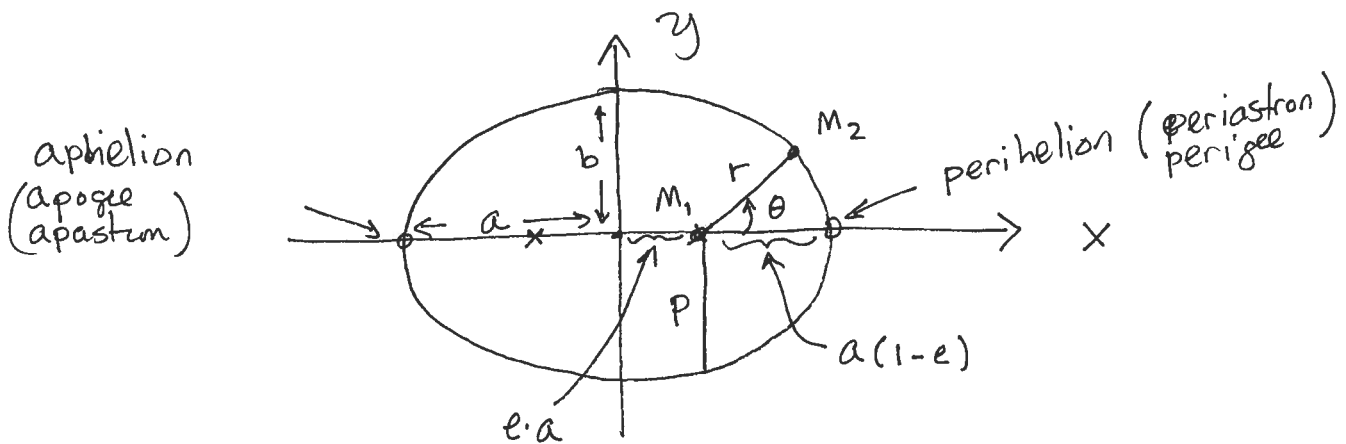


Kepler's 1st Law Properties of Ellipses

(3)



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

↑ semi-major axis ↑ semi-minor axis

$A = \pi ab = \text{area of an ellipse}$

$b = a \sqrt{1 - e^2}$

↑ eccentricity

$\Rightarrow e = \sqrt{1 - \frac{b^2}{a^2}} \quad e \in [0, 1)$

Polar Coordinates $r(\theta) = \frac{p}{1 + e \cos \theta}$

↑ eccentricity ↑ "true anomaly"

← semi-latus rectum = $a(1 - e^2)$

In General, $r(\theta)$ is the form of all conic sections

- $e = 0$ circle
- $e < 1$ ellipse
- $e = 1$ parabola
- $e > 1$ hyperbola