Due March 27, 2008

MAS423/AST001 Solar System
Coursework #3

1. Several weeks back we showed that the radial distance of an object from the primary is related to its true anomaly, f , by the equation $r = a(1 - e^2)/(1 + e\cos f)$ where a is the semi-major axis and e the eccentricity of the orbit.

   (a) Use the expressions for v^2 (i.e. the vis-viva equation), r as a function of f and $C = -\mu/2a$ to show that for small values of the eccentricity e,

   $$v \approx \sqrt{\frac{\mu}{a}}(1 + e\cos f + e^2).$$

   (b) For small eccentricities (i.e., keeping terms to first order in e) what is the difference in speed between an object on an eccentric orbit and one with the same semi-major axis, but on a circular orbit?

   (c) What is the root mean square value of this speed difference? This is sometimes called the *relative* or *random* velocity of the object. We'll use this simple result later in examining planetary accretion.