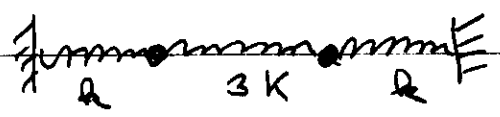


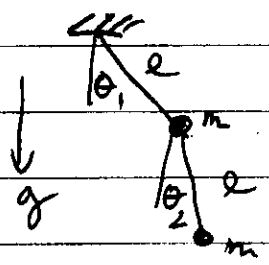
Homework set # 6

1) Consider two particles connected with springs as follows



What are the eigenfrequencies and eigenvectors of the normal modes?

2) A mass m is suspended by a weightless string of length l from another similar system as shown



- a) Write down the Lagrangian for $\theta_1 \ll 1, \theta_2 \ll 1$
- b) Derive the eqs. of motion for this Lagrangian
- c) Solve for the eigenfrequencies

3) Consider a chain of coupled oscillations with

$$L = \frac{m}{2} \sum_k \dot{x}_k^2 - \frac{1}{2} k \sum_{k=0}^{N-1} (x_k - x_{k+1})^2$$

$x_N = x_0$

- a) Obtain equations of motion
- b) Find eigenvalues and eigenvectors using ansatz $x_k(t) = c e^{i\alpha k - i\omega t}$
- c) Use $x_N = x_0$ to obtain quantization of α .

4) Consider two pendulums (both rod length l and mass m) connected by spring with $V = \frac{1}{2} \alpha (\phi_1 - \phi_2)^2$. Find normal mode frequencies and solve them approximately for weak ($\alpha \rightarrow 0$) and strong coupling ($\alpha \rightarrow \infty$)