PHYS 306: HOMEWORK ASSIGNMENT No. 1: LAGRANGIANS

(Jan. 11th, 2017)

HOMEWORK DUE: WEDNESDAY, JAN 18th, 2017

To be handed in during class- Late Homework will not be accepted

QUESTION (1): The infinitesimal "interval" or distance ds between points on a 2-dimensional plane is given by $ds^2 = dx^2 + dy^2$, so that $ds = (dx^2 + dy^2)^{1/2}$.

1(a) Give the expression for the infinitesimal distance on (i) the surface of a cylinder of radius r, in terms of cylindrical coordinates (ii) the surface of a sphere of radius r, in terms of spherical coordinates; and then (iii) write the distance in 3-dimensional Euclidean space in terms of Cartesian, cylindrical, and spherical coordinates.

1(b) For a cylinder of radius R_o, find the equation as a function of z, the axial coordinate, for the shortest path on the cylinder between points (z_1, ϕ_1) and (z_2, ϕ_2). When does this problem have more than one solution?

QUESTION (2) Here we will look at how the Lagrangian and the equations of motion are found for a specific system.

Consider a situation where 2 masses, with masses m_1 and m_2, and coordinates x_1 and x_2 respectively, move along the x-axis without friction. However there is a potential energy $W(x)$ acting on each of them, as well as a potential energy $V(x_1 - x_2)$ acting between them. Find the Lagrangian of the system, and then find Lagrange's equations of motion for the 2 masses.

END of 1ST HOMEWORK ASSIGNMENT