

**PHYS 306: HOMEWORK ASSIGNMENT No. 1: LAGRANGIANS**

(Jan. 8th, 2016)

**HOMEWORK DUE: FRIDAY, JAN 15th, 2016****To be handed in during class- Late Homework will not be accepted****QUESTION (1)** For the following two problems, find the Lagrangians:

**1(a)** We consider a "double pendulum", in which 2 masses  $M_1$  and  $M_2$  are attached to 2 rigid weightless bars of lengths  $L_1$  and  $L_2$ , which are free to move in a vertical plane (see Fig. 1(a)); the 2 bars pivot without friction at their junction, where mass  $M_1$  is situated. To find the Lagrangian, it helps to use the angular coordinates in the Figure.

**1(b)** We consider a single massless bar of length  $L$ , attached at one end to a circle of radius  $R$ , and at the other end to a mass  $M$  (see Fig 1(b)). The end of the bar attached to the circle can move without friction around the circle. Again, to find the Lagrangian, it will help to use the coordinates in the Figure.

**QUESTION (2)** Here we will find the Lagrangian for the problem, and the equations of motion using Lagrange's equations.

Consider the situation in Fig. 2, where 2 masses are free to move along a line without friction, but for which there is a potential energy  $V(x)$  coupling them, where  $x$  is the distance between the 2 masses. Using either the coordinates  $x_1$  and  $x_2$  in the figure, or any other coordinates of your choice, find the Lagrangian of the system, and then find Lagrange's equations of motion for the 2 masses.

**NB: The Figures are on the following page****END of 1ST HOMEWORK ASSIGNMENT**

FIG 1(a)

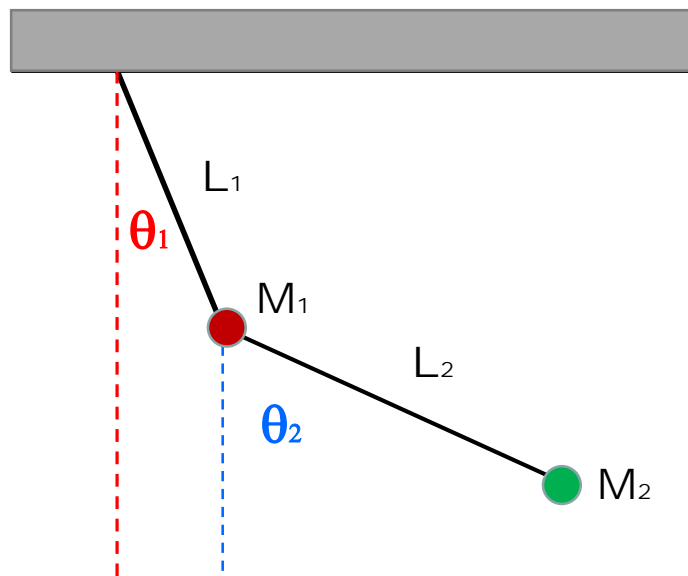


FIG 1(b)

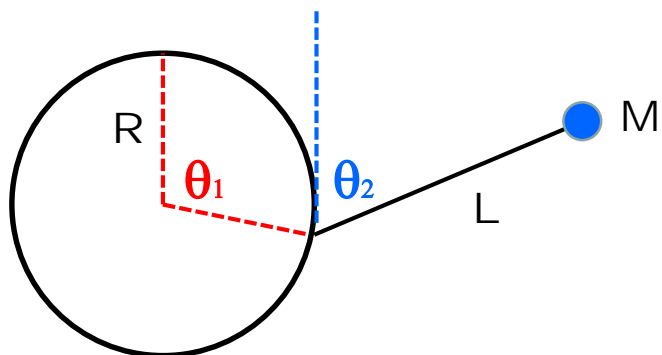


FIG 2

