Assignment 3
Lagrangians

1. A particle moves in a plane under the influence of a force $F(r) = -A\, r^{\alpha-1}$ directed toward the origin; A and $\alpha > 0$ are constants. Choose appropriate generalized coordinates and let the potential energy be zero at the origin. Find the Lagrangian equations of motion. Is the angular momentum about the origin conserved? Is the total energy conserved?

2. A double pendulum consists of two simple pendula, with one pendulum suspended from the bob of the other. If the two pendula have equal lengths and have bobs of equal mass and if both pendula are confined to move in the same plane, find Lagrange's equations of motion for the system. Do not assume small angles.

3. Two blocks, each of mass M are connected by an extensionless uniform string of length l. One block is placed on a smooth horizontal surface and the other block hangs over the side, the string passing over a frictionless pulley. Describe the motion of the system a) when the mass of the string is negligible and b) when the string has a mass m.

4. A simple pendulum of length b and bob with mass m is attached to a massless support moving horizontally with constant acceleration a. Determine a) the equations of motion and b) the period for small oscillations.