



Infinite Sheet of Charge

As a second example of application of Gauss's theorem, we consider an infinite charged sheet covering the x - z plane as shown in figure 2.5.

Assuming a surface charge density of ρ_s for the infinite surface charge, if we consider a cylindrical volume having sides placed symmetrically as shown in figure 5, we can write:

$$\oint_S \vec{D} \cdot d\vec{s} = 2D\Delta s = \rho_s \Delta s$$

$$\therefore \vec{E} = \frac{\rho_s}{2\epsilon_0} \hat{y}$$

.....(2.17)

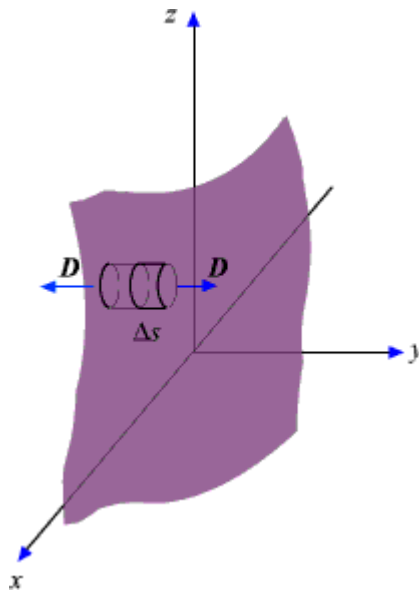


Fig 2.5: Infinite Sheet of Charge

It may be noted that the electric field strength is independent of distance. This is true for the infinite plane of charge; electric lines of force on either side of the charge will be perpendicular to the sheet and extend to infinity as parallel lines. As number of lines of force per unit area gives the strength of the field, the field becomes independent of distance. For a finite charge sheet, the field will be a function of distance.