

Warm-up 4: Hyperbola

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

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

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

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

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

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

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

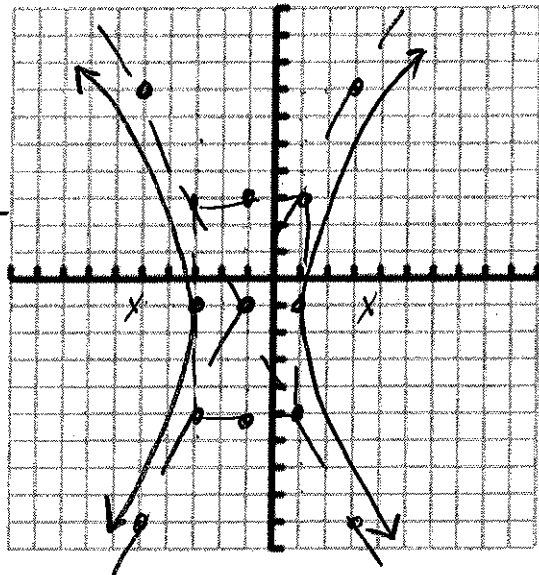
$$\text{foci} = (-1 \pm 2\sqrt{5}, -1)$$

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

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

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$$m = \frac{y}{x} = \frac{4}{2} = 2$$



$$a^2 = 4$$

$$a = 2 \text{ (x-dir)}$$

$$b^2 = 16$$

$$b = 4 \text{ (y-dir)}$$

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

$$c^2 = 4 + 16$$

$$c^2 = 20$$

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