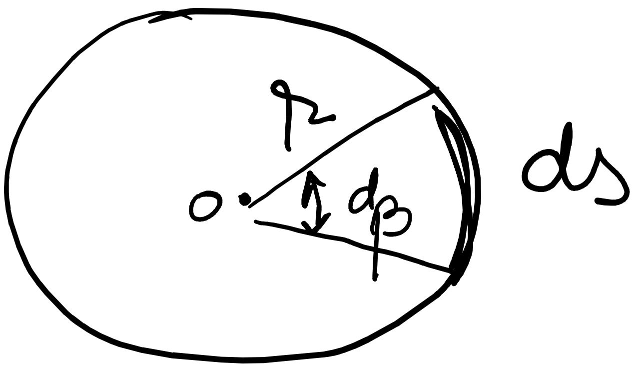
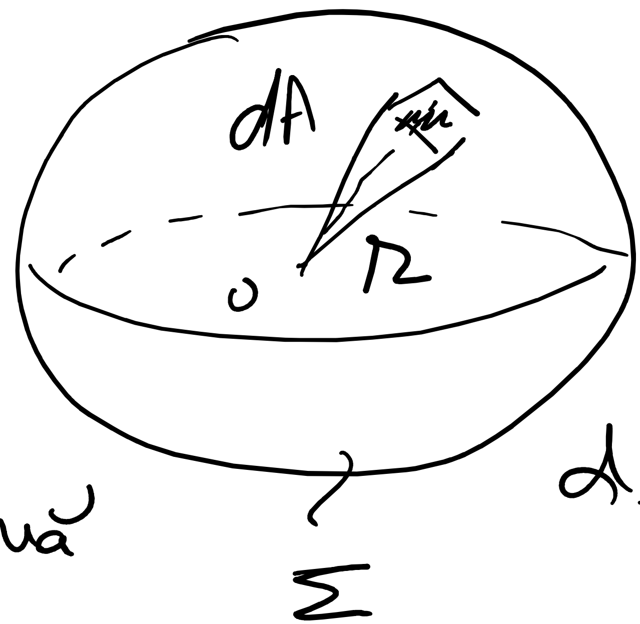
c) unghiul solid



cerc

$$d\beta = \frac{ds}{r} \rightarrow \beta = \frac{2\pi r}{r} = 2\pi$$



sferă

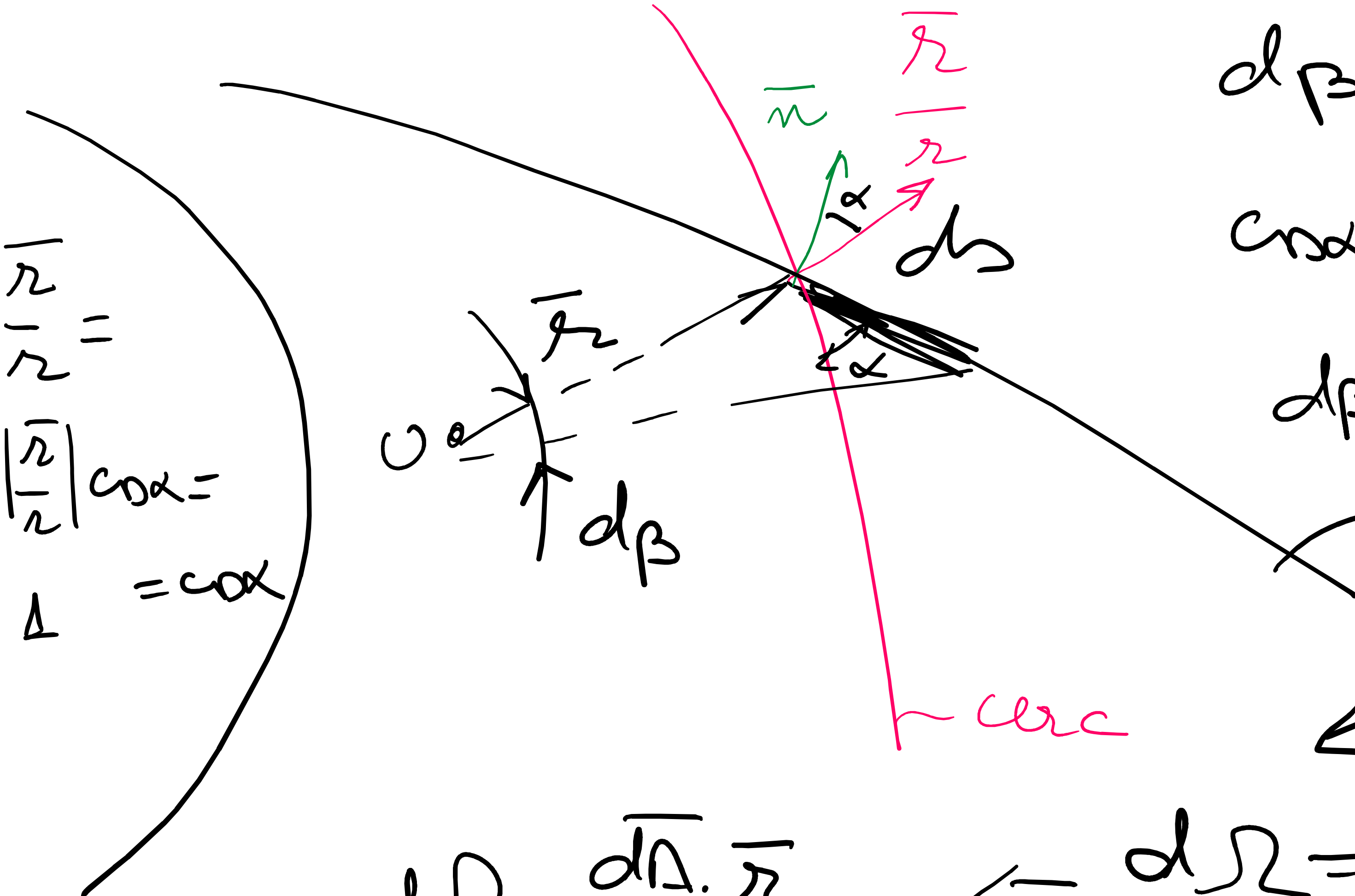
$$\Omega = \frac{4\pi r^2}{r^2} = 4\pi$$

