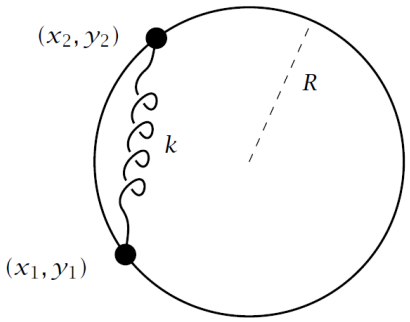
Physics 440, Autumn 2019 **Activity 2: Beads on a hoop connected by a string**

Two beads of mass m are connected by a spring with zero rest length and spring constant *k*. The beads are also confined to move around a circular, frictionless hoop of radius *R*. The beads can freely pass through each other.



Write down the total energy of the system in terms of

a. Cartesian coordinates $(x_1, y_1, \dot{x_1}, \dot{y_1}, x_2, y_2, \dot{x_2}, \dot{y_2})$
b. Polar coordinates $(r_1, \phi_1, \dot{r_1}, \dot{\phi_1}, r_2, \phi_2, \dot{r_2}, \dot{\phi_2})$

Solve this problem for both vertically and a horizontally oriented hoops.