Reading: Griffiths pages 77-93.

Problem 1  A long coaxial cable (see Fig. 2.26 in Griffiths) carries a uniform \textit{volume} charge density \( \rho \) within the solid inner cylinder of radius \( a \). It also has a uniform \textit{surface} charge density on the outer cylindrical thin shell of radius \( b \). This surface charge density is negative and of just the right magnitude so that the cable as a whole is electrically neutral. Find the electric field in each of the three regions:
(i) inside the inner cylinder \((r < a)\),
(ii) between the cylinders \((a < r < b)\), and
(iii) outside the cable \((r > b)\).

Problem 2  Find the potential \( V(r) \) for Problem 1, for all \( r \). You may choose any (fixed) convenient reference point for your potential.

Problem 3  An infinite plane slab has thickness \( 2d \) and carries a uniform volume charge density \( \rho \). Its surfaces are planes of constant \( y \), namely \( y = d \) and \( y = -d \). Find the electric field as a function of \( y \), both inside and outside of the slab. (Note that \( y = 0 \) is the center of the slab.) Make a graph of \( E_y \) as a function of \( y \).

Problem 4  Find the potential \( V(\mathbf{r}) \) for Problem 3, for all \( \mathbf{r} \). You may choose any convenient reference point for your potential.

Problem 5  In some region of space, the electric potential is given in rectangular coordinates by \( V = k_1 x^2 + k_2 y^2 + k_3 z^2 \), where \( k_1 \), \( k_2 \) and \( k_3 \) are positive constants. What are the electric field and the volume charge density in that region? Where could the reference point for this potential be?