# Conics: The Ellipse

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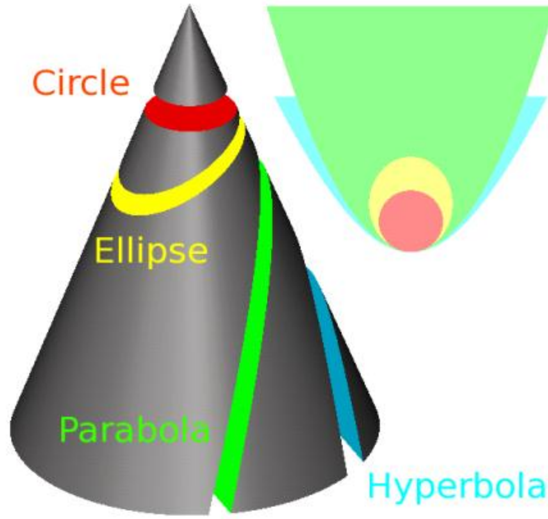


General equation of an Ellipse:

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

Think of an ellipse as a stretched circle. We will notice in the equation that the **coefficients** of $x^2$ and $y^2$ are **not** the same but they both have the same signs.

Put the following into standard form:

$$4x^2+25y^2-8x+150y+129=0$$

Step 1: Group terms.

$$4x^2-8x+25y^2+150y=-129$$

Step 2: Complete the square.

a) Remove coefficients (factor out)

$$4(x^2-2x \quad )+25(y^2+6y \quad )=-129$$

b) Use $\left(\frac{b}{2}\right)^2$ and make sure to multiply by the number outside before adding to the other side.

$$4(x^2-2x+1\ )+25(y^2+6y+9)=-129+4+225$$

$$4(x-1)^2+25(y+3)^2=100$$

DON'T FORGET TO DOWNLOAD THE FORMULA SHEET (tutorial website)

Step 3: Divide so that the equation is equal to 1.

$$\frac{4(x-1)^2}{100}+\frac{25(y+3)^2}{100}=\frac{100}{100}$$

$$\frac{(x-1)^2}{25}+\frac{(y+3)^2}{4}=1$$

Remember that a is always bigger than b and remember to square root the number from the equation to find a and b. And the location of a determines if the major axis is vetical (like the y-axis) or horizontal (like the x-axis).

**Center:(1, -3)**

a = 5 b= 2

**Vertices: (-4, -3), (6, -3)**

**Co-vertices: (1, -1), (1, -5)**

$a^2-b^2=c^2$

25-4 = 21 so $\sqrt{21}=c$

**Foci:** $\left(\mathbf{1}\pm\sqrt{\mathbf{21}},-\mathbf{3}\right)=(\mathbf{5.6},-\mathbf{3})\ \boldsymbol{and}\ (-\mathbf{3.6},-\mathbf{3})$