A bar is attached to a spring at pt O. The spring is constrained to deform purely in verical (y) direction. The bar has mass m and mass moment of inerita about its center of gravtiy of I^G $=1/12mL^2$. The coordinate y denotes the absolute position of the roller and θ the angular position of the bar.
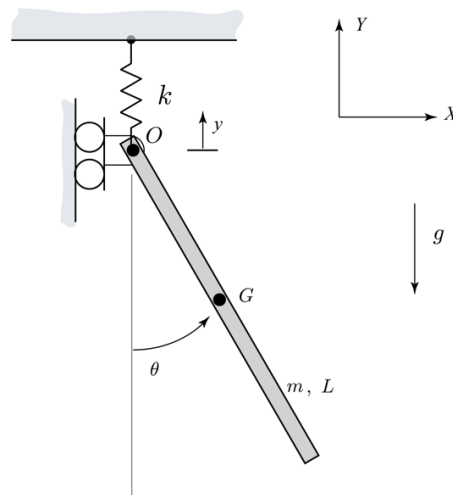
a) Draw a FBD of the system. How many and what are the degrees-of-freedom for the system?

b) Write the Newton-Euler Equations of the system. Are these equations in terms of the degrees-of-freedom from part a)?

c) If needed write down any additional kinematic relationships needed to solve the problem and introduce the degrees of freedom from part a).

d) Write the final equation(s) of motion for the system.