$$d\Omega = \frac{dA}{r^2}$$

$$\bar{n}\,\frac{\bar{r}}{r} =$$

$$|\bar{n}|\left|\frac{\bar{r}}{r}\right|\cos\alpha =$$

$$1 \quad 1 \quad = \cos\alpha$$



$$d\beta = \frac{ds}{r}\cdot\cos\alpha$$

$$\cos\alpha = \bar{n}\,\frac{\bar{r}}{r}$$

$$d\beta = \frac{ds}{r}\cdot\frac{\bar{r}}{r}\,\bar{n}$$

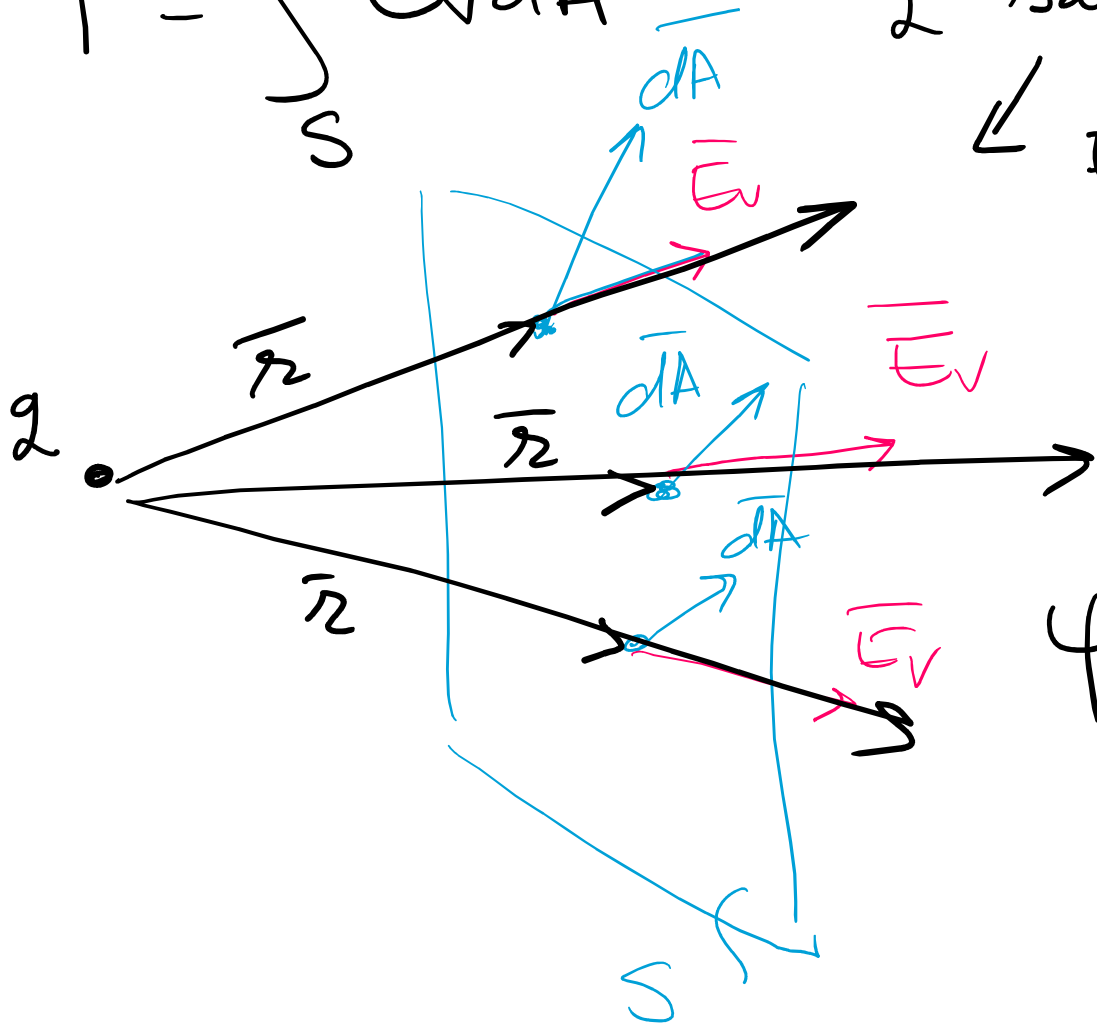
C

$$d\Omega = \frac{dA}{r^2}\,\frac{\bar{r}}{r}\,\bar{n}$$

$$d\Omega = \frac{dA\cdot\bar{r}}{r^3} \Longleftarrow$$

$$\Psi = \int_S \bar{E}_v \, d\bar{A} \rightarrow q \text{ sarcină punctiformă}$$

