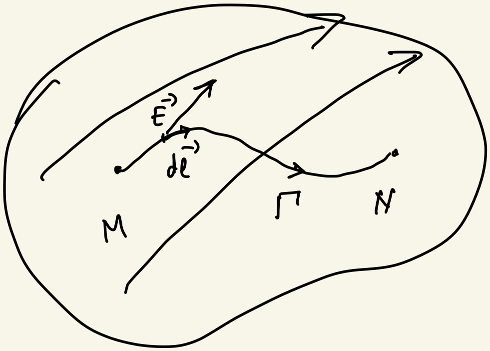
2 Martie 2022

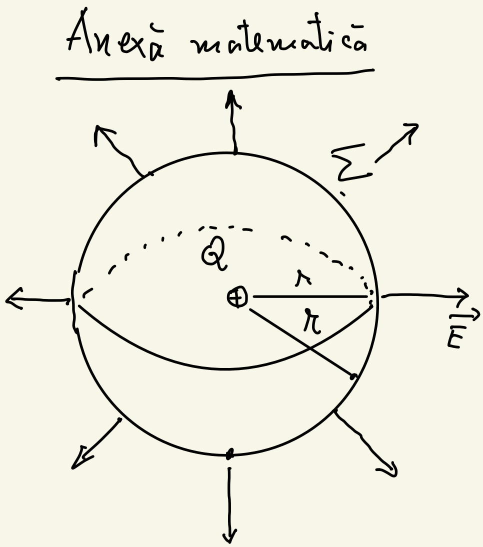


$$U_{MN} = V_M - V_N = \int_\Gamma \vec{E}\cdot d\vec{l}$$

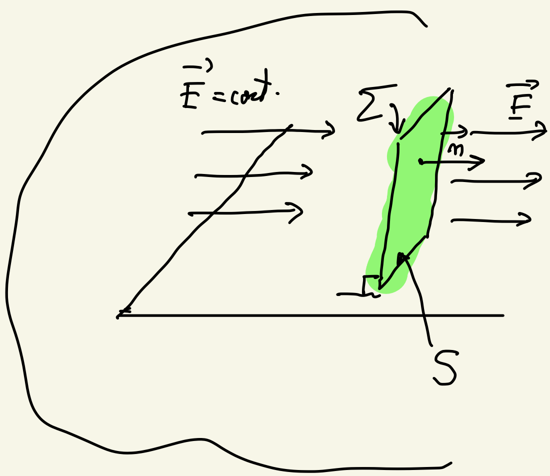
$$\vec{E} = -\operatorname{grad} V$$

$$M \equiv N \Rightarrow \boxed{0 = \oint_\Gamma \vec{E}\, d\vec{l}}$$

Anexă matematică

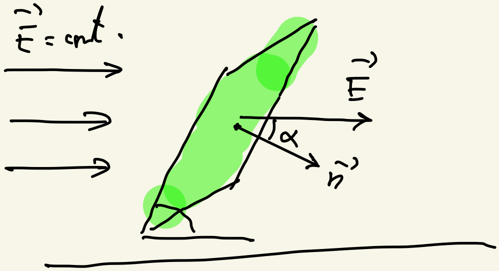


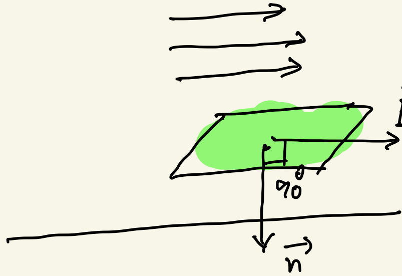
$$\vec{E} = \frac{kQ}{r^3}\vec{r}$$

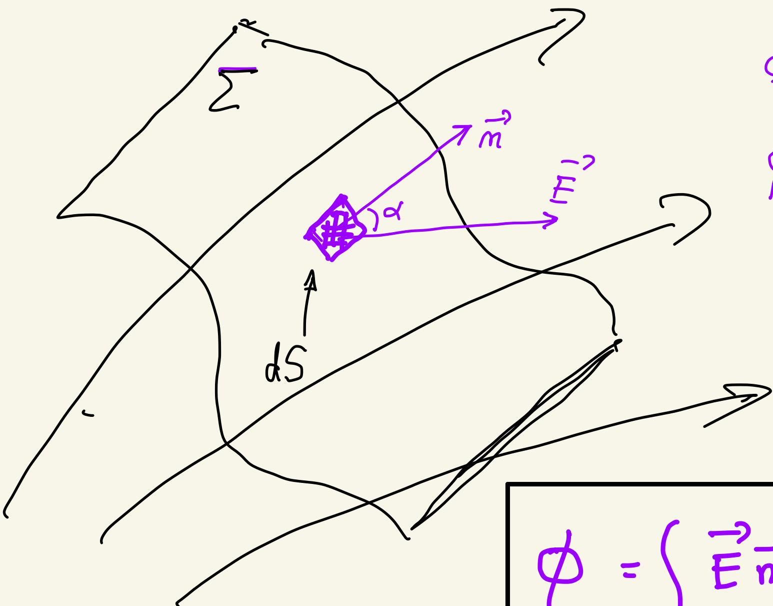


$$\Phi = \vec{E}\cdot\vec{n}\cdot S = |\vec{E}|\cdot|\vec{n}|\, S \cos 0 = ES$$

