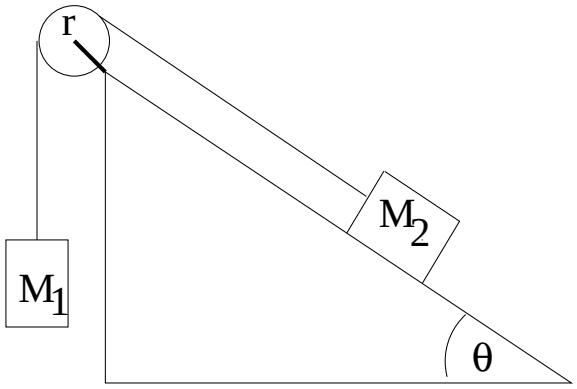
PHY6938 Mechanics Fall 2000
January 11, 2001

1. In the figure, the fixed incline is frictionless and the massless string (which cannot be stretched) passes through the center of mass of each block. The pulley has moment of inertia I and radius r, the two blocks have mass m_1 and m_2, respectively, and the angle of the incline is θ.



a) Find the net torque acting on the system (including the two masses, string, and pulley) about the center of the pulley.

b) Write an expression for the total angular momentum of the system about the center of the pulley when the blocks are moving with speed v.

c) Find the acceleration of the blocks, using your results from parts a and b.

2. An asteroid is moving toward a planet from infinity with initial speed v_0. It its trajectory were not deflected by the planet's gravitational field, it would pass by the planet with a minimum distance d from the center of the planet. The planet has a radius R ($R < d$) and mass M. The gravitational constant is G. Calculate the minimum value of v_0 in order for the asteroid to not hit the planet's surface.

3. A small ball of mass m is fired into an opening in a block of mass M with a horizontal velocity of v. Inside the opening is a spring with spring constant k attached to the block, as shown in the diagram. The block is initially at rest and it can slide along the floor without friction. Determine the maximum compression of the spring, Δx.