$$\bar{E}_v = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\cdot\frac{\bar{r}}{r}$$



$$\Psi = \int_S \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\cdot\frac{\bar{r}}{r}\, d\bar{A}$$

$d\Omega$

$$\Psi = \frac{q}{4\pi\varepsilon_0}\int_S d\Omega = \frac{q}{4\pi\varepsilon_0}\Omega$$

$$S \to \Sigma \Rightarrow \Omega = 4\pi$$

(închisă)

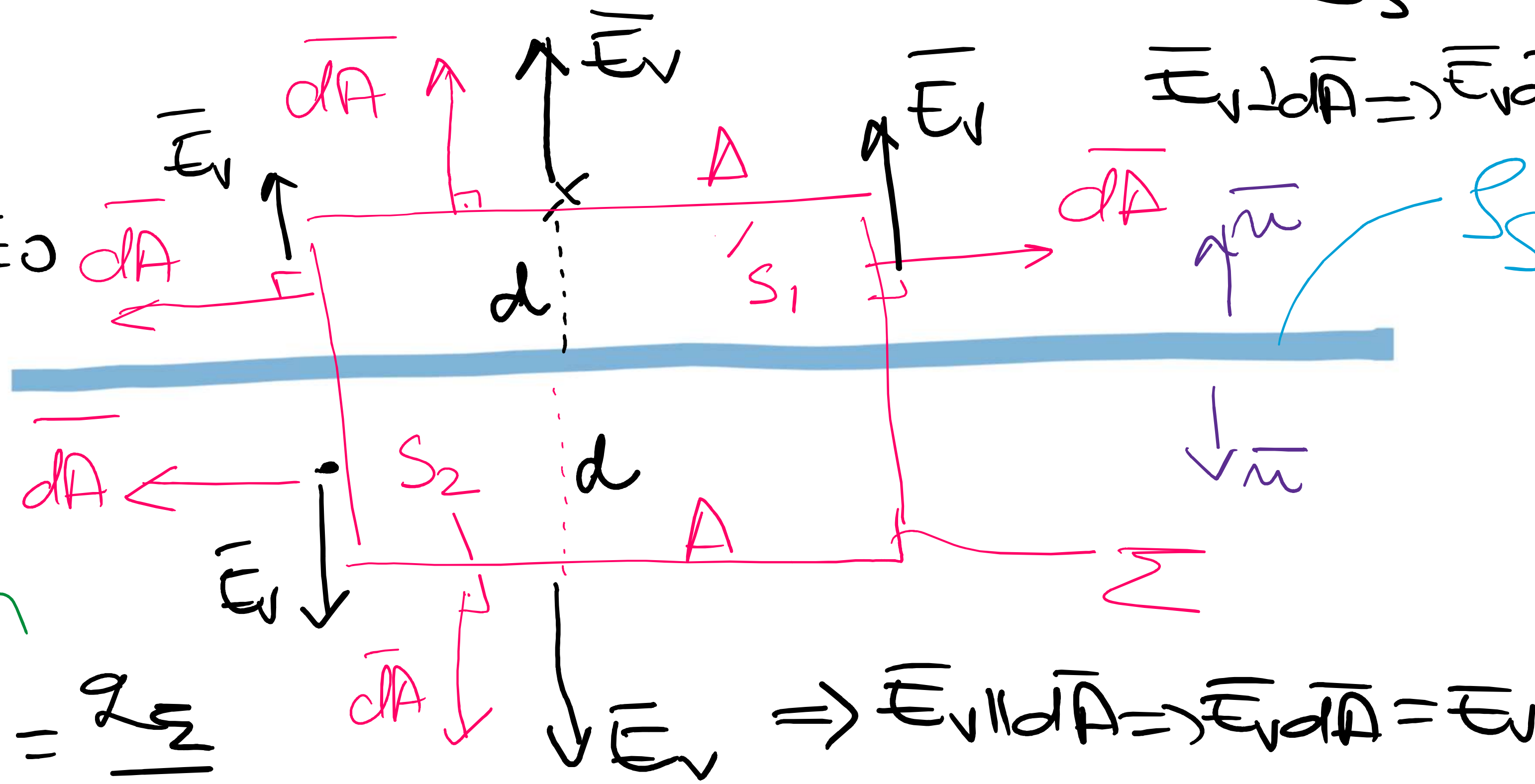
$$\Rightarrow \Psi_\Sigma = \oint_\Sigma \bar{E}\,d\bar{A} = \frac{q_\Sigma}{\varepsilon_0}$$

