1. The moment of inertia of an automotive connecting rod is to be determined experimentally. First, the rod is suspended horizontally from a cord at point A and a scale at point B. The force at B is measured and used to determine the location of the center of mass, G. Then the support at point A is released, and the force at B is measured as the rod begins to swing down. From the force at B, and the location of G, the moment of inertia of the connecting rod about G can be found. The mass of the connecting rod is 5 kg.

a) Find the location of G if, in the equilibrium position, the force on point B is 15 N.

b) Find the moment of inertia of the rod about G if, immediately after the cord at A is released, the force at B is 10 N.

2. The circular disk of mass \( m \) and radius \( r \) is mounted on a vertical shaft with a small angle \( \alpha \) between its plane (the \( x'-y \) plane) and the plane of rotation of the shaft (the \( x-y \) plane).

a) What is the kinetic energy of the disk?

b) Determine the expression for the bending moment acting on the shaft due to the wobble of the disk at a shaft speed of \( \omega \) rad/sec.
3. The fire truck is moving forward at a rate of 35 mi/hr and decelerating at 10 ft/sec². Simultaneously the ladder is being raised and extended. At the instant considered the angle \( \theta \) is 30 degrees and is increasing at the rate of 10 deg/sec. Also at this instant, the extension \( b = 5 \) ft, the rate of extension \( \frac{db}{dt} = 2 \) ft/sec, and \( \frac{d^2b}{dt^2} = -1 \) ft/sec².

What is the acceleration of point A relative to the ground?

4. The uniform slender bar weighs 60 lb and is released from rest in the vertical position shown, where the spring of stiffness 10 lb/ft is unstretched. The bar falls to a horizontal position as shown below. Calculate the velocity with which end A strikes the surface.

![Diagram of slender bar](image)

**Table of mass moments of inertia**

- Slender rod: \( I_x = \frac{1}{3} ml^2 \)
- Thin rectangular plate: \( I_x = \frac{1}{12} m(b^2 + c^2), I_y = \frac{1}{12} mc^2, I_z = \frac{1}{12} mb^2 \)
- Rectangular prism: \( I_x = \frac{1}{12} m(b^2 + c^2), I_y = \frac{1}{12} m(c^2 + a^2), I_z = \frac{1}{12} m(a^2 + b^2) \)
- Thin disk: \( I_x = \frac{1}{2} mr^2, I_y = I_z = \frac{1}{4} m r^2 \)