

## Physics 262: Problem Set #1

These problems are due by the end of the day on Friday, Jan. 9 in the graders' box.

1. Shankar, problem 3.2.8 pg. 72.
2. Consider a uniform *semi*-circle of radius  $R$  and mass  $m$ . Locate the center of mass and find the moment of inertia about that center of mass. That is, if the semicircle is defined by  $x^2 + y^2 < R^2$  and  $y > 0$ , find  $y_0$ , the height of the CM. Do this by explicitly writing out the integrals you need to do, and then either do the trig substitutions as needed, or ask Mathematica for the results. As a *last* step, verify the parallel axis theorem. (We'll step through this problem in the Thursday session.)
3. Morin 8.30 (Semicircle CM) p. 340
4. Morin 8.10 (Removing a support) p. 335
5. Morin 8.26 (Swinging stick) p. 339
6. Morin 8.47 (The spool) p. 342
7. Morin 8.64 (Colliding sticks) p. 346
8. A uniform rod of length  $2L$  and mass  $M$  lies (i.e. initially at rest) on a frictionless plane. A ball of mass  $m$  and speed  $v_0$  strikes the rod perpendicularly at one end. If the ball's final velocity happens to be parallel to its initial velocity, (a) find that final speed,  $v_f$ , assuming mechanical (i.e. kinetic) energy is conserved. And (b) Find  $v_f$  assuming the rod is pivoted at the other end.
9. (BONUS) Morin 8.7 (Slick calculations of I) p. 334 and Morin 8.34 (A triangle, the slick way) p. 340