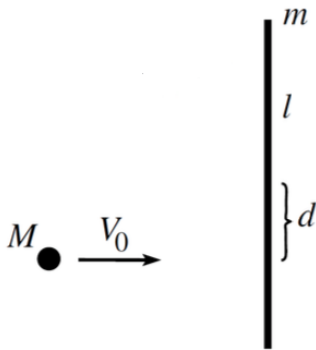# Ph1a - Flipped Section

Problem Set 9

November 4, 2019

1. Strike it good!

(Morin, Introductory Mechanics, Problem 7.9)

A ball of mass M hits a stick with moment of length l and mass m. The ball is initially traveling with velocity V_0, perpendicular to the stick. The ball strikes the stick at a distance d from its center. The collision is elastic. Find the resulting translational and rotational speeds of the stick, and also the resulting speed of the ball.

2. Spheres and Cavities

A solid sphere of radius $2R$ and mass M has a spherical cavity of radius R located a distance R away from its center(Mass M is distributed uniformly where present). Find the moment of inertia of this object,

a. rotating about an axis passing through the centers of both spheres,

b. rotating about an axis perpendicular to the one in part (a) and passing through the center of the larger sphere.

The moment of inertia of a solid sphere radius r and mass m rotating about its center is $\frac{2}{5}mr^2$.

3. Spaceships

(Lewin, Walter, Peter Dourmashkin, Thomas Greytak, Craig Watkins, Andy Neely, Sahana Murthy, J. Litster, and Matthew Strafuss. 8.01SC Physics I: Classical Mechanics, Fall 2010. (MIT Open-CourseWare: Massachusetts Institute of Technology), http://ocw.mit.edu/courses/physics/8-01sc-physics-i-classical-mechanics-fall-2010 (Accessed 4 Nov, 2019). License: Creative Commons BY-NC-SA (URL: https://creativecommons.org/licenses/by-nc-sa/4.0/).)

A spaceship is sent to investigate a planet of mass m_p and radius r_p. While hanging motionless in space at a distance $5\,r_p$ from the center of the planet, the ship fires an instrument package with speed v_0. The package has mass m_i which is much smaller than the mass of the spacecraft. The package is launched at an angle θ with respect to a radial line between the center of the planet and the spacecraft. For what angle θ will the package just graze the surface of the planet?