Astro 205. Problem set 1. September 17 2003, due September 24 2003

1. The Moon's distance from the Earth is 3.84×10^{10} cm and its revolution period around the Earth is 27.3 days. (i) assuming that the Moon's mass is very much smaller than the Earth's, calculate the Earth's mass from this information (you also need the constant of gravity G: 6.7×10^{-8} gm^{-1} cm^3 s^{-2}). (ii) The Moon's actual mass is 7.4×10^{25} gm. How far from the center of the Earth is the center of mass of the Earth-Moon system? The Earth's radius is 6.4×10^8 cm. Is the center of mass of the Earth-Moon system inside or outside the Earth?

2. Here is a list of the periods (P), eccentricities (e), and semi-major axes (a) of several well-known comets. Comets orbit the Sun. (i) Verify that their orbits obey Kepler's third law (note: Kepler's 3rd law holds for the period and semi-major axis). (ii) Calculate the perihelion and aphelion distances for each comet.

Table 1. Comets

Comet	P(yr)	a(AU)	e
Halley	76.1	17.8	0.97
Encke	3.3	2.2	0.85
Wolf	8.42	4.15	0.40
1943.1	512	64	0.999914

3. The Sun's present rotation period is 27 days. If all the angular momentum in the Solar System were returned to the Sun, what would its rotation period be? Do this problem approximately: just take Jupiter and ignore the other planets. Use the masses, distances etc. from Table 1, lecture 1.