Vibrations - 1

Consider the pendulum mechanism of figure, which is pivoted at point O. Assume that the mass of the rod, spring, and damper are negligible and that $F(t) = F_0\cos(t)$.

a) (**20 pts**) Draw the free body diagram. Assume small angles. Show all elements clearly.

b) (**20 pts**) Derive the equation of motion. Assume small angles. Show all your work.

c) (**20 pts**) Calculate the damped and undamped natural frequency of the system. Leave your answer in terms of symbols (i.e., don't use the numbers).

d) (**20 pts**) What driving frequency will cause resonance?

e) (**20 pts**) Sketch the time response (θ (t) vs t) for this system for several periods (no numbers just the form of the response) assuming that the damping is zero. θ (t) is the angular response of the pendulum to F(t).