Physics 3344 **Professor Scalise**
Spring 2000 **Assignment #11**

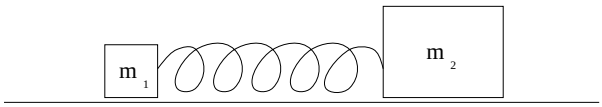
Due: 18 April 2000

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 ϕ) and vice versa.

3. (a) Where should a uniform rod be pivoted so that its natural angular frequency of oscillation is largest?
   (b) What is this maximum natural angular frequency if the rod has length 1 meter?
   (c) Compare this to the natural angular frequency of a 1 meter simple pendulum.

4. (a) Marion & Thornton 3-4.
   (b) Sketch U(t) and T(t) vs. t on the same plot.
   (c) Sketch U(x) and T(x) vs. x on the same plot.

5. Marion & Thornton 3-5.

6. (a) Marion & Thornton 3-6.
   (b) What is the effective mass of the combination? (What single mass attached rigidly to a wall by a spring of the same force constant would have the same frequency of oscillation?)