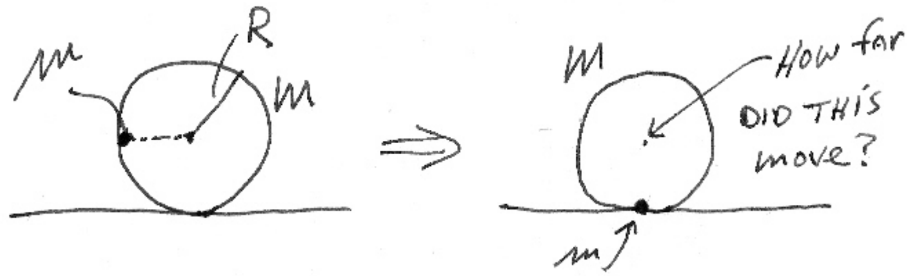
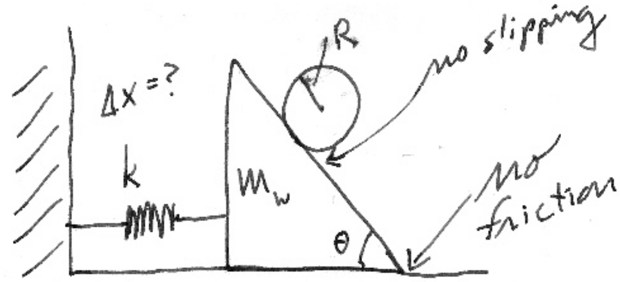
Physics 4A Exam 2 Winter 2007 Name___________________________

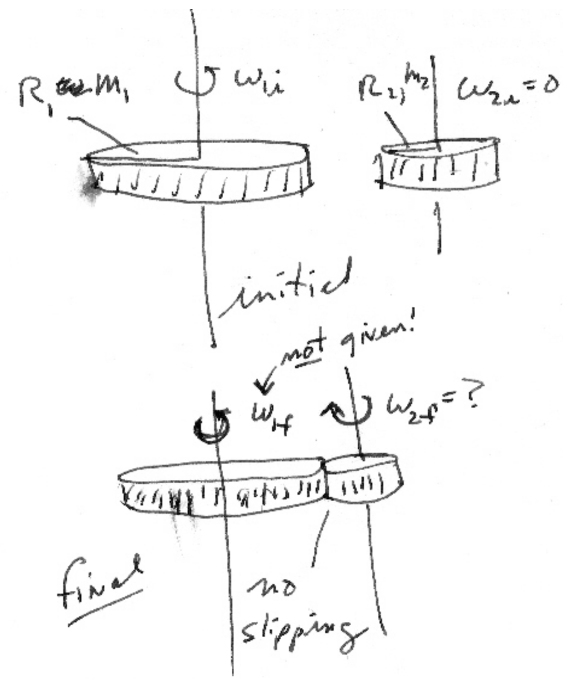
1. (25 points) A hoop of mass M and radius R and a small point mass, *m*, are placed at rest in a position as shown. After the point mass is released, the point mass goes to the bottom of the hoop. **Find the horizontal distance the center of the hoop moves after everything has come to a rest from its initial postion.** There is no friction in this problem.



2. (25 points) A disk ($I_{disk} = ½MR^2$) of mass M and radius R rolls without slipping down an inclined wedge of mass M_w and angle θ. There is no friction between the wedge and the ground. There is friction between the rolling mass and the wedge. The wedge is connected to a horizontal spring of given stiffness *k* as shown in the diagram and is not accelerating. **Find the compression of the spring while the mass rolls down the wedge.**



3. (25 points) Two disks, one of mass M_1 and radius R_1 and the other of mass M_2 and radius R_2 are constrained to spin about their own axis. Initially, only disk 1 is spinning with an initial angular velocity of ω_{1i}. The two disks are then brought into contact so that their sides are touching. There is sliding friction between the two until they both spin together with no slipping. In that case, the angular velocity of one is opposite the other in direction (and they are not equal in magnitude). **Find the angular velocity of disk 2 after they stop slipping, ω_{f2}.** ω_{1f} is not given.



4. (25 points) A mass, *m*, is at rest against a spring of stiffness *k* compressed by an amount Δx. The mass is released and then travels along the inside of a circular loop of radius *r*. **Find the amount of the compression necessary such that the mass experiences a normal force at the top of its loop that is three times its own weight.**