Simple Harmonic Oscillation

Math 230

1. Suppose that a force of 200 N stretches a spring 5 cm. What is the spring constant?

2. Now suppose that the spring is oriented horizontally, one end is fixed, and the other end is attached to a mass of 2 kg that slides on a frictionless table.

(a) Write a second-order differential equation that describes the motion of the mass.

(b) Convert your second-order differential equation to a first-order system.

(c) If the mass is displaced 10 cm (stretching the spring) and released from rest, what are the initial conditions?

3. Is the function $y(t) = \sin(\beta t)$ a solution to your second-order differential equation above, for some constant β? Can you think of any other solutions?

4. Sketch a vector field (in the yv-plane) corresponding to the first-order system you found above. Then sketch the phase portrait for the system.