PHYS 621 – HOMEWORK # 7 – DUE FRIDAY, 10/23/2009

Problem 1. An infinite thin flat sheet of conducting material has a circular thin cut of radius a. The part of the conducting sheet inside the cut is kept at constant potential V, while the conducting sheet outside the cut is kept at zero potential.

a) Show that the potential at any point above the sheet is

$$\phi(\rho,\varphi,z) = \int_0^\infty dke^{-kz}\left\{\frac{1}{2}B_0 J_0(k\rho) + \sum_{n=1}^\infty J_n(k\rho)[A_n(k)\sin(n\varphi) + B_n\cos(n\varphi)]\right\},$$

where

$$\left.\begin{matrix} A_n(k) \\ B_n(k) \end{matrix}\right\} = \frac{kV}{\pi}\int_0^a d\rho\rho\int_0^{2\pi} d\varphi J_n(k\rho)\left\{\begin{matrix} \sin(n\varphi) \\ \cos(n\varphi) \end{matrix}\right. .$$

b) Using the limit $\rho \to 0$ of the previous equation, find the potential above the center of the inner part of the conducting sheet.

c) Show that the potential above the cut is

$$\phi(\varphi,z) = Va\int_0^\infty dke^{-kz}J_0(ka)J_1(ka)\,.$$

Problem 2. Jackson problem 4.1

Problem 3. Jackson problem 4.2