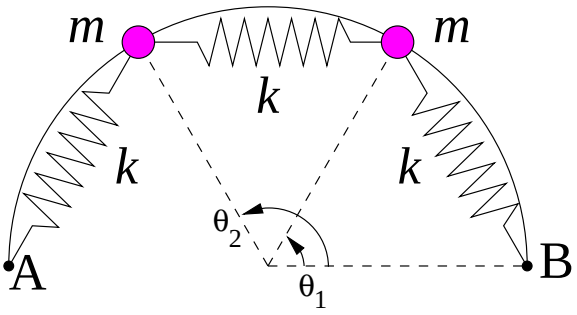
CM

Two equal masses m are attached to each other and to points A, B by identical springs of constant k. The masses are constrained to slide frictionlessly along a semicircle of radius R. Use as co-ordinates the angles θ_1 and θ_2 of the two masses, measured counterclockwise from point B. There is no gravity acting in this problem.



a) Write down the Lagrangian that can be used to study the motion of the masses. In this part of the question *do not make any approximations*. You may assume, however, that the two masses cannot pass through one another.

b) Write down the equations of motion governing small oscillations of the masses about their equilibrium position.

c) Determine the normal modes and frequencies for small oscillations of this system.

d) Now, the right-most mass is moved through a small angle $\delta\theta_1$ and held there. What is the new equilibrium position of the second mass?

e) Assume both masses are stationary in their new positions. At time $t = 0$ the rightmost mass is released and starts to oscillate. Write down the expressions giving the co-ordinates $\theta_1(t)$ and $\theta_2(t)$ of the two masses at subsequent times.