Math 450H
Homework I: Due 09/21/04
Prof. Bukiet

1. Measure the spring constant of the indicated spring using several weights and employing the formula (Hooke's Law) $F = -kx$. Is the spring linear? Find a best fit line for the data (Use at least 4 different masses). Give the results in Newtons/meter. For comparison, calculate the spring constant by using the apparatus in the lab to measure the frequency of oscillations (Use at least 2 masses). Discuss any discrepancies in the results.

2. This problem is related to problems 9.3 and 9.4 of the text.

Consider a mass-spring system attached between two walls as in problem 9.3 but with n springs on the left (where k_1 is) and one on the right (where k_2 is). Suppose all springs have the same resting length l and spring constant k. Let d be the distance between the two walls.

(a). Derive the equation governing the dynamics of this system.

(b). What position of the mass is the equilibrium position?

(c). Change variables to modify the equation of part (a) to study how the position of the mass behaves relative to the equilibrium position.

(d). What is the frequency and period of the oscillation?

(e). If the n springs on the left were replaced by just one spring but with different spring constant, what should this spring constant be to have the same frequency as the case of n springs?

(f). If the n springs on the left were replaced by just one spring but with different resting length, what should this length be to have the same frequency as the case of n springs?

Your report should include:

- Text of the problem;
- Description of experimental procedure;
- Experimental results, including units;
- The equations you are solving;
- Discussion of the results.