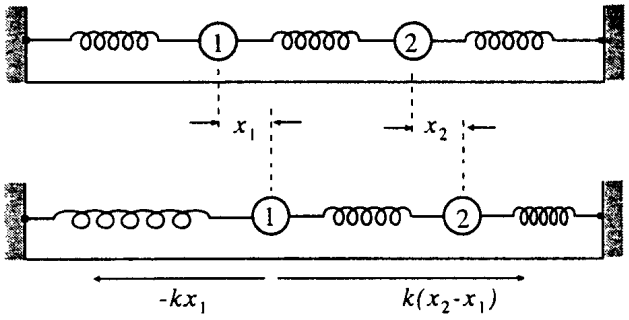
HW# 4 -Phys273-Spring 2003
Due Tuesday, March 11, 2003, by 9.30am

Prof. Melanie Becker
Room 4125, (301)405-1774
melanieb@physics.umd.edu

Problem 1. [*10 points*]

Consider the system of two point particles coupled through springs with equal spring coupling constant of the figure below. Both masses have the same value $m_1 = m_2 = m$ and we consider a one dimensional oscillation about the equilibrium position, where non of the strings are stretched. Suppose (as sketched below, that m_1 is displaced by an amount x_1 and m_2 by an amount x_2.



a) What is the equation of motion of both masses?

b) Suppose both masses oscillate with the same frequency but a different amplitude $x_1(t) = A_1\ cos(\omega t)$ and $x_2(t) = A_2\ cos(\omega t)$. Determine the possible values of the frequency ω.

c) Once you know the value of the frequencies, determine the value of (or more precisely the relation between) A_1 and A_2.

d) How do you interpret this result?

Problem 2. [*10 points*]

The most general solution to problem 1 will have four undetermined constants, which follow from the initial conditions. Making an ansatz

$$\begin{aligned} x_1(t) &= c_1\ cos(\omega_1 t + \phi_1) + c_2\ cos(\omega_2 t + \phi_2) \\ x_2(t) &= -c_1\ cos(\omega_1 t + \phi_1) + c_2\ cos(\omega_2 t + \phi_2), \end{aligned} \tag{1}$$

determine the form of the solution by considering the initial conditions $x_1(0) = 0$, $x_2(0) = a$, $\dot{x}_1(0) = \dot{x}_2(0) = 0$.