

## 9-5 Part 2 Hyperbolas in General Form

$$Ax^2 + By^2 + Cx + Dy + E = 0$$

- 1) A & B must have different signs (one positive and the other negative).
- 2) A & B must be different numbers or opposites (same number with different signs)

Ex 1) For the hyperbola find the center, vertices, and foci.

$$x^2 - y^2 - 2x - 4y - 4 = 0$$

$$x^2 - 2x \quad -y^2 - 4y \quad = 4$$

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

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

horizontal center  $(1, -2)$

$$a = 1 \leftrightarrow b = 1 \updownarrow$$

vertices:  $(0, -2)$   $(2, -2)$

$$c = \sqrt{1+1} = \sqrt{2} \approx 1.4 \leftrightarrow$$

foci:  $(-0.4, -2)$   $(2.4, -2)$

Ex 2) For the hyperbola find the center, vertices, and foci.

$$-9x^2 + 4y^2 - 54x - 8y - 113 = 0$$

$$-9x^2 - 54x + 4y^2 - 8y = 113$$

$$-9(x^2 + 6x + 9) + 4(y^2 - 2y + 1) = 113$$

$-81$   
 $+4$

$$\frac{-9(x+3)^2}{36} + \frac{4(y-1)^2}{36} = \frac{36}{36}$$

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

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

vertical center  $(-3, 1)$

$$a = 3 \updownarrow \quad b = 2 \leftrightarrow$$

vertices:  $(-3, 4)$   $(-3, -2)$

$$c = \sqrt{9+4} = \sqrt{13} \approx 3.6 \updownarrow$$

foci:  $(-3, 4.6)$   $(-3, -2.6)$