

Physics 262: Problem Set #3

These problems are due by the end of the day on Friday, Jan. 23 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. Morin 8.21 (Many bounces) p. 337
2. Morin 8.51 (Coin and plank) p. 343
3. Morin 8.73 (Doing work) p. 348
4. A boy of mass m runs on ice with velocity $\vec{v}_0 = v_0\hat{x}$ and steps on to one end of plank of length L and mass M which is lying on the positive y -axis, perpendicular to his path. (a) Choosing as your origin the point where the boy steps on to the plank, write a vector expression for the subsequent motion of the boy. (b) One point on the plank is at rest immediately after the collision. Where is it? (c) Is energy lost in the collision? If so, how much?
5. Morin 7.4 (r^k Potential) p. 297.
6. Morin 7.5 (Spring ellipse) p. 297.
7. A mass $m = 2\text{kg}$ slides on a frictionless table while attached to the end of a spring with constant $k = 3\text{N/m}$. The other end of the spring is attached to a frictionless pivot, and the spring's unstretched length is negligible (i.e. $F_r = -kr$). Initially the mass moves in a circle and has total energy $E_0 = 12\text{J}$. (a) Find the radius of the orbit and the velocity of the mass. (b) The mass is struck by a sudden blow, instantaneously giving it a velocity $v_r = 1\text{m/s}$ outward. Show the state of the system before and after the blow on a plot of the effective potential. (c) For the new orbit, find the maximum and minimum values of r .
8. (BONUS) Morin 7.19 (Zero potential) p. 300