

Warm-up 4: Hyperbola

$$4x^2 - y^2 + 8x - 2y - 13 = 0$$

$$4x^2 + 8x - y^2 - 2y = 13$$

$$4(x^2 + 2x + 1) - (y^2 + 2y + 1) = 13 + 4 - 1$$

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

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

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

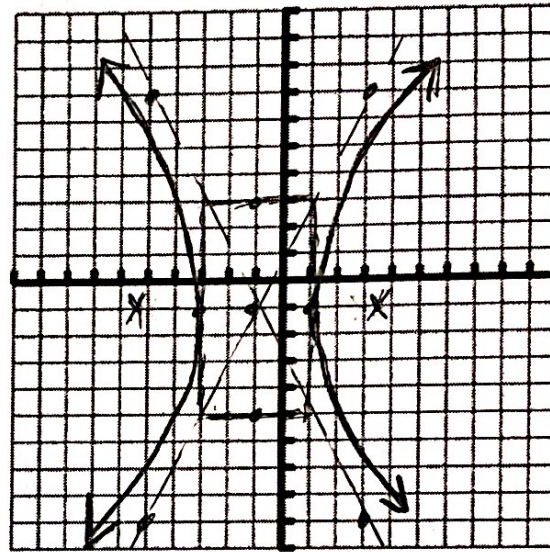
$$\text{center} = \underline{\underline{(-1, -1)}}$$

$$\text{vertices} = \underline{\underline{(1, -1), (-3, -1)}}$$

$$\text{foci} = \underline{\underline{(-1 \pm 2\sqrt{5}, -1)}}$$

$$\text{asymptotes} = \underline{\underline{y+1 = \pm 2(x+1)}}$$

$$y-k = \pm \frac{b}{a}(x-h)$$



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

$a^2 \rightarrow 4$ $b^2 \rightarrow 16$

horizontal
Hyperbola
) (

$$a = 2$$

$$b = 4$$

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

$$c^2 = 4 + 16$$

$$c^2 = 20$$

$$c = \pm \sqrt{20} = \pm 2\sqrt{5} \approx 4.5$$