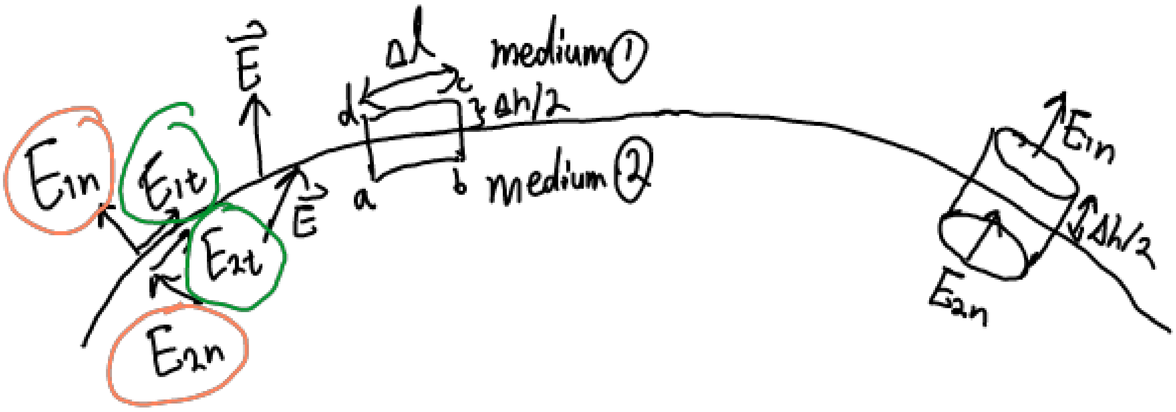
Boundary Conditions

Electrostatic B.C.

= normal
= tangential



$$\oint_{path} \vec{E}\cdot d\vec{l} = 0$$

$$= \int_a^b + \int_b^c + \int_c^d + \int_d^a$$

$$= E_{2t}\Delta l + 0 + (-E_{1t}\Delta l) + 0 = 0$$

$$\boxed{\therefore E_{2t} = E_{1t}}$$

btw
$\vec{D} = \epsilon \vec{E}$

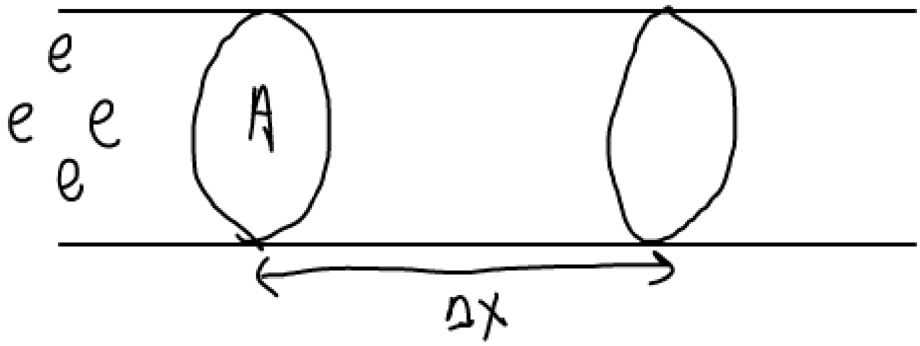
Gauss' Law

$$\int_{\text{closed } S} \vec{E}\cdot d\vec{s} = \frac{Q}{\epsilon_0} \qquad Q = \rho_s A$$

$$\Rightarrow E_{1n}\cancel{A} - E_{2n}\cancel{A} = \frac{\rho_s \cancel{A}}{\epsilon_0}$$

$$\boxed{E_{1n} - E_{2n} = \frac{\rho_s}{\epsilon_0}}$$

The normal components are disconnected by ρ_s/ϵ_0. maybe



$i_e \equiv$ electron current $\frac{1}{sec}$

$N_e =$ # electrons passing through A in Δt.

$V_d = \frac{\Delta x}{\Delta t}$

$n_e \equiv$ # density of e $\left(\frac{\text{electron}}{m^3}\right)$

$$N_e = n_e(\text{Volume}) = n_e A \Delta x = n_e A V_e \Delta t$$

$$N_e = i_e \Delta t \Rightarrow \boxed{i_e = n_e A V_d}$$

$$I = e\, i_e \quad \frac{\text{Coulomb}}{\text{sec}}$$

$$\boxed{J \equiv \frac{I}{A} = \frac{e n_e A V_d}{A} = e n_e V_d}$$

current density

$$\boxed{J = \sigma E}$$