

**9-2 Ellipses Day 1**

**Ellipse:**  $(h, k)$  = center  $a > b$ , minor axis length =  $2b$ , major axis length =  $2a$ , foci lie on the major axis " $c$ " units from the center with  $c^2 = a^2 - b^2$ .

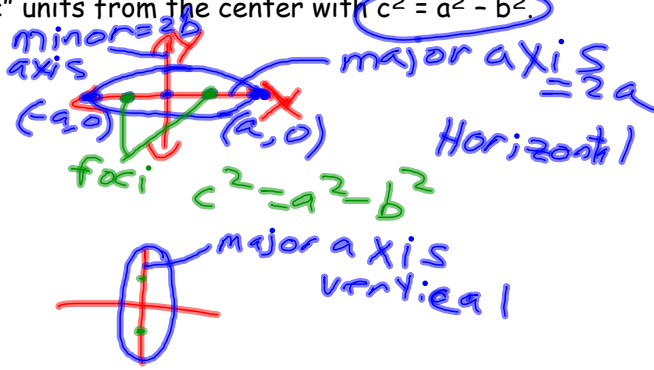
$$\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$$

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

If  $(h, k) = (0, 0)$ , then

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad (\text{major axis horizontal})$$

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1 \quad (\text{major axis vertical})$$



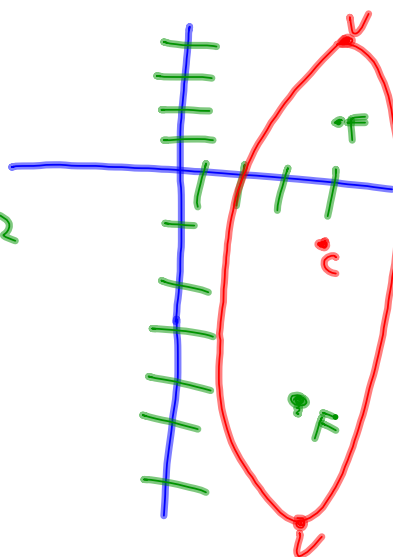
**Find the center, vertices, foci, and sketch.**

Ex 1)  $\frac{(x - 4)^2}{16} + \frac{(y + 1)^2}{25} = 1$   
 $16 = b^2$     $25 = a^2$

Center:  $(4, -1)$   
 Vertices:  $(4, 4)$   $(4, -6)$   
 Foci:  $(4, 2)$   $(4, -4)$

$a^2 = 25$   
 $a = 5$   
 $(4, -1 + 5)$   
 $(4, -1 - 5)$

$c^2 = a^2 - b^2$   
 $c^2 = 25 - 16$   
 $c^2 = 9$   
 $c = 3$   
 $(4, -1 + 3)$   
 $(4, -1 - 3)$



Ex 2)  $(x + 5)^2 + (y - 1)^2 = 1$

$a^2 = (9/4)$   $b^2 = 1$

Center:  $(-5, 1)$

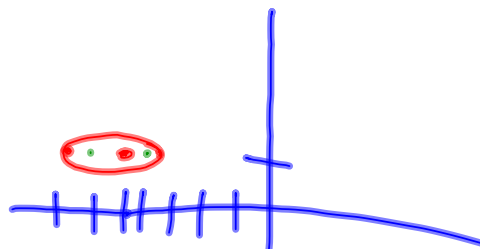
Vertices:  $(-3.5, 1)$   $(-6.5, 1)$

Foci:  $(-5 \pm \frac{\sqrt{5}}{2}, 1)$

$a^2 = \frac{9}{4}$   
 $a = \frac{\sqrt{9}}{\sqrt{4}} = \frac{3}{2}$   
 $a = \frac{3}{2}$   
 $(-5 + \frac{3}{2}, 1)$   
 $(-5 - \frac{3}{2}, 1)$

$c^2 = a^2 - b^2$   
 $c^2 = \frac{9}{4} - 1$   
 $c^2 = \frac{5}{4}$   
 $c = \frac{\sqrt{5}}{2}$

$(-5 + \frac{\sqrt{5}}{2}, 1)$   
 $(-5 - \frac{\sqrt{5}}{2}, 1)$



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

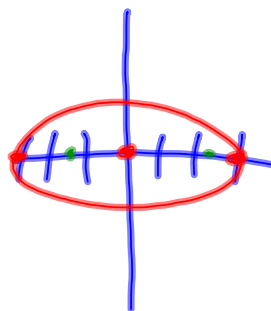
Center:  $(0, 0)$

Vertices:  $(-3, 0)$   $(3, 0)$

Foci:  $(\pm\sqrt{5}, 0)$

$a^2 = 9$   
 $a = 3$

$c^2 = a^2 - b^2$   
 $c^2 = 9 - 4$   
 $c^2 = 5$   
 $c = \sqrt{5}$   
 $(0 \pm \sqrt{5}, 0)$



Ex 4)  $x^2 + 4y^2 + 6x - 8y + 9 = 0$

Center:

Vertices:

Foci:

Ex 5)  $4x^2 + y^2 - 8x + 4y - 8 = 0$

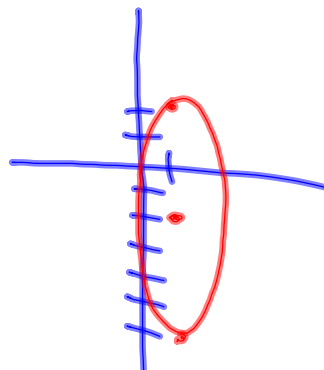
$$\frac{(x-1)^2}{4=b^2} + \frac{(y+2)^2}{16=a^2} = 1$$



Center:  $(1, -2)$   
 Vertices:  $(1, 2), (1, -6)$   
 Foci:  $(1, -2 \pm 2\sqrt{3})$

$a^2 = 16$   
 $a = 4$   
 $(1, -2+4)$   
 $(1, -2-4)$

$c^2 = a^2 - b^2$   
 $c^2 = 16 - 4$   
 $c^2 = 12$   
 $c = \sqrt{12} = \sqrt{4 \cdot 3}$   
 $c = 2\sqrt{3}$



$$5.) 4x^2 + y^2 - 8x + 4y - 8 = 0$$

$$(4x^2 - 8x) + (y^2 + 4y + 4) = 8 + 4$$

$$4(x^2 - 2x) + (y^2 + 4y + 4) = 8 + 4 + 4$$

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

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

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