Physics 6321 Professor Olness
Homework 10 Spring 2024

#1) For a simple harmonic oscillator:

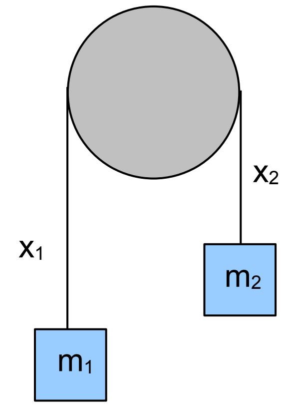
a) Compute the Lagrangian and the Lagrange equations.

b) Compute the Hamiltonian and the Hamilton equations.

#2) For the Atwood machine (with a massless pulley)

a) Compute the Lagrangian and the Lagrange equations.

b) Compute the Hamiltonian and the Hamilton equations.



#3) For a simple harmonic oscillator, using the below F1[q,Q] generating function,

a) compute the relations between [q,p] and [Q,P],

b) compute the transformed Hamiltonian H[q,p] → K[Q,P],

c) compute and solve the equations of motion in [Q,P] space,

d) transform back to find the solution in[q,p] space.

$$F_1 = \frac{m\omega q^2}{2} \cot Q,$$

#4) For a simple harmonic oscillator, using the below F3[p,Q] generating function,

[Note, I created this problem and I think I have the wm factors correct, but check me :]

a) compute the relations between [q,p] and [Q,P],

b) compute the transformed Hamiltonian H[q,p] → K[Q,P],

c) compute and solve the equations of motion in [Q,P] space,

d) transform back to find the solution in[q,p] space.

$$F_3[p,Q] = \frac{-p^2}{2\omega m}\, TanQ$$