Announcements

- Get anything you want graded in soon!
- Homework 6 due Monday
- Read thru Section 5.7 and 5.8 for next CompDay
- Midterm will be handed out on Monday afternoon
- We are a day ahead, so I was going to offer to not have class next Wednesday if that would hope with the issue of new content while you are trying to remember the old content for the Midterm. Thoughts?
- Responses: `rembold-class.ddns.net`

Today's Objectives

- To determine the necessary number of Lagrange Equations
- Establishing the correct number of generalized coordinates
- Identifying special cases when the standard Lagrange Equations may or may not apply

Q1

The kinetic and potential energy of our previous particle are given by:

$$T = \frac{1}{2} m v^2 \left(v^2 \dot{u}^2 + 4 \dot{v}^2 \right) \quad \text{and} \quad U = m g v^2 \sin(u)$$

What would the differential equation from the Lagrangian equation in the u coordinate look like?

A) $\ddot{u} - \dfrac{4\dot{u}\dot{v}}{u} + \dfrac{g\cos(u)}{uv} = 0$

B) $\ddot{u} + \dfrac{4\dot{u}\dot{v}}{v} + \dfrac{g\cos(u)}{v^2} = 0$

C) $\ddot{u} - \dfrac{4\dot{u}\dot{v}}{v} - \dfrac{g\cos(u)}{uv} = 0$

D) $\ddot{u} + \dfrac{4\dot{u}\dot{v}}{u} - \dfrac{g\cos(u)}{v^2} = 0$

Q2

We have seen that the Lagrange Equations and Newton's second law are just different ways of thinking about the same physics. A third method involves determining where the below integral is stationary.

$$\int \mathcal{L}\, dt$$

The integral is called the:

A) Action
B) Trajectory
C) Generalized Momentum
D) Hamiltonian

Q3

Suppose we have a single particle constrained to move along the surface of a sphere (like yourself on the Earth for instance). How many Lagrange equations would be need to describe the motion of that particle?

A) 1

B) 2

C) 3

D) 4

Q4

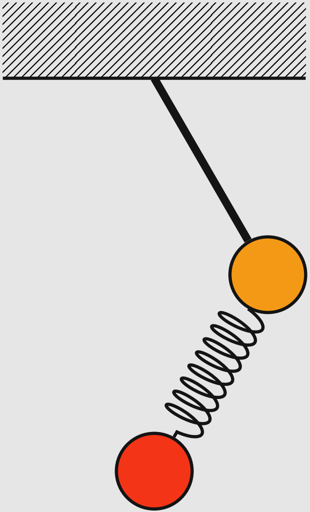
On HW1 you investigate a springy pendulum. Suppose you chained a springy pendulum to a rigid pendulum, as shown to the right. Movement is still only possible in 2D here. What is the minimum number of generalized coordinates necessary to describe the problem?

A) 1

B) 2

C) 3

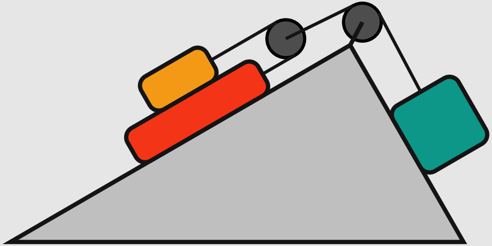
D) 4



Q5

In any earlier polling problem we had a setup that looked like the situation to the right, with 3 moving masses in two dimensions. How many generalized coordinates are needed to completely describe the system?

A) 2
B) 3
C) 4
D) 6



MECHANICS

Q6

You have a problem in which 5 forces are present:

- 2 conservative non-constraining forces
- 2 conservative constraining forces
- 1 non-conservative constraining force

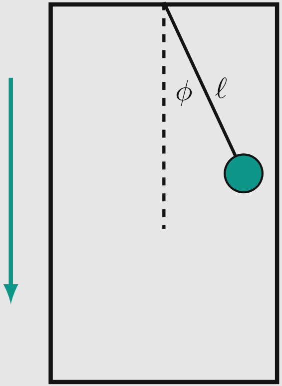
Can you use our standard formulation of the Lagrange Equations to solve for the equations of motion?

A) Yup

B) Nope

C) Uhh, none of the above?

Q7



The box to the left has a pendulum attached to the ceiling. Box and pendulum are dropped in a freefall and we want to describe the resulting motion of the pendulum. What would the expression for the kinetic energy look like?

A) $\frac{1}{2}m\left(\ell^2\dot{\phi}^2\right)$

B) $\frac{1}{2}m\left(\ell^2\dot{\phi}^2 - \frac{1}{2}gt^2\right)$

C) $\frac{1}{2}m\left(\ell^2\dot{\phi}^2 + g^2t^2 - 2gt\ell\dot{\phi}\sin(\phi)\right)$

D) $\frac{1}{2}m\left(\ell^2\dot{\phi}^2 - g^2t^2 - 2gt\ell\dot{\phi}\cos(\phi)\right)$