ASTR450 Homework # 5 – Two Body Problem
Due Tuesday, March 11

Reading: Read Chapter 9 & start Chapter 8. Also, test your knowledge of orbital elements with the 2D and 3D orbit viewers now available from the class web page (click on: "Celestial Mechanics Toolbox").

1. Danby: Page 136, Problem 1. Given that the Moon's eccentricity is 0.05, what total fraction of the Moon's surface is visible to observers on Earth over a month due to this effect?

2. Danby: Page 138, Problem 15. Give the initial conditions as six orbital elements (a,e,i,Ω,ω, and ν), taking the equator plane to be the reference plane (the xy plane), the x-axis to be the inertial reference direction, and the launch point to be in the xz plane at the time of launch. You will probably need to use a calculator to get the semimajor-axis and eccentricity. The six orbital elements could be translated into three initial positions and velocities with a little extra effort.

3. Danby: Page 143, Problem 21. Find the semimajor axis and eccentricity of the orbit too.

4. Derive Equations 6.7.9 on page 163.

5. In your favorite computer language, write six subroutines to translate between the mean anomaly M, the eccentric anomaly E, and the true anomaly ν for elliptic orbits. Find E and ν given $M = \pi/2$, $e = 0.8$. Write down an inequality relating the three anomalies over the pericenter to apocenter half of the orbit. How does this change for the apocenter to pericenter half? Please turn in a copy of your code.