PHY3110 Homework Assignment 2

1. (20 points) Derive the equations of motion for a point mass in spherical coordinates.

2. (30 points) A uniform sphere with mass m_1 and radius R and a mass m_2 hang by massless strings from the same point (see Fig. 1). Ignore frictional forces, use D'Alembert's principle to find at what angle θ they are in balance?
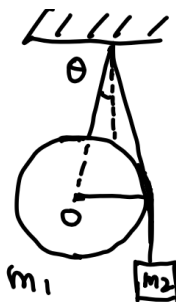

Fig. 1

3. (25 points) In special relativity, the Lagrangian of a point mass is $L = -m_0 c^2 \sqrt{1 - \frac{v^2}{c^2}} - V$ (m_0 is its mass, v is its velocity, c is the speed of light, and V is the potential). Derive the Lagrange's equations for it.

4. (25 points) Let a uniform rod of length $2l$ slide down freely from rest on a frictionless plane (see Fig. 2), write down the equations of motion. What are the conserved quantities?
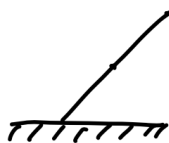

Fig. 2