PHYS2063 Wave Physics Fall 2017 HW #2 Due 8 Sep 2017

(1) A spring with stiffness k hangs vertically from point on the ceiling. A mass m is attached to the lower end of the spring without stretching it, and then is released from rest. Show that when the gravitational force mg is taken into account, the motion is still sinusoidal with $\omega = (k/m)^{1/2}$ but with an equilibrium position shifted to a lower point. Find the new equilibrium position in terms of m, k, and g.

(2) A mass $m = 2.3$ kg is attached to a spring with stiffness $k = 0.8$ N/m. It starts from a position $x_0 = +1.5$ m away from its equilibrium point, with a velocity $v_0 = -1.35$ m/sec. Using MATHEMATICA, plot the following quantities for exactly three periods of oscillation:

- Position $x(t)$
- Velocity $\dot{x}(t)$
- Acceleration $\ddot{x}(t)$
- Kinetic energy $K \equiv m\dot{x}^2/2$
- Potential energy $U \equiv kx^2/2$
- Total energy $E \equiv K + U$

Start with the expression for $x(t)$ and use MATHEMATICA to calculate the derivatives.