

Classical Mechanics (PH211 + PH403)

Tutorial VIII

1. Formulate the Hamiltonian and obtain the Hamilton's equations of motion for the following systems:

- (a) Two point masses m_1 and m_2 are connected by a light inextensible string of length l and slides on the surface of prism with angles α and β (see figure on right). Gravity acts vertically downward as shown.
- (b) The two body central force with $V = -K/r$. Using the Poisson bracket formalism show that the p_θ is a constant of motion.
- (c) Two dimensional motion of a projectile under gravity. Treat in both (a) Cartesian and (b) plane polar coordinates. For case (a) show that p_x is conserved using the Poisson bracket.
- (d) An isotropic harmonic oscillator in two dimensions, ie., having equal force constants, $k = m\omega^2$. Show that $A = \frac{1}{2m}(p_x p_y + m^2 \omega^2 xy)$ is a constant of motion.
- (e) For a point mass m confined to move on the surface of a sphere of radius R under gravity. Identify the constants of motion, with supporting proof using Poisson bracket formalism.

