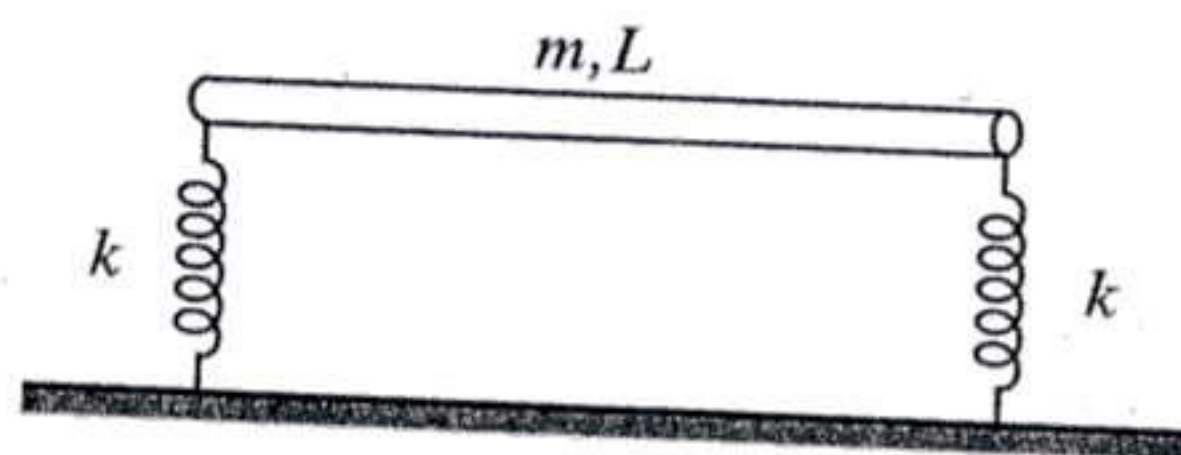


- (1). (15 points) A particle moving along the x axis is acted upon by a resisting force which is such that the time t for it to travel a distance x is given by $t = Ax^2 + Bx + C$ where A , B , and C are constants. Prove that the magnitude of the resisting force is proportional to the cube of the instantaneous speed.
- (2). (15 points) A mass m lies on the perpendicular through the center of a uniform thin circular plate of radius a and at distance b from the center. Find the force of attraction between the plate and the mass m .
- (3). (20 points) A particle of mass m rests on a smooth plane. The plane is raised to an inclination angle β at a constant rate α ($\beta = \theta$ at $t = \theta$), causing the particle to move down the plane. Determine the motion of the particle.
- (4). (15 %) A stick of length L is fixed at an angle θ from its x -axis in its own rest system K . What is the length and orientation of the stick as measured by an observer moving along x -axis with speed $0.8c$, where c is the speed of light.
- (5). (15 %) Find the moment of inertia of a sphere about an axis through its center. The radius of the sphere is R , and the homogeneous density is ρ .
- (6) (20 %) (a) Find the moment of inertia of a thin homogeneous bar of length L with respect to an axis perpendicular to the bar.
- (b) A homogeneous bar of length L and mass m is supported at the ends by identical springs (spring constant k). The bar is moved at one end by a small displacement a and then released.

Solve the equation of motion and determine the normal frequencies and normal vibrations.



A bar is supported by two identical springs.