

8.12 Hyperbolas - Day 2

Date: _____

Write the standard form of the equation of each hyperbola and list the coordinates of the center, vertices, foci and the equation of the asymptotes. Then graph the hyperbola.

3. $x^2 - 4y^2 + 6x - 8y - 11 = 0$ $x^2 + 6x + _ - 4y^2 - 8y + _ = 11 + _ + _$

$$\left(\frac{(x+3)^2}{16} - \frac{(y+1)^2}{4} = 1 \right) \begin{cases} c^2 = a^2 + b^2 \\ c^2 = 16 + 4 = 20 \\ c = \sqrt{20} \end{cases}$$

$a = 4 \leftarrow$

$b = 2 \downarrow$

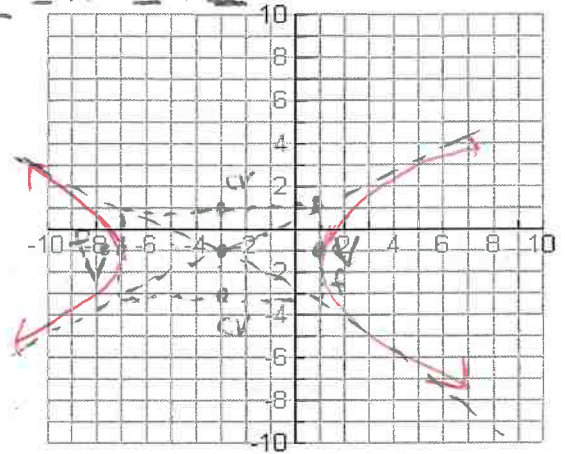
Standard Form: _____

Center: $(-3, -1)$

Vertices: $(1, -1)$ $(-7, -1)$ Foci: $(-3 \pm \sqrt{20}, -1)$

Asymptotes: $(y+1) = \pm \frac{1}{2}(x+3)$

Eccentricity = $\frac{\sqrt{20}}{4}$ or $\frac{\sqrt{5}}{2}$



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

$$\left(\frac{(y-5)^2}{9} - \frac{(x+3)^2}{4} = 1 \right) \begin{cases} c^2 = a^2 + b^2 \\ c^2 = 9 + 4 = 13 \\ c = \sqrt{13} \end{cases}$$

$a = 2 \downarrow$

$b = 3 \leftarrow$

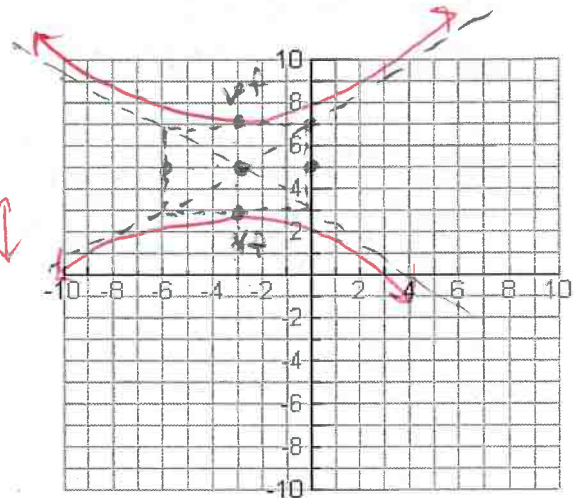
Standard Form: _____

Center: $(-3, 5)$

Vertices: $(-3, 7)$ $(-3, 3)$ Foci: $(-3, 5 \pm \sqrt{13})$

Asymptotes: $y - 5 = \pm \frac{2}{3}(x + 3)$

Eccentricity = $\frac{\sqrt{13}}{2}$



5. $36x^2 - 49y^2 - 72x - 294y - 2169 = 0$

$$\left(\frac{(x-1)^2}{9} - \frac{(y+3)^2}{49} = 1 \right) \begin{cases} c^2 = a^2 + b^2 \\ c^2 = 9 + 49 = 58 \\ c = \sqrt{58} \end{cases}$$