$$\boxed{\oint_\Sigma \bar{E}\cdot d\bar{A} = \frac{q_\Sigma}{\varepsilon_0}}$$

$\Rightarrow$ probleme cu simetrii

T. Gauss

Ex: Să se determine expresia E_V produsă în vecinătatea unui plan ∞ extins încărcat cu sarcină electrică cu densitatea $\rho_S = ct$



$\overline{E}_V \perp d\overline{A} \Rightarrow \overline{E}_V d\overline{A} = 0$

$\overline{E}_V d\overline{A} = 0$

$$\oint_{\Sigma} \overline{E}_V d\overline{A} = \frac{q_{\Sigma}}{\varepsilon_0}$$

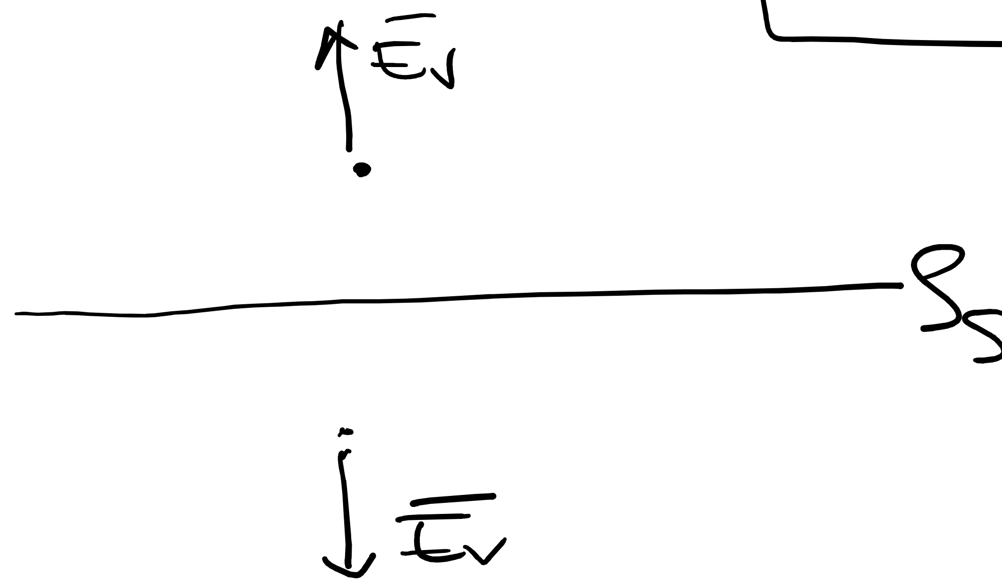
$\Rightarrow \overline{E}_V \parallel d\overline{A} \Rightarrow \overline{E}_V d\overline{A} = E_V dA$

$$\oint_{\Sigma} \bar{E}_v \, d\bar{A} = \int_{S_1} E_v \, dA + \int_{S_2} E_v \, dA = E_v \cdot A + E_v A = 2E_v A$$

$$q_{\Sigma} = \rho_s \cdot A$$

$$\Rightarrow 2E_v \cancel{A} = \frac{\rho_s \cancel{A}}{\varepsilon_0} \Rightarrow E_v = \frac{\rho_s}{2\varepsilon_0}$$