flux al câmpului electric prin suprafața plană Σ



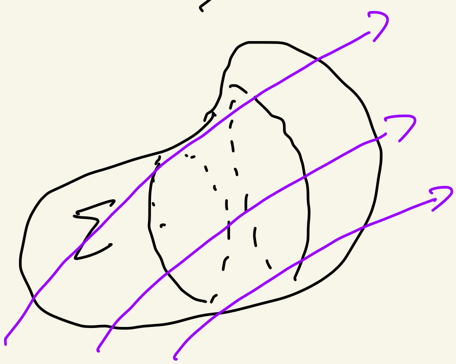




$$d\Phi = \vec{E}\,\vec{n}\,dS$$

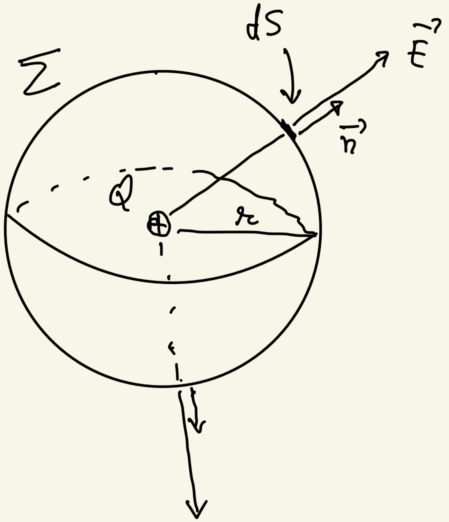
$$\Phi = \int_{\Sigma} d\Phi$$

$$\boxed{\Phi_{\Sigma} = \int_{\Sigma} \vec{E}\,\vec{n}\,dS}$$



$$\Phi_{\Sigma\,\text{închisă}} = \oint_{\Sigma} \vec{E}\,\vec{n}\,dS$$

O suprafață închisă se numește <u>gaussiană</u>.



$$\Phi_\Sigma = \oint_\Sigma \vec{E}\,\vec{n}\,dS =$$

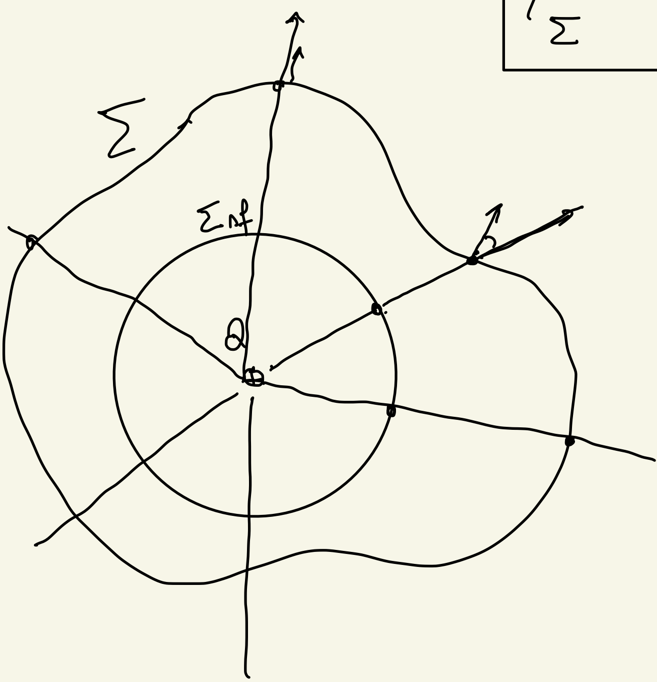
$$= \oint_\Sigma E \cdot 1 \cdot dS = E \oint_\Sigma dS$$