$a = 3 \leftarrow$

$b = 7 \downarrow$

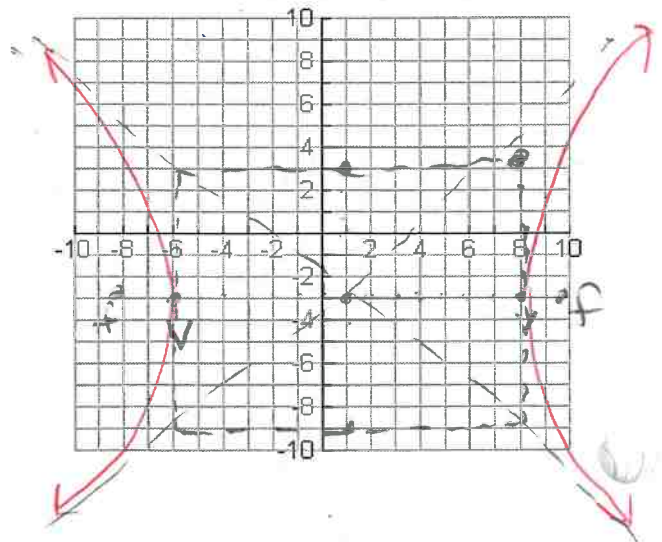
Standard Form: _____

Center: $(1, -3)$

Vertices: $(8, -3)$ $(-6, -3)$ Foci: $(1 \pm \sqrt{58}, -3)$

Asymptotes: $y + 3 = \pm \frac{6}{7}(x - 1)$

eccentricity: $\frac{\sqrt{58}}{3}$



$$3) x^2 - 4y^2 + 6x - 8y - 11 = 0$$

$$x^2 + 6x + \underline{9} - 4y^2 - 8y + \underline{\quad} = 11 + \underline{9} + \underline{\quad}$$

$$\left(\frac{6}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = 9 \cdot x^2 + 6x + \underline{9} - 4(y^2 + 2y + \underline{1}) = 11 + \underline{9} + \underline{-4}$$

$$\left(\frac{2}{2}\right)^2 = 1$$

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

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

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

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

$$9(y^2 - 10y + \underline{25}) - 4(x^2 + 6x + \underline{9}) = -153 + \underline{225} + \underline{-36}$$

$$\frac{9(y-5)^2}{36} - \frac{4(x+3)^2}{36} = \frac{36}{36}$$

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

$$5) 36x^2 - 49y^2 - 72x - 294y - 2169 = 0$$

$$36x^2 - 72x - 49y^2 - 294y = 2169 + _ + _$$

$$36(x^2 - 2x + \underline{1}) - 49(y^2 + 6y + \underline{9}) = 2169 + \underline{36} + \underline{-441}$$

$$\left(\frac{2}{2}\right)^2 = 1$$
$$(x-1)(x-1)$$

$$\left(\frac{6}{2}\right)^2 = 9$$

$$\frac{36(x-1)^2}{1764} - \frac{49(y+3)^2}{1764} = \frac{1764}{1764}$$

$$\frac{(x-1)^2}{49} - \frac{(y+3)^2}{36} = 1$$

Eccentricity = _____

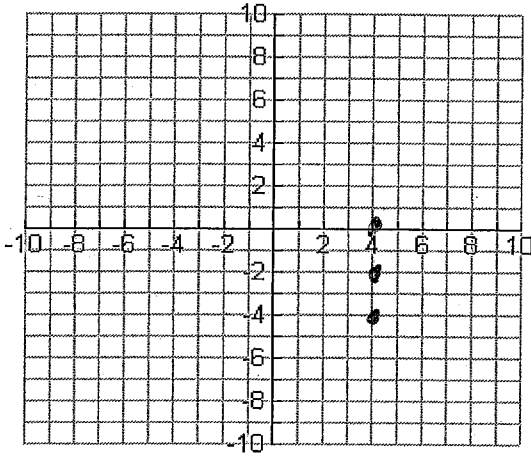
Write the equation of the hyperbola in standard form that meets each set of conditions. Use the grid if it helps.

