Assignment 4
PHGN361

Homework due Feb. 24

1. Read section 3.1, 3.2, 3.3 of Griffiths.
2. Given point P(-2,6,3) and the vector function $\overrightarrow{\mathbf{A}} = y\hat{x} + (x+z)\hat{y}$,
   (a) express P and $\overrightarrow{\mathbf{A}}$ in cylindrical and spherical coordinates and
   (b) evaluate $\overrightarrow{\mathbf{A}}$ at P in the Cartesian, cylindrical and spherical systems.
3. Something seems wrong with the trig function solutions to Laplace's equation using separation of variables. Explain in words only how you can have extremum only at the boundaries in the example used in lecture (remember that at the boundaries $y = 0$ and $y = b$ the trig function vanished yet the voltage was non-zero in the region between these points).
4. Read the article "An approximate image solution method for the electrostatic quadrupole lens," American Journal of Physics, Volume 58 No 3, pp 257-261 (1990). Explain in words what the authors did, how they did it, and its utility.
5. Explain in words and at most 5 equations how you would solve for the electric field inside a parallel plate capacitor using separation of variables.
6. Explain in words how you would solve problem 3.18. Your explanation should not contain more than 6 equations. I don't want the answer but rather a discussion of how you start from separation of variables, get a solution which doesn't fit the boundary conditions, then how you would resolve this issue, and how you use the orthogonality of the separation of variables solutions to construct the solutions both inside and outside. Finally, knowing the solution for the potential everywhere how would you find the charge density on the surface of the sphere using Gauss's law.
7. 3.13(PMC).