Questions for P435 Lecture Notes 7

1.) What are the physical reasons/motivation for wanting to solve the Laplace equation $\nabla^2 V(\vec{r}) = 0$, or the Poisson equation $\nabla^2 V(\vec{r}) = -\rho(\vec{r})/\varepsilon_o$?

2.) What is the general form of the 1-D solution to Laplaces equation?

3.) Understand/know that the nature of Laplace's equation $\nabla^2 V(\vec{r}) = 0$ is such that it tolerates/allows NO local maxima or minima for $V(\vec{r})$ – all extrema of $V(\vec{r})$ *must* occur at endpoints/boundaries. Why?

4.) What are Dirichlet-type boundary conditions on $V(\vec{r})$?

5.) What are Neumann-type boundary conditions on $V(\vec{r})$?

6.) If there exist two (or more) solutions $V_1(\vec{r}), V_2(\vec{r}), V_3(\vec{r}), \ldots$ of Laplace's equation $\nabla^2 V(\vec{r}) = 0$, each satisfying the bound conditions, are the $V_k(\vec{r})$ different from each other, or are they all the same solution – i.e. does there exist at most one *unique* solution $V(\vec{r}) = V_1(\vec{r}) = V_2(\vec{r}) = V_3(\vec{r}) = \ldots$ to Laplace's equation?

7.) Know/learn the general form of each of the various types of infinite series solutions for Laplace's equation $\nabla^2 V(\vec{r}) = 0$ in 2-D and 3-D using separation of variables techniques for problems having rectangular, cylindrical and spherical symmetry, and learn the general methodology/approach needed to determine the coefficients, using/imposing the boundary conditions, etc.

8.) Please see/read P435 Supplemental Handout # 1 for a primer on basic aspects of orthogonal functions and expansions.

9.) Please see/read P435 Supplemental Handout # 2 where eight more examples of solving Laplace's equation are worked out in detail.