1- Gauss - law :-

$\Psi = Q_{net} = Q_{total}$

Electric flux ← J

2- Electric flux Density :- $\vec{D}$ c/m^2

$$\vec{D} = \varepsilon_0 \vec{E}$$

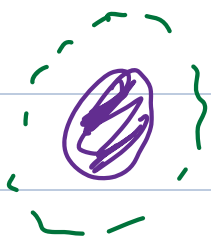
$$\oint \vec{D}\, ds = Q_{net}$$

$$\int_0^{2\pi}\int_0^{\pi} \vec{D}\, r^2 \sin\theta\, d\theta\, d\phi = Q$$

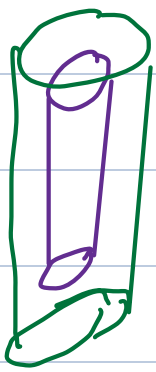
$$\vec{D}\, r^2 \int_0^{2\pi}\int_0^{\pi} \sin\theta\, d\theta\, d\phi = Q$$

$$\vec{D}\, 4\pi r^2 = Q$$

$$\vec{D}\, 2\pi \rho L = P_l$$



$$\vec{D}\, 4\pi r^2 = \rho_v$$



$$\rho\, 2\pi \rho L = \rho_v$$

$$\psi = \oint \vec{D} \cdot \vec{ds} = Q_{net}$$

$$\vec{D}\ 4\pi r^2$$
$$\vec{D}\ 2\pi \rho L$$

$$\nabla \cdot \vec{D} = \rho_v$$ ① Maxwell

3- potential :- $V(r)$ Volt

$$\vec{E} = -\nabla V$$

$$V_{AB} = -\int_A^B E \cdot dL = V_B - V_A$$

special caresе:-

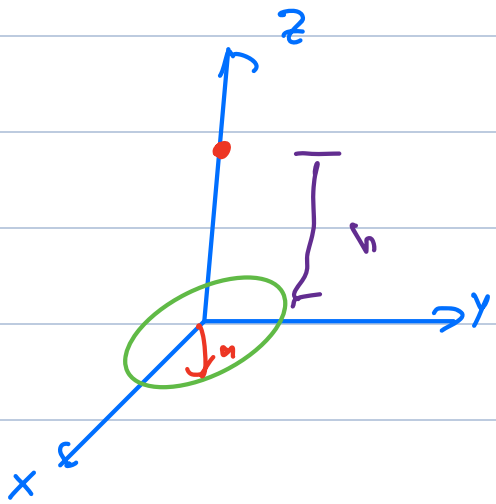
i) $V_{AB} = V_B - V_A = \frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r_B} - \frac{1}{r_A}\right]$ Point charge

ii) $V_{AB} = V_B - V_A = \frac{-\rho_L}{2\pi\varepsilon_0} \ln\frac{\rho_B}{\rho_A}$ line charge

iii) $V_{AB} = V_B - V_A = \frac{-\rho_s}{2\varepsilon_0}\left[z_B - z_A\right]$ sheet charge

✗ potential for ring:-

$$V = \frac{\rho_L \, a}{2\varepsilon_0 \sqrt{a^2 + h^2}}$$



potential for disk :-

$$V = \frac{\rho_s}{2\varepsilon_0}\left[\sqrt{a^2+h^2} - h\right]$$

$$\rho_s = \frac{1}{\rho}$$