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 $\alpha$, let $r$ be the distance from the particle to the axis of the cone, and let $\theta$ 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, $\omega$, of the motion? If the particle is perturbed slightly from this circular motion, what is the frequency, $\Omega$, 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 $\theta$. 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. $F = ma$. You will have a greater appreciation for the Lagrangian method!)

3. Chapter 2, Problem 5 of your Textbook.


2 Non-graded suggested problems

5. Chapter 2, Problem 6 of your Textbook.