

Physics 105, Spring 2021, Reinsch, **Homework Assignment 10**  
Due Thursday, April 22, 11:59 pm

Problem 1

Read this inspirational document (Note the references to the Hamiltonian point of view in Sec. 5.)

[http://bohr.physics.berkeley.edu/reinsch/phys105spr2015/files/Witten\\_Atiyah.pdf](http://bohr.physics.berkeley.edu/reinsch/phys105spr2015/files/Witten_Atiyah.pdf)

Then dive into this Homework assignment on the Hamiltonian formulation of Mechanics by solving Taylor, Problem 13.7

Problem 2

Study parts (a) and (b) of Problem 2, Midterm 1, and the solutions posted on bCourses. Calculate the Hamiltonian as a function of coordinates and momenta. Write out Hamilton's Equations, and show that we have agreement with the results in part (b).

Problem 3

- (a) For the Lagrangian in Eq. (7.61) calculate the generalized momenta.
- (b) Calculate the Hamiltonian as a function of the coordinates and momenta. Is the Hamiltonian equal to  $T + U$ ? Is the Hamiltonian conserved?
- (c) Write out all four of Hamilton's equations of motion.
- (d) By differentiating, you can get second-order differential equations that make reference only to the coordinates. Show that these agree with the Lagrangian results given on page 260.

#### Problem 4

- (a) For the Lagrangian in Eq. (7.68) calculate the generalized momentum.
- (b) Calculate the Hamiltonian as a function of the coordinate and momentum. Is the Hamiltonian equal to  $T + U$ ? Is the Hamiltonian conserved? Explain.
- (c) Write out Hamilton's equations of motion.
- (d) For the oscillations with the frequency given in Eq. (7.80), write the coordinate and momentum as functions of time. [Your answer will involve an arbitrary amplitude and phase as in Eq. (7.75).] Verify that these equations satisfy the differential equations you worked out in part (c), to the appropriate order.

#### Problem 5

Taylor, Problem 13.14

#### Problem 6

Taylor, Problem 13.23