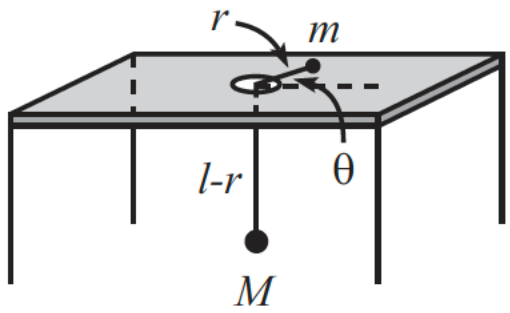
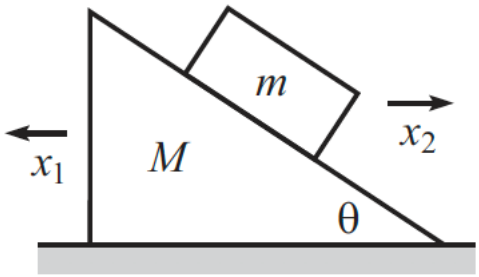
Problem I



A mass m is free to slide on a frictionless table and is connected by a string, which passes through a hole in the table, to a mass M which hangs below M. Assume that M moves in a vertical line only, and assume that the string always remains taut.

1) Find the equations of motion for the variables r and theta shown in the figure, meaning theta is used instead of x, in producing Euler Lagrange equation $\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}}\right) = \frac{\partial L}{\partial x}$ or r is used instead of x.
2) Discuss the behavior of the theta (or rotation of m) using the E-L equation of theta.
3) Discuss the behavior of the string, using the E-L equation of of r.
4) Under what condition, the m has circular motion (r dot, r two dot =0)?

Problem II



A block of mass m is held motionless on a frictionless plane of mass M and angle of inclination theta. The plane rests on a frictionless horizontal surface. The block is released. What is the horizontal acceleration of the plane? Use Lagrangian, and E-L, not newton approach.