

PHY3110 Homework 5: Central Forces: Due Tuesday Nov 1 at 9:30am.

1. a. Show that the radius for a circular orbit of a synchronous (24-hour) Earth satellite is about 6.6 earth radii. Look up constants you need on the internet.
b. the distance to the moon is about 60.3 earth radii. From this calculate the length of the sidereal month (period of the moon's orbital revolution).

2. A particle moving in a central field describes the spiral orbit $r = r_0 \exp(k \theta)$. Show that the force law is an inverse cube and that θ varies logarithmically with t .

3. A comet is first seen at a distance of "d" astronomical units from the Sun and it is traveling with a speed of "q" times the Earth's speed. Show that the orbit of the comet is hyperbolic, parabolic, or elliptic, depending on whether the quantity $q^2 d$ is greater than, equal to, or less than 2, respectively.

4. Show that the stability condition for a circular orbit of radius "a" is equivalent to the condition that $d^2V_{\text{eff}}/dr^2 > 0$ for $r=a$, where $V_{\text{eff}}(r)$ is the effective potential which is the sum of the gravitational potential and the angular momentum term, i.e. equation (8.34) in the Thornton & Marion text.

5. Problem 8-8 in Thornton & Marion.

6. Problem 8-40 in Thornton & Marion