CLASSICAL ELECTRODYNAMICS I

Homework Set 4

February 17, 2017

1. (a) Consider the two-dimensional problem in which we want to find the potential $\Phi(x, y)$ in the slit defined by the $x = 0$ and $x = a$ planes. On the $x = 0$ plane, $\Phi(0, y) = 0$, and on the $x = a$ plane, $\Phi(a, y) = V \cdot \exp(-b^2 y^2)$. Express the potential in the slit as a Fourier integral. (Integral tables are permitted for the evaluation of the expansion coefficients.)

   (b) Now suppose that the boundary conditions are the same on both planes; that is, suppose $\Phi(0, y) = \Phi(a, y) = V \cdot \exp(-b^2 y^2)$. Use the results of part (a) to determine the potential $\Phi(x, y)$ in the slit for this case.

2. Find the potential $\Phi(x, y, z)$ in an infinitely deep rectangular well, with sides at $x = 0$, $x = a$, $y = 0$, and $y = b$. The potential is zero on all sides of the well except the bottom side, which lies in the $z = 0$ plane, where the potential satisfies $\Phi(x, y, 0) = V$.