

ASTR450 Optional Homework # 12 – Final Review

1. Find the places along an elliptical orbit where the angle between the radius vector and the velocity vector is minimum and maximum.
2. Apollo 13 is on a circular orbit 100km above the Earth's surface. It fires its engines and produces a tangential velocity which will take it to the Moon (assume that the spacecraft's orbit is always in the Moon's orbital plane).
 - a) In a two-body approximation (Earth, spacecraft) how much extra velocity must be added to put the spacecraft onto an orbit whose apocenter is at the Moon? How much extra velocity does it need to escape from the Earth altogether?
 - b) What is the minimum extra velocity that might enable the spacecraft to get to the Moon in the three-body approximation (Earth, Moon, spacecraft)? Hint: Use Jacobi's integral to see when a transfer orbit first becomes possible.
3. Estimate the period of oscillations in Neptune's eccentricity induced by Jupiter.