

WARM-UP

$$9x^2 + 4y^2 - 54x + 40y + 37 = 0$$

$$(9x^2 - 54x) + (4y^2 + 40y) = -37$$

$$9(x^2 - 6x + \underline{3^2}) + 4(y^2 + 10y + \underline{5^2}) = -37$$

$$+ \underline{81}$$

$$+ \underline{100}$$

$$\frac{9(x-3)^2}{144} + \frac{4(y+5)^2}{144} = \frac{144}{144}$$

$$\frac{(x-3)^2}{16} + \frac{(y+5)^2}{36} = 1$$

$$a=6$$

$$b=4$$

$$36 = 16 + c^2$$

$$20 = c^2$$

$$\pm\sqrt{20} = c$$

$$\pm 2\sqrt{5} = c$$

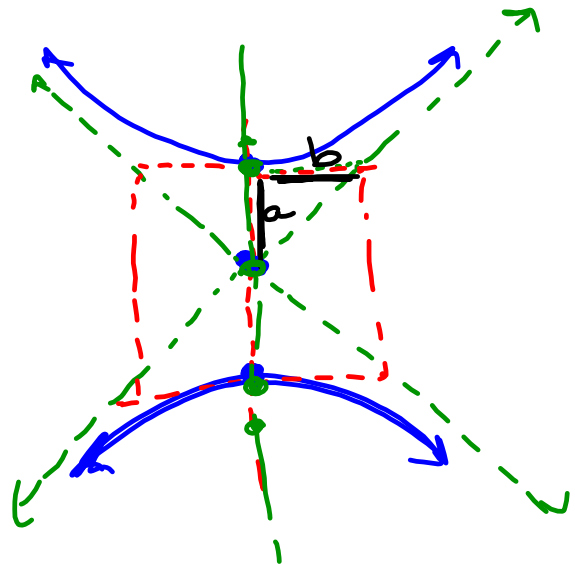
Center (3, -5)

Vert (3, 1), (3, -11)

Co-Vert (7, -5), (-1, -5)

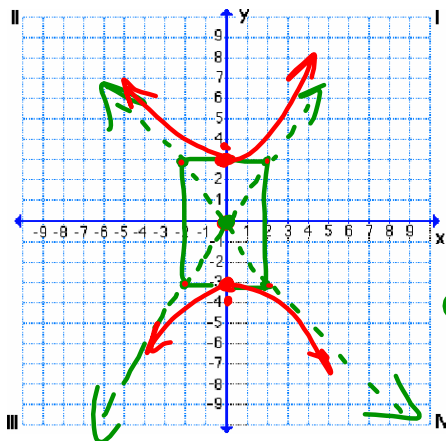
foci (3, -5 + 2\sqrt{5})
(3, -5 - 2\sqrt{5})9.3 Hyperbolas

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

Vertical
Transverse
Axis

EX1) Find the center, vertices, asymptotes, and foci

$$4y^2 - 9x^2 = 36$$



$$\frac{4y^2}{36} - \frac{9x^2}{36} = \frac{36}{36}$$

$$C(0, 0)$$

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

$$V(0, -3)$$

$$(0, 3)$$

$$a = 3 \quad c^2 = 13$$

$$b = 2 \quad c = \pm\sqrt{13}$$

$$F(0, \pm\sqrt{13})$$

$$y = \pm\frac{3}{2}x$$

EX2) Identify vertices, foci, asymptotes, and center.

$$x^2 - y^2 - 6x + 16y - 119 = 0$$

$$(x^2 - 6x) + (-y^2 + 16y) = 119$$

$$(x^2 - 6x + 9) - (y^2 - 16y + 8^2) = 119 + 9 - 64$$

$$(x-3)^2 - (y-8)^2 = 64$$

$$\text{Center}(3, 8)$$

$$\frac{(x-3)^2}{64} - \frac{(y-8)^2}{64} = 1$$

$$V(11, 8)$$

$$(-5, 8)$$

$$a = 8$$

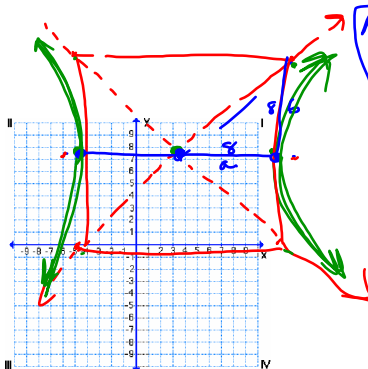
$$b = 8$$

$$c^2 = 128$$

$$c = \pm\sqrt{128}$$

$$c = \pm 8\sqrt{2}$$

$$F(3 \pm 8\sqrt{2}, 8)$$



$$\text{Asymptotes: } y = 8 \pm 1(x-3)$$

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

$$= 8 \pm \frac{8}{8}(x-3)$$

$$= 8 \pm 1(x-3)$$

Warm-Up (Day 2)

$$\textcircled{1} \quad 9x^2 - y^2 - 36x - 6y + 18 = 0$$

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

$$9(x^2 - 4x + \underline{2^2}) - (y^2 + 6y + \underline{3^2}) = -18 + \underline{36} + \underline{-9}$$

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

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

$$\begin{aligned} a &= 1 & c^2 &= 1+9 \\ b &= 3 & c^2 &= 10 \\ c &= \sqrt{10} \end{aligned}$$

Center $(2, -3)$

Vert $(3, -3), (1, -3)$

Foci $(2 \pm \sqrt{10}, -3)$

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

$$y = -3 \pm 3(x-2)$$

CLASSIFY CONICS

$$\textcircled{A}x^2 + Bx + \textcircled{C}y^2 + Dy = E$$

Parabola: either A or C is missing

Circle: $A = C$

Ellipse: $AC > 0$

Hyperbola: $AC < 0$

