COT6602 Quantum Information Theory
Fall 2019

Homework 3

Due: will be posted on Webcourses

Type up your solutions using a computer. Do not turn in handwritten notes.

Problem 1 (Hamilton's equations/Poisson bracket)

Hamilton's equations can be written in the form

$$\dot{q} = \{q, H\}$$
$$\dot{p} = \{p, H\}$$

Assume that the Hamiltonian has the form

$$H = \frac{1}{2m}p^2 + V(q)$$

Using the Poisson bracket axioms, prove Newton's equations of motion.

Problem 2 (Symmetry/Poisson bracket)

Taking a Poisson bracket with a conserved quantity gives the transformation behavior of the coordinates under a symmetry – the symmetry related to the conservation law.

Consider a system of two particles moving a long the x-axis with Hamiltonian

$$H = \frac{1}{2}(\dot{x}_1^2 + \dot{x}_2^2) + V(x_1 - x_2)$$

Determine a symmetry and the corresponding conserved quantity. Compute the Poisson brackets with the conserved quantity and show that these reveal the symmetry.