Problem Set #6 Due Friday May 18, 2007 in class

1. A ladder of length *L* rests against a smooth wall and slides without friction on the wall and the floor. Assume that the ladder is initially at rest at an angle α with respect to the floor. Using the method of Lagrange undetermined multipliers, find the angle at which the ladder leaves the wall.

2. Consider the roller coaster ride shown below. A car of mass *m* descends a track and reaches a velocity v_o just before it enters the frictionless, circular loop-de-loop of radius *R*.
   a) Considering only the motion within the loop-de-loop, write the Lagrangian in terms of generalized coordinates appropriate for the unconstrained system. Draw a diagram so it is clear what your choice of coordinates is.
   b) Write down the constraint equation.
   c) Find the Lagrange equations of motion using the method of undetermined Lagrange multipliers.
   d) Find the force of constraint.
   e) What is the minimum value of v_o for which the car will not leave the track in the loop-de-loop?