

PH673 - High Energy Astrophysics

Assignment 2 - Aug 22, 2007

1. Consider the reduced 3-body problem seen in a frame Σ' which is rotating with m_1 and m_2 . Assume $m_1 + m_2 = 1$, $D = 1$ (distance between m_1 and m_2) and $G = 1$.

(a) Show that the rotation of the rest frame Σ' with respect to an inertial frame Σ centered at the center of mass of the system is $\omega = 1$.

(b) Show that the Lagrangian points L_4 and L_5 form an equilateral triangle with the baseline $D = 1$.

2. Consider a 1-D harmonic oscillator with $V(x) = \frac{k}{2}x^2$. Using the quadrature equation which ensues from the solution of the Hamilton-Jacobi equation,

$$t + t_0 = \int_0^t \sqrt{\frac{m}{2(E - V(x))}} dx$$

show that $x(t)$ performs a sinusoidal oscillation with $\omega = \sqrt{k/m}$.