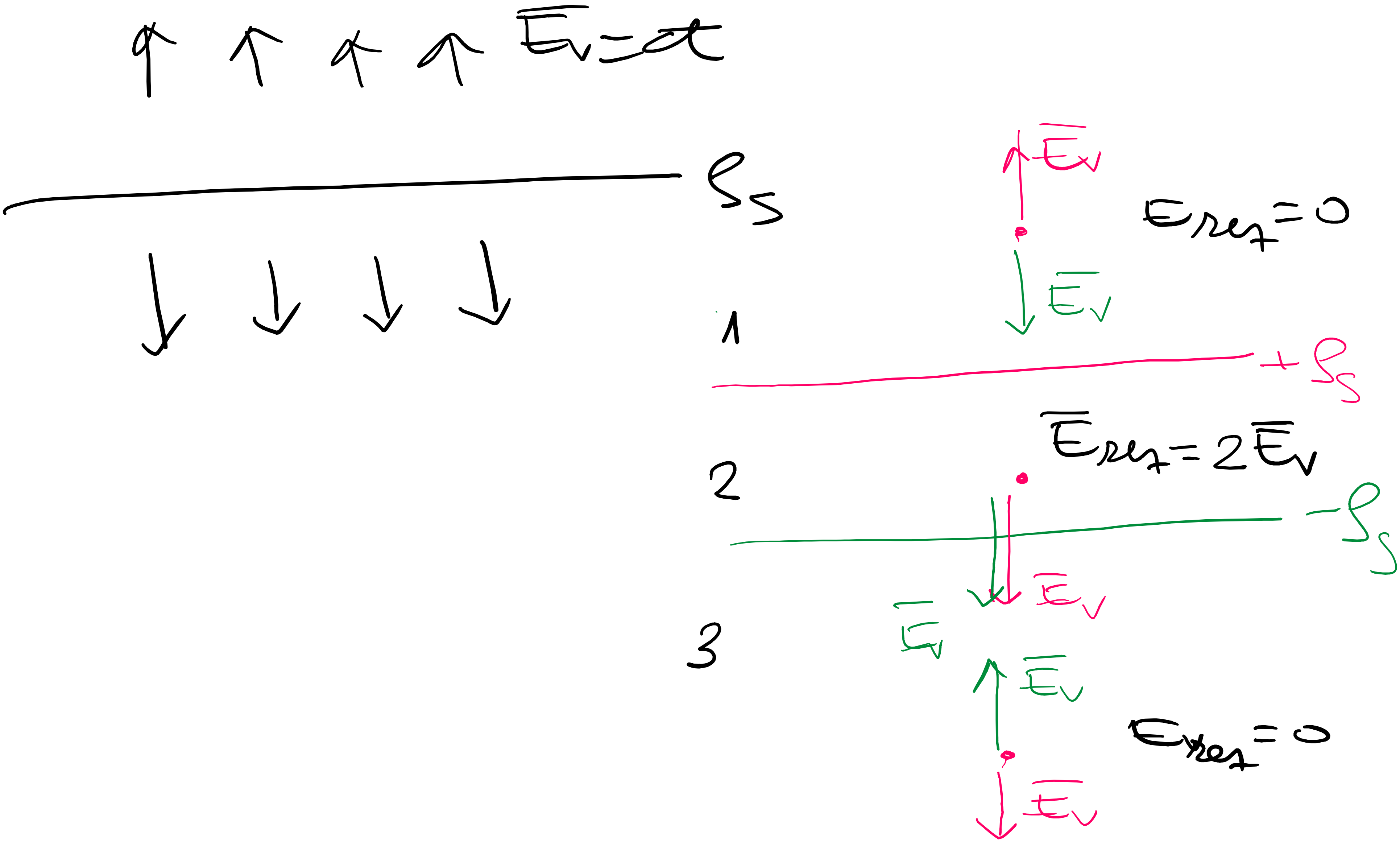
$$\bar{E}_v = \frac{\rho_s}{2\varepsilon_0} \cdot \bar{n}$$



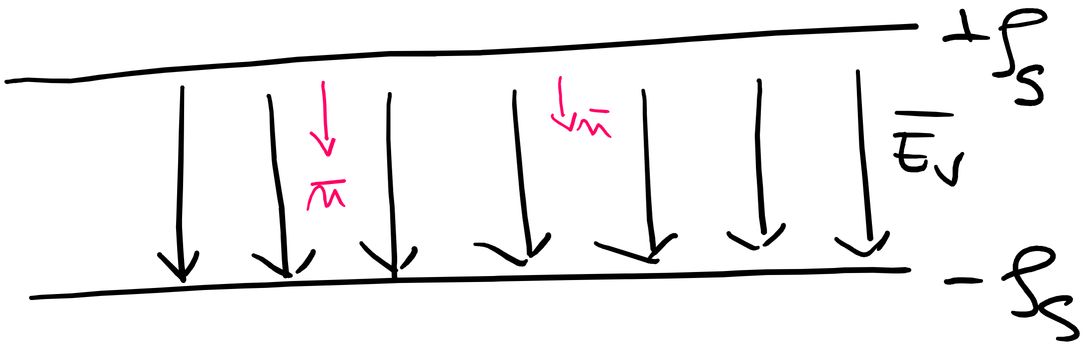
Obs $\bar{E}_v = ct$

$\Downarrow$

câmp uniform!



