ME 230 - Dynamics
Tutorial 3

Your Name:_____
Section No.:_____

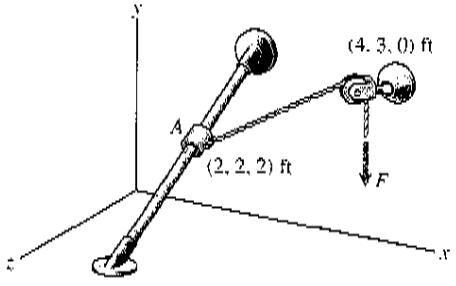
Partners:_____ _____ _____
_____ _____ _____

Newton's 2nd Law

This tutorial will examine methods of using Newton's Second Law in solving kinetics and kinematics problems..

1) The acceleration of the 20-lb collar A is $2\bar{i} + 3\bar{j} - 3\bar{k}$ ft/sec^2. What is the magnitude of the force $\bar{F}$?

The acceleration of the 20-lb collar A is $2\mathbf{i} + 3\mathbf{j} - 3\mathbf{k}$ (ft/s^2). The bar is smooth. What is the force F?

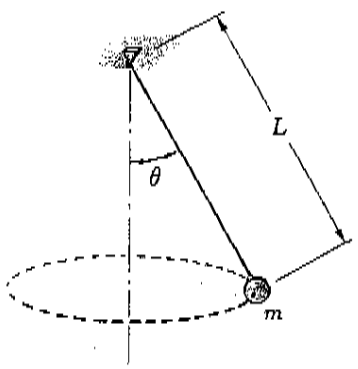


i. Draw a FBD of the collar, showing the vector forces acting on it.

ii. Symbolically describe the solution to this problem by using Newton's Second Law, $\sum \bar{F} = m\bar{a}$. (That is, write the relevant forces, mass, and acceleration in symbolic vector form.) Hint: dot products and unit vectors may be useful here, because you need to resolve the forces and acceleration in a direction parallel to the bar.

iii. Solve for the magnitude of $\bar{F}$.

2) A 4 lb ball revolves in a horizontal circle as shown. Knowing that L=3 ft. and that the maximum allowable tension in the cord is 10 lb, find a) the maximum allowable speed, and b) the corresponding angle of θ. (Hint: solve using normal and tangential components.)



i. Draw a FBD of the ball. It is suggested that you show a "side" view, with the origin of a Cartesian reference frame at the center of the ball.

ii. Ask yourself: What is the tangential acceleration in this case? Why?

iii. Is there a normal acceleration component? Normal acceleration $a_n = \frac{v^2}{p}$. Write an expression for a_n.

iv. Using Newton's Second Law, solve for the maximum allowable speed, v, and for the corresponding angle, θ.