4. The center is at (4, -2), a = 2, b = 3, and the transverse axis is vertical.

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

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

Equation: _____



5. The length of the transverse axis is 6 units and the foci are at (3, 2) and (-7, 2).

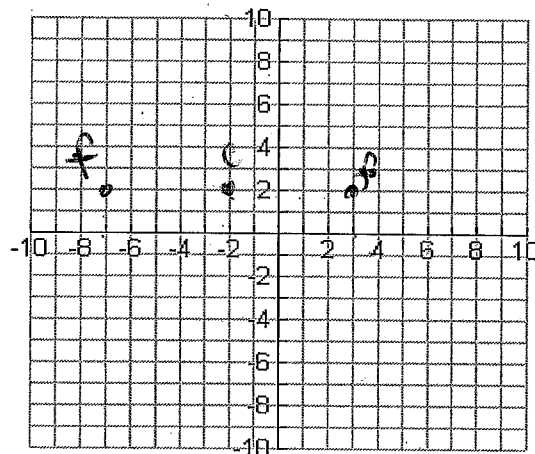
center (-2, 2)

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

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

Equation: _____

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



6. The length of the conjugate axis is 8 units and the vertices are (-3, 9) and (-3, -5)

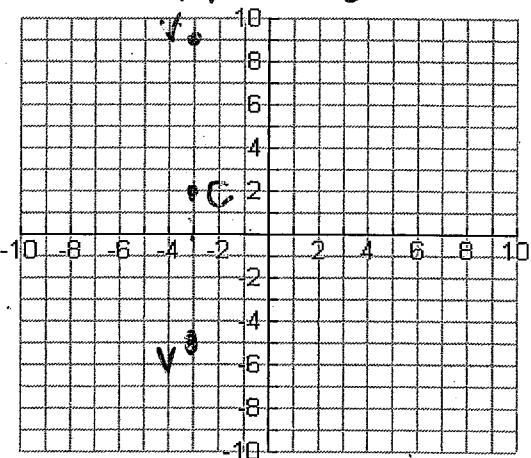
b = 4

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

center (-3, 2)

$$\frac{(y-2)^2}{49} - \frac{(x+3)^2}{16} = 1$$

Equation: _____



7. The center is at (0, 1), one focus is at (10, 1) and the eccentricity is $\frac{5}{3}$

c = 10 ↔

a = 6 ↔

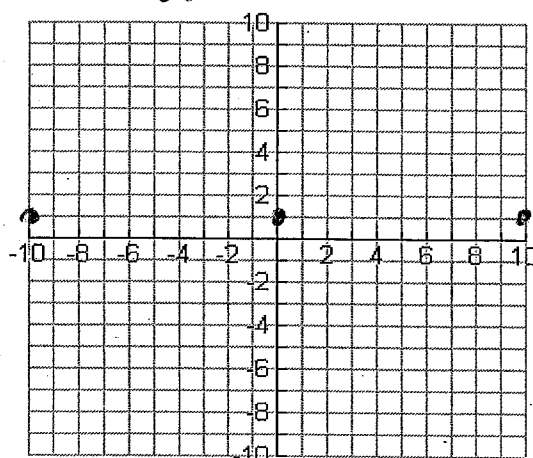
$$e = \frac{c}{a} \rightarrow \frac{5}{3} \rightarrow \frac{10}{6}$$

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

$$\frac{(x-0)^2}{36} - \frac{(y-1)^2}{64} = 1$$

Equation: _____

$c^2 = a^2 + b^2$
 $100 = 36 + b^2$
 $b^2 = 64$
 $b = 8$



Identify conics: circle, ellipse, parabola, hyperbola

$$a) 3x^2 - 6x + 3y^2 - 9y = 16$$

a) circle

$$b) 3x^2 - 6x + 5y = 12$$

b) parabola

$$c) 3x^2 - 6x + 4y^2 - 9y = 16$$

c) ellipse

$$d) 4y^2 - 6y - 4x^2 + 9x = 12$$

d) hyperbola