$$= E \cdot A_{sferă} = E \cdot 4\pi r^2$$

$$= \frac{kQ}{r^2} 4\pi r^2 = 4\pi k Q$$

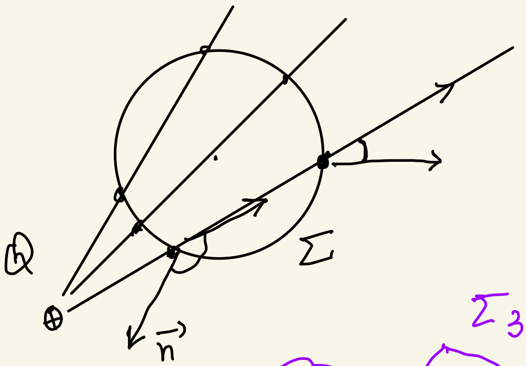
$$= 4\pi \cdot \frac{1}{4\pi\varepsilon_0} Q = \frac{Q}{\varepsilon_0}$$

$$\boxed{\Phi_\Sigma = \frac{Q}{\varepsilon_0}}$$



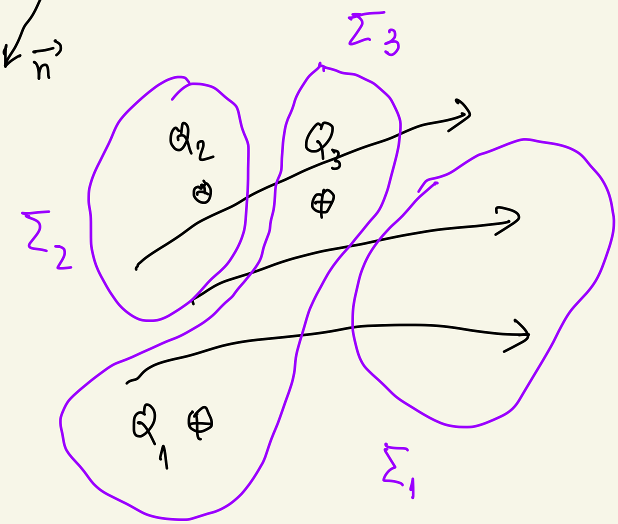
$$\boxed{\Phi_{\Sigma_{sf}} = \Phi_\Sigma}$$ fără demonstrație

$$\Phi_\Sigma = \frac{Q_{int}}{\varepsilon_0}$$



$$\boxed{\Phi_{\Sigma} = \frac{Q_{int}}{\varepsilon_0}}$$

Teorema lui Gauss pentru câmpul electric.



$$\Phi_{\Sigma_1} = 0$$

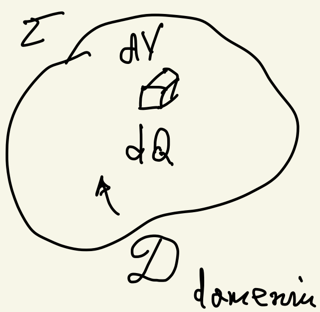
$$\Phi_{\Sigma_2} = \frac{Q_2}{\varepsilon_0}$$

$$\Phi_{\Sigma_3} = \frac{Q_1 + Q_3}{\varepsilon_0}$$

$$\Phi_{\Sigma} = \frac{Q_{int}}{\varepsilon_0} \Rightarrow \oint_{\Sigma} \vec{E}\,\vec{n}\,dS = \frac{Q_{int}}{\varepsilon_0}$$

