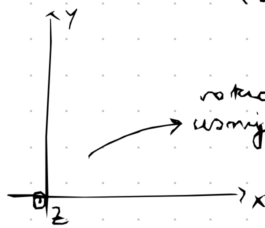
1. Zadano vekt polje $A = \frac{(x-2y)i + (2x+y)j}{8}$

$A_z = 0$

$$\vec\nabla \times \vec E = \begin{vmatrix} \hat x & \hat y & \hat z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ \frac{x-2y}{8} & \frac{2x+y}{8} & 0 \end{vmatrix} = \hat x \left(0 - \frac{\partial}{\partial z}(2x+y)\cdot\frac18\right) + \hat y \cdot \frac{\partial}{\partial z}(x-2y)\frac18 + \frac18 \hat z \cdot \left(\frac{\partial}{\partial x}(2x+y) - \frac{\partial}{\partial y}(x-2y)\right)$$

rotacija polja

$$\vec\nabla \times \vec E = \frac18 (2+2)\hat z = \frac12 \hat z$$



rotacija je u $\hat z$ usmjerena je prema meni

$\vec\nabla \vec E$ = divergencija $= 0$

$$\vec\nabla = \frac{\partial}{\partial x}\hat x + \frac{\partial}{\partial y}\hat y + \cancel{\frac{\partial}{\partial z}\hat z}^{\,0}$$

$$\vec\nabla \vec E = \frac18 \left[\frac{\partial}{\partial x}\left((\cancel{x-2y})i + (2x+y)j\right)\hat x + \frac{\partial}{\partial y}\left((x-2y)i + (\cancel{2x+y})j\right)\hat y\right]$$

$$\vec\nabla E = \frac18 \left(\frac{\partial}{\partial x}(2x+y)\underbrace{\hat j \hat x}_{-\hat z} + \frac{\partial}{\partial y}(x-2y)\underbrace{\hat i \cdot \hat j}_{\hat z}\right)$$

$$\cancel{\vec\nabla \vec E = \frac18 \left(-2\hat z - 2\hat z\right)} =$$ Valja veće od nule

2. Za homogeno sfernu ljusku (nabijenu) polumjera R s ukupnim nabojem Q, jakost el. polja E mjerena <u>unutar</u> sferne ljuske, na udaljenosti r od središta sfere $(r < R)$ $\longrightarrow$ $E(r) = 0$

3. $Q = 0{,}1\,C$ $\quad \vec{v_0} = \vec{j}\,15\,m/s$

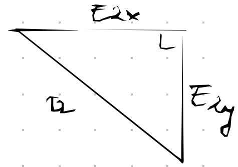
$\vec{B} = (\vec{i}\,0{,}9 - \vec{j}\,1)\,T$ $\quad \vec{F_L} = ?$

$F_L = q\,v \times B$ $\longrightarrow$ $\vec{v}\times\vec{B} \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \cancel{v_x} & v_y & \cancel{v_z} \\ B_x & B_y & 0 \end{vmatrix}$

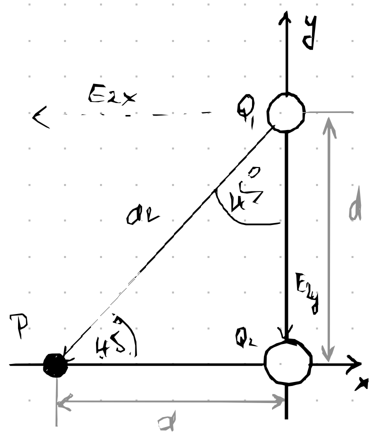
$\vec{v}\times\vec{B} = \hat{x}\,(\underset{0}{-\cancel{B_y v_z}}) + \hat{y}\,\underset{0}{\cancel{v_z}\cdot B_x} + \hat{z}\,(\underset{0}{\cancel{v_x B_y}} - B_x v_y)$