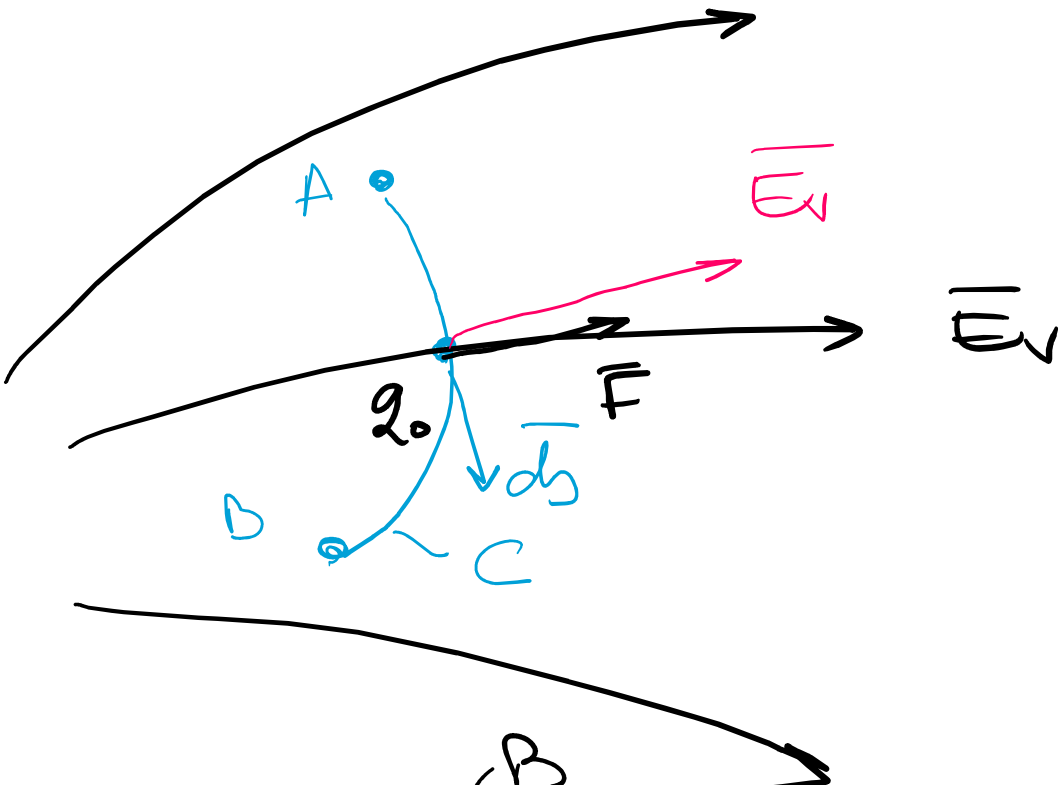
$\vec{E}_v = ct$
ρ_s
1
2
3
$\vec{E}_v$
$E_{rez} = 0$
$+\rho_s$
$\vec{E}_{rez} = 2\vec{E}_v$
$-\rho_s$
$E_{rez} = 0$



$$\underbrace{\bar{E}_v = \frac{\rho_s}{\varepsilon_0}\bar{n}}_{\text{(uniform)}} = ct$$

modelul condensatorului plan ideal

1.4. Tensiune electrică și potențial electric



$$dL = \bar{F}\,d\bar{s}$$

$$L_{AB} = \int_{A\,(c)}^{B} \bar{F}\,d\bar{s} = \int_A^B q_0 \bar{E}_v\,d\bar{s}$$

$$\bar{F} = q_0 \cdot \bar{E}_v$$

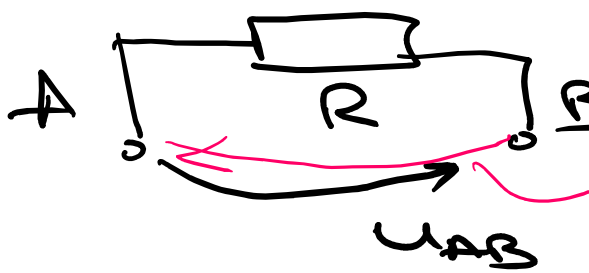
$$L_{AB} = q_0 \cdot \int_A^B \bar{E}_v\,d\bar{s} \Rightarrow U_{AB} \overset{def}{=} \frac{L_{AB}}{q_0}$$

$$\boxed{U_{AB} = \int_A^B \bar{E}_v \, d\bar{s}} \quad [V] \Rightarrow [E_v]_{SI} = \frac{V}{m}$$

