Physics 6303 | Homework Set 5 | September 26, 2018

Due: Wednesday, October 2, 2018

1. Prove that the solutions to Laplace's equation are unique provided the potential is specified on the boundary.

2. Prove that the eigenvalues of the Sturm-Liouville differential equation are real.

3. Reconsider the problem of the hollow conducting sphere of radius $R$ that is divided into two halves, with the top half held at potential $V_o$ and the bottom half grounded. Determine the potential outside the sphere. (HINT: We solved the problem inside the sphere in class.)

4. Suppose a charge distribution is given by $\sigma_o \sin^2\theta$. (a) Determine the charge distribution in terms of Legendre polynomials. (b) What is the advantage of writing the charge distribution in this way?

5. A circular ring having radius $R$ and lying in the x-y plane with its center at the origin carries a uniformly distributed charge $q$. Calculate the electric potential everywhere for $r > R$.

6. A conducting sphere having radius $R$ is separated into two parts that are insulated from one another. The top portion is held at a constant potential $V_o$, whereas the bottom section is grounded (potential = 0). The angle that divides the top portion from the bottom section is $2\alpha$ as shown. Calculate the potential everywhere for $r > R$.