Problem 1

a) Find the electric field a distance z above the centre of a circular loop of radius a, which carries a uniform line charge λ.

b) Find the electric field a distance z above the centre of a flat circular disk of radius a, which carries a uniform surface charge σ.

Check the behaviour in the limiting cases:

i) $a \to \infty$

ii) $z \gg a$

Problem 2

A hollow spherical shell carries charge density

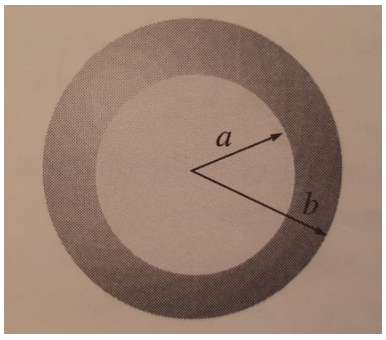
$$\rho(r) = \frac{k}{r^2}$$

in the region $a \leq r \leq b$, as shown in the figure. Find the electric field in three regions:

i) $r < a$

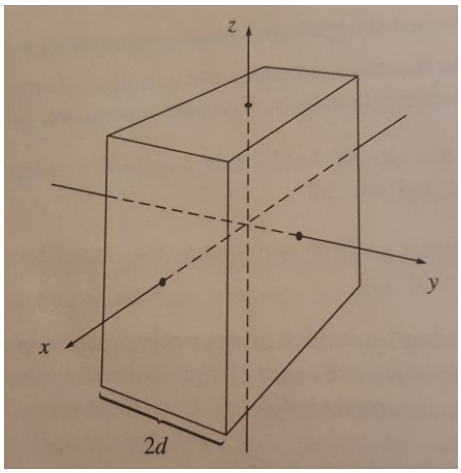
ii) $a < r < b$

iii) $r > b$



Problem 3

An infinite plane slab, of thickness $2d$, carries a uniform volume charge density ρ. Find the electric field, as a function of y, where $y = 0$ at the centre.



Problem 4

A long coaxial cable (see figure) carries a uniform *volume* charge density ρ on the inner cylinder (with radius a), and a uniform *surface* charge density on the outer cylindrical shell (with radius b). The surface charge is negative and its magnitude is chosen to make the cable electrically neutral. Find the electric field in three regions:

i) $\rho < a$

ii) $a < \rho < b$

iii) $\rho > b$