<u>Obs</u>

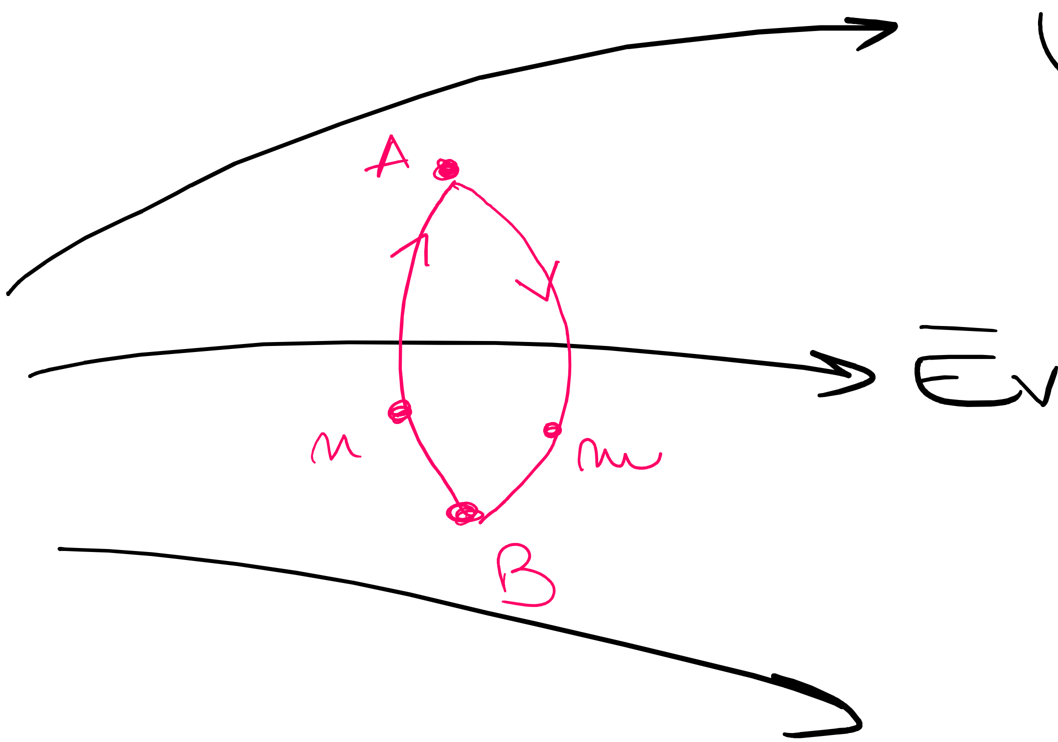
1) $U_{BA} = \int_B^A \bar{E}_v \, d\bar{s} = -U_{AB}$

U - mărime scalară, orientată!



$U_{BA} = -U_{AB}$!

