IC200 : Introduction to Astronomy & Astrophysics **Instructor : Dr. Mahavir Sharma**
Tutorial-1

1. Prove that the motion of a particle/body in a central force field remains in a plane.

2. Show that the problem of the dynamics of two bodies interacting with each other via gravitational force can be transformed to the problem of the dynamics of one body moving in central force field.

3. Prove Kepler's second law (see Figure 1), that a planet going around the Sun traverses equal amount of area in a given constant time interval no matter which part of the orbit it is covering.

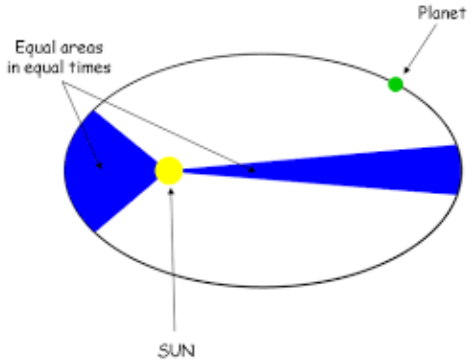

Figure 1: Kepler's second law

4. Kepler's third law: begin with the elliptical orbital equation,

$$\frac{1}{r} = \frac{GMm^2}{L^2}(1 + \epsilon \cos\theta)$$

and prove that the semi major axis of the orbit, a, and the time period of the orbit, T, are related as $T^2 \propto a^3$

5. Follow the method described in the class and derive the orbits (and also try plotting) for the potential energy $V = \alpha r^2$ and also find out for $V = \alpha/r^2$, where α is a constant.

6. What is the eccentricity, ϵ, for the Earth's orbit around the Sun. What would you say: the orbit is close to circular or more like elliptical?