Physics 3344 **Professor Scalise**
Fall 1997 **Assignment #10**

Due: 11 November

1. Suppose that a spring of force constant k has unstretched and uncompressed length ℓ. The spring is suspended vertically and loaded with a mass m.
   (a) Find the equilibrium length of the loaded spring (the length of the spring when the mass is not oscillating).
   (b) Find the natural angular frequency of undamped vertical oscillations.
   (c) Compare with the natural angular frequency of undamped horizontal oscillations of the same spring with the same mass attached, sliding on a frictionless horizontal surface.
2. Show that the solutions $x(t) = A\cos(\omega t) + B\sin(\omega t)$ and $x(t) = D\cos(\omega t + \phi)$ are equivalent by finding equations relating (A and B) to (D and δ) and vice versa.
3. Find, analytically and numerically, the natural angular frequency for a uniform rod of mass 5 kg and length 1 meter pivoted about
   (a) one end
   (b) a point 20 cm from one end
   (c) the middle
4. Marion & Thornton 3-14.
5. Derive Marion & Thornton equations (3.63) and (3.72) by carrying out the differentiations yourself.
6. (a) Marion & Thornton 3-11.
   (b) Plot (not **sketch**) the curves yourself. Pick reasonable values for A, m, β, k, etc.