Homework 4, due 3-5

1. Consider a capacitor made of two concentric cylindrical conducting shells with radii a, b ($b > a$). Determine the capacitance in the following two cases

   (a) The region $a < \rho < d$ ($d < b$) is filled with a dielectric (dielectric constant ϵ).

   (b) The region $0 < \phi < \pi$ is filled with a dielectric.

   Here, ρ, ϕ refer to cylindrical coordinates with respect to the axis of the cylinder.

2. In an anisotropic medium we have $D_i = \epsilon_{ij} E_j$ where $\epsilon_{ij} = \epsilon_{ji}$ is the dielectric tensor. Determine the field of a point charge at the origin in an anisotropic medium. (Note: ϵ_{ij} can be diagonalized. This implies that it is sufficient to consider the case $\epsilon_{ij} = \mathrm{diag}(\epsilon_x, \epsilon_y, \epsilon_z)$.)