

Physics 262: Problem Set #6

These problems are due by the end of the day on Friday, Feb. 13 in the graders' box.

NOTE: For each problem, your solution should begin with a brief statement of the problem, i.e. a description of the setup, including a list of the inputs and the goal.

1. There will be a worksheet to do and hand in from the Wednesday session.
2. Morin 7.10 (Power law spiral) p. 298
3. Morin 7.16 (Skimming a planet) p. 299
4. Morin 8.50 (Pulling a cylinder) p. 342
5. Morin 8.65 (Lollipop) p. 346
6. Morin 9.5 (A nice cylinder) p. 415
7. Morin 9.10 (Rotating stick) p. 416 and Morin 9.42 (Pivot and string) p. 424
8. (K+K 7.5) A car of mass M and wheelbase (separation between right and left wheels) b has its center of mass a height L off the ground. It is rounding a turn of radius R at a speed v . The road is unfortunately unbanked, so the car might tip over.
 - (a) What are the total normal forces between the ground and the tires on the inner side and the outer side?
 - (b) What is the maximum v before the car flips over?
 - (c) To stabilize the car we might install a gyroscope (say a uniform disk of mass m and radius R spinning at ω). How should we choose ω , and in what direction should we spin, in order to make the normal forces equal?
9. (BONUS) K+K 7.6 A coin of radius b rolls without slipping in a circle of radius R (where $R \gg b$) at velocity v . As it does so, it must tilt at an angle ϕ . Find ϕ .