Warm-up 6: Hyperbola

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

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

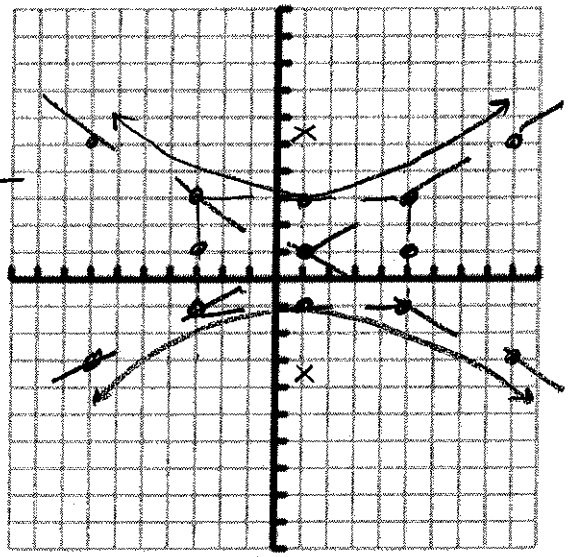
$4(y^2 - 2y + 1) - (x^2 - 2x + 1) = 13 + 4 - 1$

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

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

$\frac{16}{16}$

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



center = $(1, 1)$

vertices = $(1, 3)(1, -1)$

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

asyptotes = $y - 1 = \pm\frac{1}{2}(x-1)$

$a^2 = 4$

$a = 2$ (ydir)

$b^2 = 16$

$b = 4$ (xdir)

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

$c^2 = 4 + 16$

$c^2 = 20$

$2 \cdot 2 \cdot 5$

$c = 2\sqrt{5}$

≈ 4.5

$m = \frac{y}{x} = \frac{2}{4} = \frac{1}{2}$