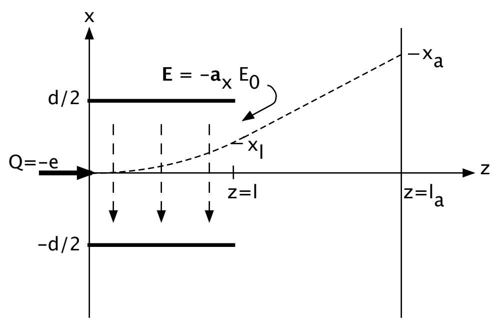
Homework No. 2 – Electrostatics
Engineering Electromagnetics

1. The $z = 0$ plane contains a concentric circular line charge density of 10^{-5} C/m with a radius of 1 m. Determine the electric field at $\vec{E}(0, 0, z)$.

2. Consider the two-dimensional electrostatic deflection system shown below. The upper deflection plate is located at $x = d/2$, $0 \leq z \leq l$, while the lower plate is located at $x = -d/2$, $0 \leq z \leq l$. Assume the electric field is uniform and is given by $\vec{E} = -\hat{a}_x E_0$ only in the region between the two plates. An electron is accelerated by a cathode-accelerating grid arrangement (not shown) and enters the deflection system at the origin with a velocity of $\vec{u} = \hat{a}_z u_0$. Find x_l at $z = l$ and x_a at $z = l_a$.



3. Find the work required to transport an electron from $(1, 1, 1)$ to $(2, 2, 2)$ in the field of
   (a) A point charge of $Q = 10^{-9}$ C at the origin.
   (b) An infinite line charge density $\rho_l = 10^{-9}$ C/m on the z axis.
   (c) An infinite surface charge density $\rho_s = 10^{-9}$ C/m^2 in the $z = 0$ plane.

4. *Derive* the electrostatic potential for a point charge that is *not* located at the origin.

5. *Derive* an expression for $\nabla \frac{1}{|\vec{r} - \vec{r}'|}$ in terms of $\hat{a}_R$ and R.