PHY 711 – Assignment #7

Note: This problem is similar to one posed in the Classical Mechanics text by Goldstein.

9/13/2013

Continue reading Chapter 3 in **Fetter and Walecka**.

1. Consider a Lagrangian function which depends on $\ddot{q}(t)$ in addition to $q(t), \dot{q}(t)$ and t; $L = L(q, \dot{q}, \ddot{q}; t)$.

   (a) Show that the Euler-Lagrange equation for this Lagrangian is:

   $$\frac{d^2}{dt^2}\left(\frac{\partial L}{\partial \ddot{q}}\right) - \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}}\right) + \frac{\partial L}{\partial q} = 0.$$

   (b) Consider the specific Lagrangian given below and find the corresponding equations of motion.

   $$L(q, \dot{q}, \ddot{q}; t) = -\frac{m}{2} q\ddot{q} - \frac{k}{2} q^2.$$