

# PHYSICS 180

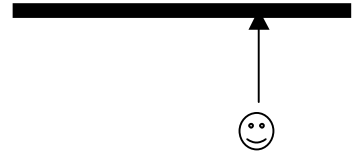
## Problem set #8

due: November 22, 2006

*“The real danger is not that computers will begin to think like people, but that people will begin to think like computers.”*

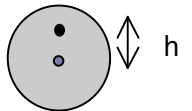
S. J. Harris

- 1) A 0.3 kg thin metre stick is resting on a frictionless surface when it is struck by a small clay ball of mass 0.05 kg moving at a speed of 1 m/s and in a direction perpendicular to the stick. If the clay ball sticks at the 75 cm mark, determine,
- the kinetic energy of the stick/clay afterwards;
  - the angular velocity of the metre stick after the collision.



- 2) Show that the total angular momentum of a system with mass  $M$  about any point,  $P$ , can be written as the sum of the angular momentum about the center of mass (spin angular momentum) plus the angular momentum of the center of mass (with mass  $M$ ) about  $P$  (orbital angular momentum).

- 3) A uniform disc of radius  $R$  can be hung from a horizontal axis at a distance  $h$  from its centre so that it can oscillate in its own vertical plane. Determine the period of small oscillations and the value of  $h$  for which this period is a minimum.



4. Two springs of force constant 500 N/m are attached to either side of an axle which passes through the center of a sphere of mass 10 kg and radius 0.1 m. The sphere can roll without slipping on a horizontal surface as indicated in the diagram. The sphere rotates about the axle without friction. What is the period of oscillation for small amplitudes of horizontal motion.

