PHY3110 Homework Assignment 3

1. (20 points) Is the constraint

$$(x^2 + y^2 + z^2)dx + 2(xdx + ydy + zdz) = 0 \tag{1}$$

a holonomic constraint or a non-holonomic one?

2. (30 points) A particle is subjected to the potential $V(x) = -Fx$, where F is a constant. The particle travels from $x = 0$ to $x = a$ in a time interval t_0. Assume the motion of the particle can be expressed in the form $x(t) = A + Bt + Ct^2$. Find the values of A, B, and C such that the action is a minimum.

3. (25 points) A bead of mass m slides down a frictionless wire bent into the form of a parabola $y = Ax^2$, determine the constraint force acting on the bead.

4. (25 points) A uniform hoop of mass m and radius r rolls under gravity from rest without slipping on top of a fixed cylinder of radius R, use the method of Lagrange multipliers to find the point where the hoop falls off the cylinder.