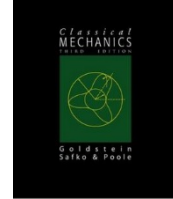Chapter 6. Coupled Oscillations.
*Homework 7*
(Due to May 1, 2018).

7A. (10 pts) Derive the equations of motion governing the free vibrations of the system shown in the figure. Assume the springs and the rigid bar to be massless. Consider only small oscillations.

a)　Write the Lagrangian of the system;
b)　Find the normal mode frequencies;
　　(one of the frequencies is an irrational number. You should round it to get 22k/m)
c)　Find the normal mode eigenvectors and the general solution;
d)　Construct the modal matrix A**;**
e)　Find transformation equations from the old to the normal coordinates;
f)　Write matrix T and matrix V in the normal coordinates.
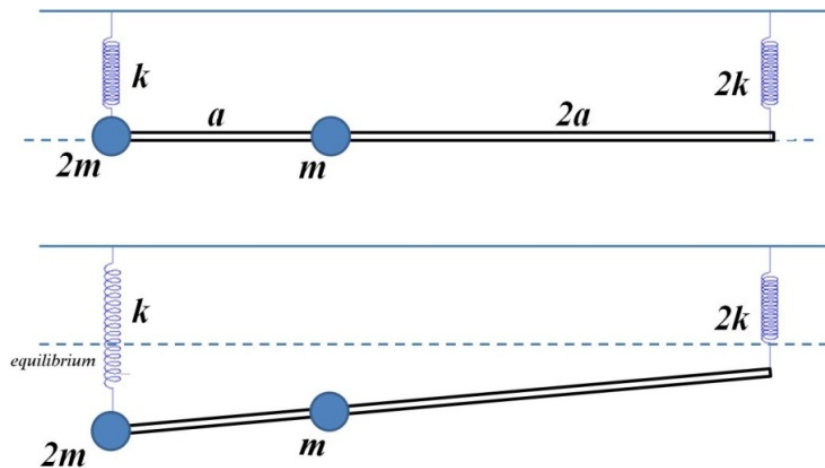
7B. (10 pts) Consider the system of two carts ($m_1 = m_2 = m$) and two springs ($3k, 2k$), which is free to move in a line on a frictionless plane (see the figure). The left end of the spring 3k is attached to a wall.

a) *Write the Lagrangian of the system*
b) *Find the normal mode frequencies*
c) *Find the normal mode eigenvectors and the general solution*
d) *Construct the modal matrix A*
e) *Find the normal coordinates (just write transformation equations).*