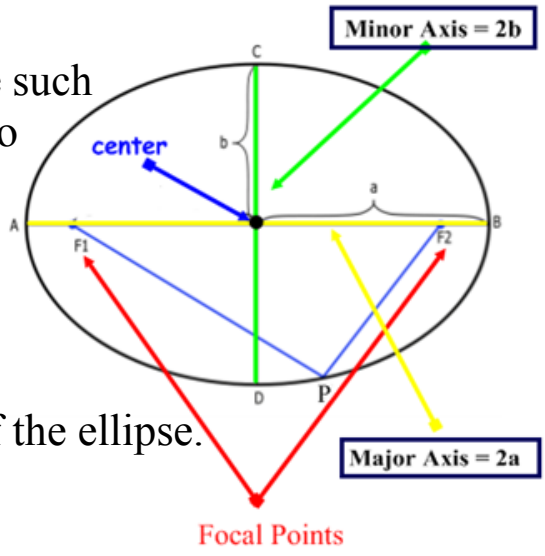
Equation of an Ellipse

An ***ellipse*** is the set of all points in a plane such that the sum of the distances from **P** to two fixed points $\mathbf{F_1}$ and $\mathbf{F_2}$ is a constant.

$\mathbf{PF_1 + PF_2 = constant}$



$\mathbf{F_1}$ and $\mathbf{F_2}$ are both **foci**(plural of focus) of the ellipse.

The ***major axis*** is the longest line segment that contains both foci and has its endpoints on the ellipse. These endpoints are called the ***vertices.***

The midpoint of the major axis is the **center** of the ellipse.

The ***minor axis*** is the shortest line segment whose endpoints are on the ellipse and is perpendicular to the ***major axis*** at the center. The endpoints of the ***minor axis*** are called co-vertices.

The **vertices** are at the intersection of the ***major axis*** and the ellipse.

The **co-vertices** are at the intersection of the ***minor axis*** and the ellipse.

The **standard equation** of an ellipse with the ***center at the origin*** is:

Horizontal Major Axis

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Vertical Major Axis

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$$

where…

major axis = 2a
minor axis = 2b

***Note: If a = b, you have a circle!

MORE EXAMPLES!!!

① c) $\frac{x^2}{100} + \frac{y^2}{25} = 1$

Horizontal Major Axis

bigger # under the x^2

$$\frac{x^2}{(10)^2} + \frac{y^2}{(5)^2} = 1$$

(i) Major Axis $= 2a$
$= 2(10)$
$= 20$ units

Minor Axis $= 2b$
$= 2(5)$
$= 10$ units

(ii) Coordinates of Vertices: (10,0) and (-10,0)

" of Co-Vertices (0,5) and (0,-5)

(iii) x intercepts: (10,0) & (-10,0)

y intercepts: (0,5) & (0,-5)