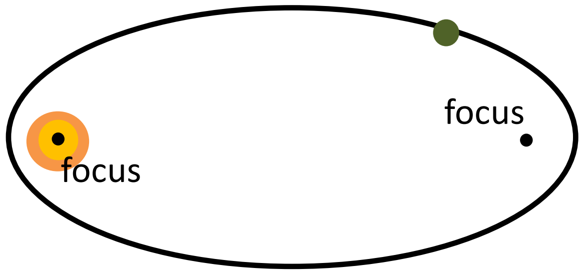
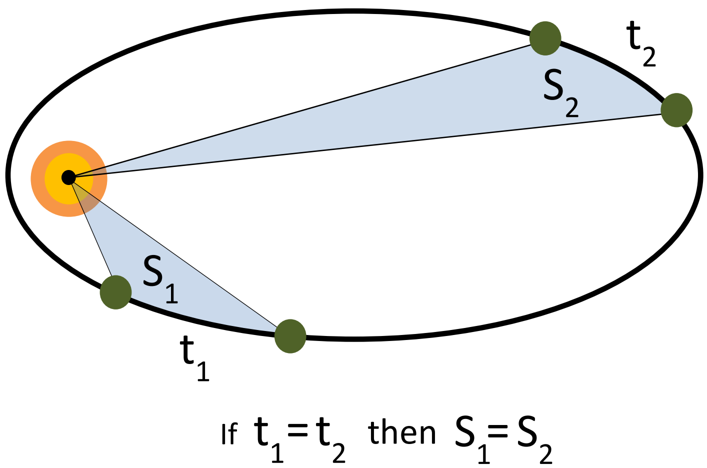
Homework 14

During last class we discussed Kepler's first law. There are 3 of them:

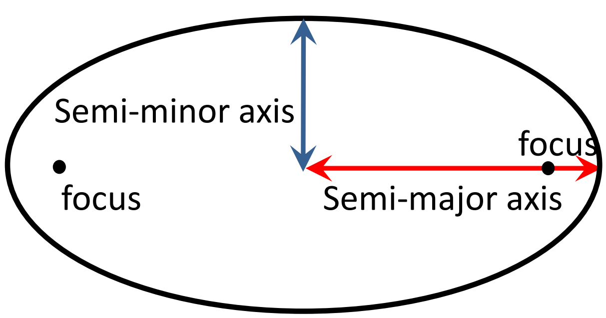
1. ***The orbit of every planet is an ellipse with the Sun at one of the two foci.***



2. ***A line joining a planet and the Sun sweeps out equal areas during equal intervals of time.***



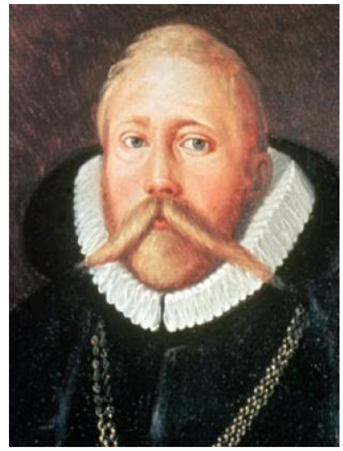
3. ***The square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit.***



In spite that we are talking here about the Sun and the planet, Kepler's laws are universal and can be used to describe the orbital motion of satellites around the Earth for example.

These laws were formulated by German astronomer Johannes Kepler in 1609 (laws 1,2) and 1619 (law3)

Johannes Kepler (1571-1630)



Tycho Brage (1546-1601)

Kepler formulated the laws of planetary motion using detailed results of astronomical observations made by Danish astronomer Tycho Brage.

As we discuss in the class we can understand these laws in terms of conservation of angular momentum and energy. Below is a problem which I would like to offer to you as homework:

1. A satellite is revolving around the Earth along a circular orbit with radius $\boldsymbol{R}$. At a certain moment the "braking engine" reduces the speed of the satellite, so it starts moving along an elliptical orbit which touches the Earth's surface. In what time after the "braking" the satellite will be landed? The radius of the Earth is $\boldsymbol{R_E}$. Please neglect the friction.