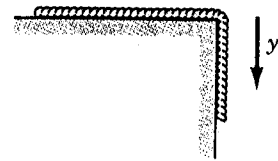
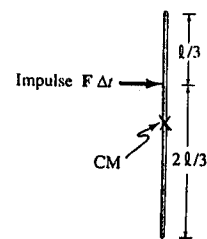


1. A flexible rope of length b slides off the edge of a frictionless table. If, initially, a length y_0 hangs over the edge. (a) Find the acceleration and the velocity of the rope after the length of the hanging side becomes y . (b) Find the time it takes for the rope to slides completely off the table. (20%)



2. A rod of mass M and length ℓ is at rest on a frictionless surface. An impulse $\vec{F}\Delta t$ is applied at right angle at a distance $\ell/3$ from one end of the rod. (a) Find the linear and the angular velocities of the rod after it have been hit. (b) Describe, briefly, the subsequent motion of the rod. (20%)

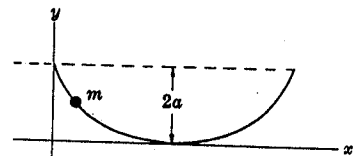


3. A mass m moves in one dimension and is subjected to a constant force $+F_0$ when $x < 0$ and to a constant force $-F_0$ when $x > 0$. (a) Construct the phase diagram for the particle. (b) If the damping of the motion could be neglect, find the period of the motion in terms of m, F_0 and the amplitude A . (20%)

1. A bead slides without friction on a frictionless wire in the shape of a cycloid with equations

$$x = a(\theta - \sin \theta), \quad y = a(1 + \cos \theta)$$

- where $0 \leq \theta \leq 2\pi$. Find (a) the Lagrangian of the bead, and (b) the equation of motion for the bead. (20%)



1. A homogeneous cube of density ρ , mass M and side of length b (see figure). (a) Find the inertia tensor for the cube. (b) Find the principal moments of inertia and the principal axes for the cube. (20%)

