COT6602 Quantum Information Theory
Fall 2019

Homework 1

Out: Wed 10/01

Due: will be posted on Webcourses

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

Problem 1 (Simple pendulum)

A simple pendulum consists of a massless rod of length ℓ with a bob of mass m. The rod is suspended from the origin O and moves without any friction. The entire motion is restricted in the xy plane. The y axis points downward. Let ϕ denote the angle between the rod and the y axis.

Write down the Lagrangian $\mathcal{L}(\phi, \dot{\phi})$ and solve the Euler-Lagrange equation to determine the motion of the simple pendulum. Use https://www.glowscript.org/ to visualize the motion of the simple pendulum.

There are several examples on this web page that will help you get started.

Problem 2 (Brachistochrone)

The brachistochrone problem is a famous problem in the calculus of variation: given two points 1 and 2, which 1 higher above the ground, in what shape should we build the track for a frictionless roller coaster so that a car released from point 1 will reach point 2 in the shortest possible time. We cover this problem in class.

Use `https://www.glowscript.org/` simulate how the roller coaster moves along the track. (The roller coaster can be visualized a simple blob.)