 - y^2 - 36x - 6y + 18 = 0$

$9x^2 - 36x - y^2 - 6y = -18$

$9(x^2 - 4x + 4) - (y^2 + 6y + 9) = -18 + 36 - 9$

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

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

2. $16y^2 - x^2 + 2x + 64y + 47 = 0$

$16y^2 + 64y - x^2 + 2x = -47$

$16(y^2 + 4y + 4) - (x^2 - 2x + 1) = -47 + 64 - 1$

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

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

3. $6x^2 - 4y^2 - 12x - 8y - 46 = 0$

$6x^2 - 12x - 4y^2 - 8y = 46$

$6(x^2 - 2x + 1) - 4(y^2 + 2y + 1) = 46 + 6 - 4$

$6(x-1)^2 - 4(y+1)^2 = 48$

$$\frac{(x-1)^2}{8} - \frac{(y+1)^2}{12} = 1$$

4. $9y^2 - x^2 + 2x + 54y + 62 = 0$

$9y^2 + 54y - x^2 + 2x = -62$

$9(y^2 + 6y + 9) - (x^2 - 2x + 1) = -62 + 81 - 1$

$9(y+3)^2 - (x-1)^2 = 18$

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

If the minus is in the middle

x first → H

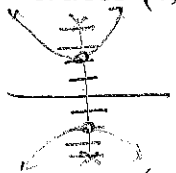
y first → V

Identify if the following Hyperbola will be horizontal or vertical. DO NOT GRAPH.

5. $(y-3)^2 - (x-2)^2 = 1$ V	6. $-\frac{(y+3)^2}{9} + \frac{(x+2)^2}{4} = 1$ $\frac{(x+2)^2}{4} - \frac{(y+3)^2}{9} = 1$ H	7. $\frac{(y+2)^2}{16} - \frac{(x-1)^2}{49} = 1$ V
8. $\frac{x^2}{1} - \frac{y^2}{4} = 1$ H	9. $\frac{(y+1)^2}{4} - \frac{(x+1)^2}{4} = 1$ V	10. $\frac{(x+2)^2}{25} - \frac{(y-1)^2}{9} = 1$ H

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

11. Vertices $(0,\pm 2)$: foci $(0,\pm 4)$



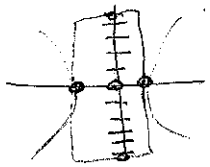
$c^2 = a^2 + b^2$ $\quad c:(0,0)$

$16 = 4 + b^2$ $\quad a = 2$

$12 = b^2$

$$\frac{y^2}{4} - \frac{x^2}{12} = 1$$

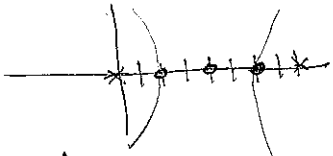
12. Vertices $(\pm 1, 0)$; Asymptotes $y = \pm \frac{5}{1}x$ (5 ← b, 1 ← a)



$c:(0,0)$

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

13. Vertices (2, 0) and (6, 0); Foci (0, 0) and (8, 0)



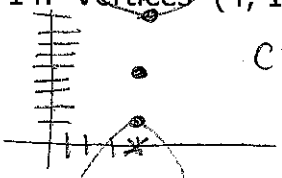
$c:(4,0)$ $\quad c^2 = a^2 + b^2$

$a = 2$ $\quad 16 = 4 + b^2$

$c = 4$ $\quad 12 = b^2$

$$\frac{(x-4)^2}{4} - \frac{y^2}{12} = 1$$

14. Vertices (4, 1) and (4, 9); Foci (4, 0) and (4, 10)



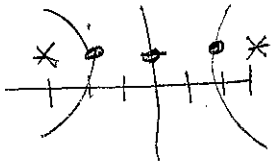
$c:(4,5)$ $\quad c^2 = a^2 + b^2$

$a:4$ $\quad 25 = 16 + b^2$

$c:5$ $\quad 9 = b^2$

$$\frac{(y-5)^2}{16} - \frac{(x-4)^2}{9} = 1$$

15. Vertices (-2, 1) and (2, 1); Foci (-3, 1) and (3, 1)



$c:(0,1)$ $\quad c^2 = a^2 + b^2$

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

$c:3$ $\quad 5 = b^2$

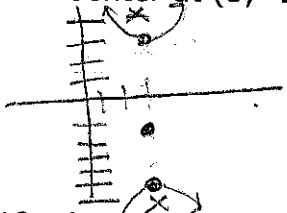
$$\frac{x^2}{4} - \frac{(y-1)^2}{5} = 1$$

16. Vertices (4, 1) and (4, 5); Asymptote $y - 3 = \pm \frac{2}{3}(x-4)$ (2 ← a, 3 ← b)

$c:(4,3)$

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

17. Center at (3, -1) with transverse axis of length 8 and Foci at (3, 4) and (3, -6)



$c = 5$ $\quad a = 4$

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

$25 = 16 + b^2$

$9 = b^2$

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

18. An Asymptote $y - 2 = \pm \frac{19}{36}(x+4)$ (19 ← a, 36 ← b) and a vertical transverse axis (aka opens up and down)

$c:(-4,2)$ $\quad$ y first

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