PHY 5246: Theoretical Dynamics, Fall 2011

September 16th, 2011
Assignment # 3
(Graded problems are due Friday September 23rd, 2011)

1   Graded problems

1. A particle slides on the inside surface of a frictionless cone. The cone is fixed with its tip on the ground and its axis vertical. Let the half-angle at the tip be α, let r be the distance from the particle to the axis of the cone, and let θ be the angle around the cone.

   (1.a) Find the equations of motion.
   (1.b) If the particle moves in a circle of radius r_0, what is the frequency, ω, of the motion? If the particle is perturbed slightly from this circular motion, what is the frequency, Ω, of the oscillations about the radius r_0? Under what conditions does $\Omega = \omega$?

2. A block of mass m is held motionless on a frictionless plane of mass M and angle of inclination θ. The plane rests on a frictionless horizontal surface. The block is released. What is the horizontal acceleration of the plane? (Try solving this problem using Newtonian mechanics, i.e. $\mathbf{F} = m\mathbf{a}$. You will have a greater appreciation for the Lagrangian method!)

3. Chapter 2, Problem 5 of your Textbook.

4. Chapter 2, Problem 19 of your Textbook.

2   Non-graded suggested problems

5. Chapter 2, Problem 6 of your Textbook.

6. Chapter 2, Problem 22 of your Textbook.