Assignment #1

Reading: Chapter 1 in *Goldstein*.

Problems: Due by the start of class on Monday, 8/26/19.

(1) Two point particles of mass m are joined by a rigid, weightless rod of length ℓ. The center of the rod is constrained to move on a circle of radius a. Define appropriate generalized coordinates for this system and use them to express the system's kinetic energy.

(2) Suppose $x(t)$ is the position of a particle whose Lagrangian is,

$$L = \tfrac{1}{12}m^2\dot{x}^4 + m\dot{x}^2 V(x) - V^2(x) \ .$$

  (a) What is the equation of motion for the particle?

  (b) Provide a simple physical interpretation for this particle.

(3) Consider a point particle whose position is $q(t)$ and whose Lagrangian is,

$$L = \tfrac{1}{2}e^{\gamma t}\left(m\dot{q}^2 - kq^2\right) \ .$$

  (a) What are the Euler-Lagrange equations?

  (b) What would be the physical interpretation of this system in terms of friction?

  (c) What is the general initial value solution of this system?