

PHY 5246: Theoretical Dynamics, Fall 2011

September 9th, 2011

Assignment # 2

(Graded problems are due Friday September 16th, 2011)

1 Graded problems

1. A bead of mass m slides without friction in a uniform gravitational field on a vertical circular hoop of radius R . The hoop is constrained to rotate at a fixed angular velocity ω about its vertical diameter. Let θ be the position of the bead on the hoop measured from the lowest point.
 - (1.a) Write down the Lagrangian $L(\theta, \dot{\theta})$.
 - (1.b) Find how the equilibrium values of θ depends on ω . Which are stable, which unstable?
 - (1.c) Find the frequencies of small oscillations about the stable equilibrium positions. Say something concerning the motion about the only stable equilibrium point when $\omega = \sqrt{g/R}$.
2. Consider a stretchable plane pendulum, that is, a mass m suspended from a spring of spring constant k and unstretched length l , constrained to move in a vertical plane. Write down the Lagrangian and obtain the Euler-Lagrange equations.
3. Chapter 1, Problem 14 of your Textbook.
4. Chapter 1, Problem 21 of your Textbook.

2 Non-graded suggested problems

5. Chapter 1, Problem 15 of your Textbook.
6. Chapter 1, Problem 18 of your Textbook.
7. Chapter 1, Problem 22 of your Textbook.