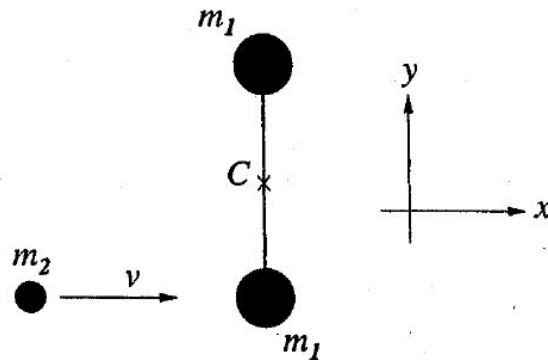


FP8



A massless rod of length $2R$ has masses m_1 attached to each end. The rod is free to rotate on the surface of a frictionless table about a pin attached to its center C . A mass m_2 is moving across the table at speed v perpendicular to the rod and is aimed directly at one of the masses m_1 as shown in the diagram. At time $t = 0$, m_2 collides with m_1 and sticks instantaneously, setting the rod into rotation about C .

- a) (2 points) Considering only the rod and masses, which, if any, of the following quantities are conserved in this collision:
 - 1) Linear Momentum?
 - 2) Angular Momentum about C ?
 - 3) Kinetic Energy?
- b) (3 points) What is the angular velocity ω following the collision, and is it constant?
- c) (3 points) Determine the total linear momentum P of the rod and mass system following the collision. Give both the x and y components and specify their time dependence, if any.
- d) (2 points) Determine the force F exerted by the pin at C . Again, give both the x and y components and specify their time dependences, if any. Also give the magnitude of the force.