2) $U_{AA} = \int_A^A \bar{E}_v \, d\bar{s} \equiv 0$

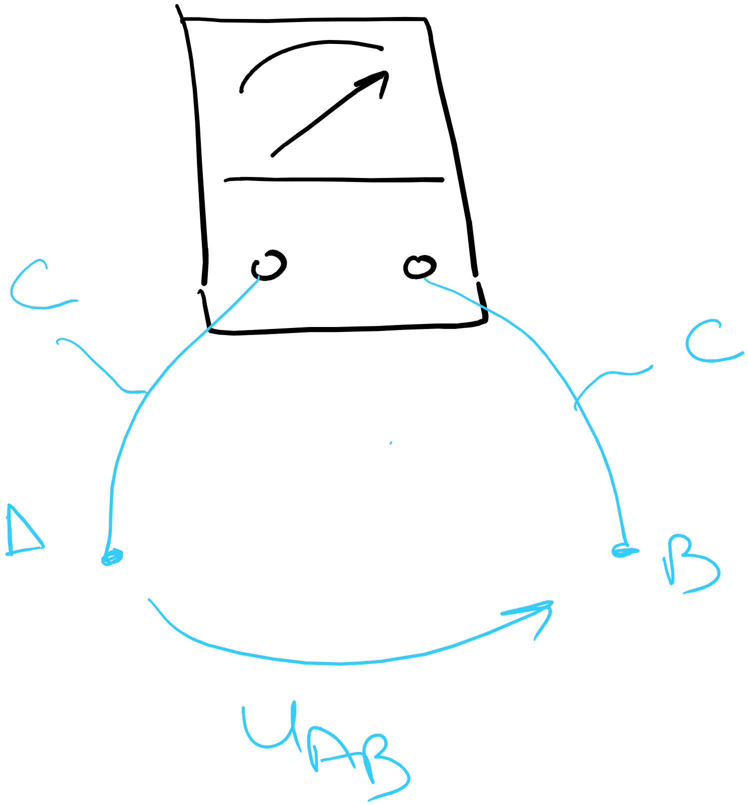


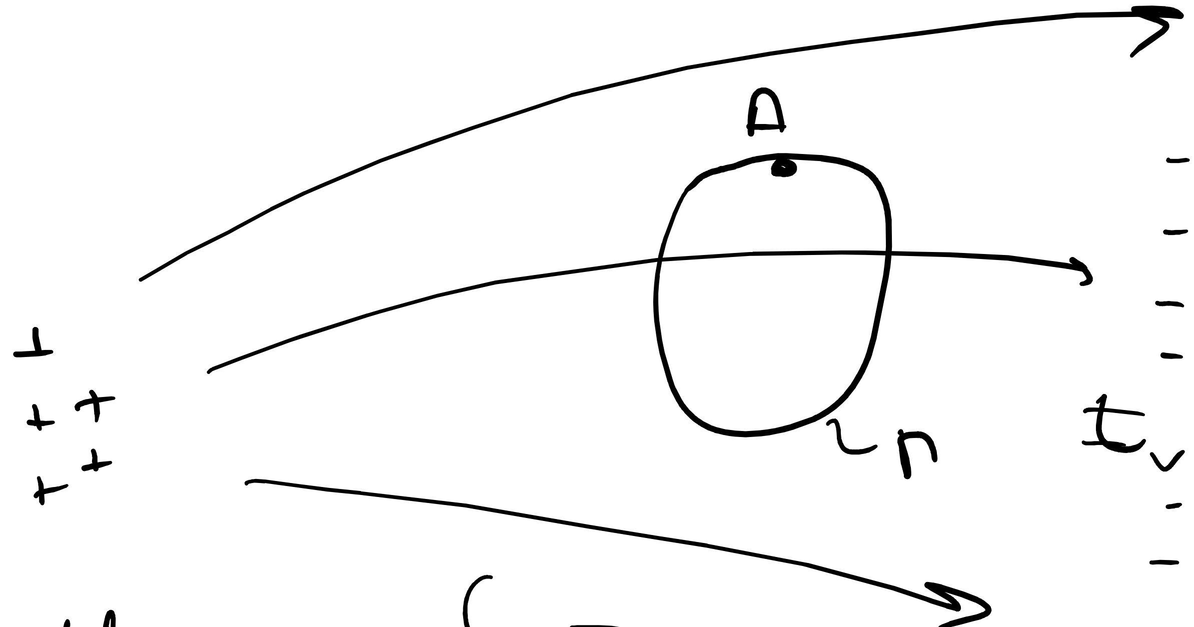
$U_{AA} = U_{AnB} + U_{BmA} = 0$

$\Downarrow$

$U_{AnB} = U_{AmB}$

nu depinde de drumul de integrare!





$U_{AA}=0 \Rightarrow \oint_{\Gamma} \bar{E}_v \, d\bar{s} = 0$

teorema fundamentală a elst.

$\bar{E}_v$ irotațional ←

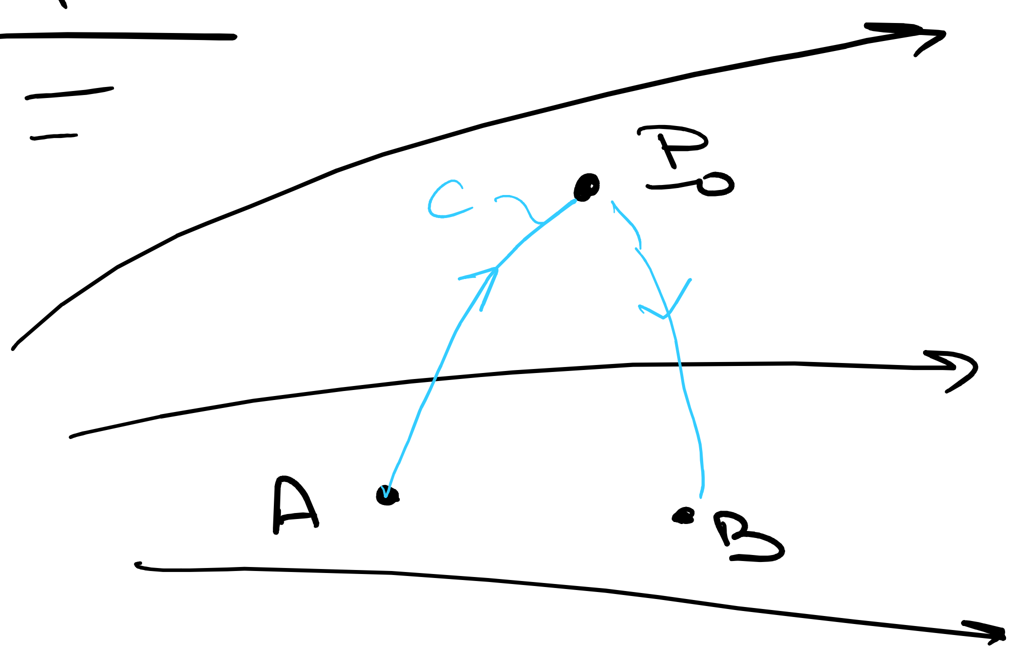
câmp potențial

$\mathrm{rot}\, E_v = 0$

Potențialul electric

⇒ tensiune electrică calculată în raport cu un punct de referință P_0

P_0



$$U_{AP_0} = V_A = \int_A^{P_0} \bar{E}_v \, d\bar{s} \quad [V]$$

$\bar{E}_v$

$$U_{AB} = U_{AP_0} + U_{P_0B}$$

$$\boxed{U_{AB} = V_A - V_B}$$

Obs

1) P_0 → Sarcina electrică → zonă finită în spațiu, at $P_0 \to \infty$ $\quad V_{P_0} = 0$

→ Sarcina electrică → zonă ∞ în spațiu at P_0 - arbitrară

2) Suprafețe echipotențiale

$$V_P = \int_P^{P_0} \underbrace{\bar{E}_v \, \bar{ds}}_{\bar{E}_v \perp \bar{ds}} \Rightarrow V = ct$$

$$dV = -\bar{E}_v \, \bar{ds}$$