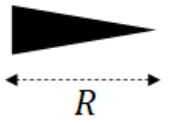
AP Physics C: Mechanics
Unit 5&6 Quiz

1. A wheel rotates about a fixed axis with an initial angular velocity of 40 rad/s. During a 10.0 s interval the angular velocity decreases to 20 rad/s. Assume that the angular acceleration is constant during the 10.0 s interval. The wheel is a solid wheel ($I = \frac{1}{2}mr^2$) and has a radius of 0.5 m and a mass of 1.0 kg.
   a) How many complete revolutions does the wheel make in the 10.0 s interval?
   b) Suppose a tangential force is applied at 0.5 m from the center of the wheel. What is the magnitude of this force in order to cause the deceleration in a).
   c) What would happen to the force required if it were applied further from the center of rotation?

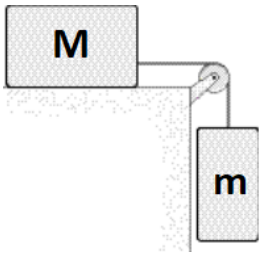
2. Check out that thin narrow wedge shown on the right. If r is the distance from the left end of the wedge, then the linear mass density of the wedge can be expressed as follows:



$$\lambda(r) = \frac{Mr}{4R^2}$$

   a) Using integral calculus, derive an expression for the rotational inertia of the wedge around its tip.
   b) The Germans arrange 3 of the wedges inside of a hollow ring of mass M and radius R as shown. The moment of inertia of a hollow ring is given by $I_{ring} = MR^2$. Determine the moment of inertia of the apparatus shown.

3. A mass m = 2.0 kg is connected, as shown, by a light cord to a mass M = 4.0 kg, which slides on a horizontal surface with a coefficient of sliding friction equal to $\mu = 0.30$. The pulley has a mass of 1.0 kg radius R = 0.20 m. The pulley is a solid disc ($I_{disc} = \frac{1}{2}mr^2$).



   a) What is the magnitude of the acceleration of m?
   b) The solid disc pulley is now removed from the set-up and replaced with a hollow disc with the same mass and radius. Would the acceleration of the blocks increase, decrease, or remain the same? Justify your answer conceptually without performing any calculations.