ρ ← densitate volumică de sarcină

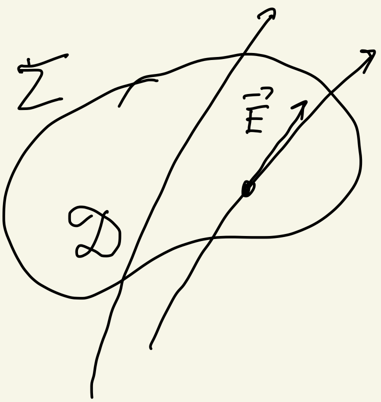
$$\rho = \frac{dQ}{dV} \quad \left(\frac{C}{m^3}\right)$$



$$dQ = \rho\, dV$$

$$\boxed{Q = \int_{D} \rho\, dV}$$

$$\oint_{\Sigma} \vec{E}\,\vec{n}\,dS = \frac{1}{\varepsilon_0}\int_{\mathcal{D}} \rho\, dV \,..$$



$$\boxed{\oint_{\Sigma} \vec{E}\,\vec{n}\,dS = \int_{\mathcal{D}} (\mathrm{div}\,\vec{E})\, dV}$$ Matematică

$$\mathrm{div}\,\vec{E} \overset{def.}{=} \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z}$$

$$E_x, E_y, E_z \;(x,y,z)$$

divergența lui $\vec{E} \longrightarrow \mathrm{div}\,\vec{E}$

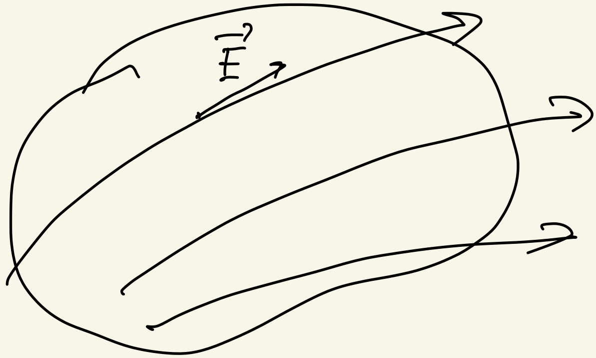
<u>Obs.</u> $\mathrm{grad}\,V \xrightarrow{not} \nabla V$

$$\mathrm{div}\,\vec{E} \xrightarrow{not} \nabla \vec{E}$$

$$\int_{\mathcal{D}} (\mathrm{div}\,\vec{E})\, dV = \frac{1}{\varepsilon_0}\int_{\mathcal{D}} \rho\, dV$$

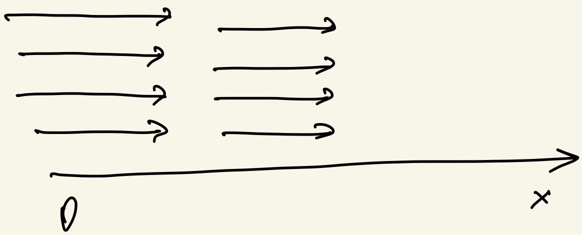
$$\int_{\mathcal{D}} \mathrm{div}\,\vec{E}\, dV - \int_{\mathcal{D}} \frac{\rho}{\varepsilon_0}\, dV = 0$$

$$\int_{\mathcal{D}} \left(\mathrm{div}\,\vec{E} - \frac{\rho}{\varepsilon_0}\right) dV = 0 \implies \boxed{\mathrm{div}\,\vec{E} = \frac{\rho}{\varepsilon_0}}$$



$$\frac{\partial E_x}{\partial x}+\frac{\partial E_y}{\partial y}+\frac{\partial E_z}{\partial z}=\frac{\rho}{\varepsilon_0}$$

$$\vec{E}=\vec{ct.} \Rightarrow E_x\vec{i}+\underbrace{E_y}_{=0}\vec{j}+\underbrace{E_z}_{=0}\vec{k}=\vec{ct}$$



$$E_x\vec{i}=\vec{ct.}$$

$$E_x=\text{const.} \Rightarrow$$

$$\Rightarrow \operatorname{div}\vec{E}=\frac{\partial E_x}{\partial x}+0+0$$

$$=0$$

Invers: Dacă $\operatorname{div}\vec{E}=0 \Rightarrow E_x=\text{ct.}$ $\quad \operatorname{div}\vec{E}=0.$

Materiale conductoare și izolatoare.
Influența câmpului electric asupra lor.