$F_L = q\,v\times B = 0{,}1\,(0\cdot\hat{x} + 0\cdot\hat{y} - 0{,}9\cdot 15\,\hat{z})$

$$\boxed{F_L = \underset{F_x}{0\hat{x}} + \underset{F_y}{0\cdot\hat{y}} - \underset{F_z}{1{,}35\,\hat{z}}}$$



4. $Q_1 = -2e$ $\quad Q_2 = 3e$ $\quad E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$



$\longrightarrow E = \frac{1}{4\pi\varepsilon_0}\cdot\frac{e}{d^2}$

$E_2 = \frac{3}{2}E$ $\qquad E_1 = -2E$

$E_{2x} = \frac{3}{2}E\cdot\cos(45^\circ)$

$E_{2y} = \frac{3}{2}E\sin(45^\circ) \rightarrow E_{2y} = E_y$ jer druga nema y komp.

$\longrightarrow E_x = E_{2x} + E_1$

$E_y = E_{2y}$

$d_2 = \sqrt{2d^2} = d\sqrt{2}$

$tg\alpha = \frac{E_y}{E_x} = \frac{\frac{3\sqrt{2}}{4}}{\frac{3\sqrt{2}}{4} - 2} \rightarrow \boxed{tg\alpha = -1{,}129}$

5 ?

6. $B = B_0(i\cos wt + k\sin wt)$ $\longrightarrow$ $E_0 = c \cdot B_0$

$B_0 = 3\times10^{-3}\,T$ $E_0 = 9\times10^{5}\,V/m$

$w = 63\,rad/s$

$\rightarrow$ x y ravnina $\mathcal{E} = \frac{-d}{dt}\Phi_M = \frac{-d}{dt}\int \vec{B}\,d\vec{s}$

$\rightarrow S = 71\,cm^2 \rightarrow 71\times10^{-4}\,m^2$

$B = B_0\cos(wt)\cdot\vec{i} + B_0\sin(wt)\cdot\vec{k}$

$\mathcal{E}_{ind_0} = ?$ $\rightarrow$ normala površine je u z onije je površina u x, y ravnini

magnetski tok

$\Phi_B = \oint \vec{B}\,d\vec{S} = \int B\,ds$ ali budući da je $\hat{k} = \hat{z}$

$\hookrightarrow B\,\hat{k} = B_0\sin(wt)$

$\longrightarrow \Phi_B = \oint B_0\sin(wt)\,d\vec{s} = B_0\sin(wt)\,S$

$\mathcal{E} = \frac{-d}{dt}\Phi_0 = \frac{-d}{dt}\left(B_0\sin(wt)\,S\right) = S\,B_0\cdot\cos(wt)\cdot w$

$\mathcal{E}_{ind_0} = max$ kada je $\cos(wt) = 1$

$\hookrightarrow \mathcal{E}_{ind_{max}} = B_0 A w = 3\times10^{-3}\cdot71\times10^{-4}\cdot63$

$$\boxed{\mathcal{E}_{ind} = 1{,}3419\,mV}$$

7 Polarizacija

Malusov zakon: $I = \frac{I_0}{2}$ $\longrightarrow$ $I_2 = I_1 \cdot \cos^2\theta$

$I_2 = I_1 \cos^2(\theta) - \frac{I_0}{2} \cos^2(\theta) \ldots I_5 = \frac{I_0}{2} \cos^8(\theta)$

$$\frac{I_5}{I_0} = \frac{\cos^8(\theta)}{2} = 0{,}925659 \longrightarrow \boxed{92{,}566}$$

Gracia DZ

(1) $A = \frac{(x+2y)\hat{i} + (-2x+y)\hat{j}}{16(x^2+y^2)^{3/2}}$

$\nabla = \frac{\partial}{\partial x}\hat{x} + \frac{\partial}{\partial y}\hat{y} + \cancel{\frac{\partial}{\partial z}\hat{z}}$ $\longrightarrow$ divergencija $\vec{\nabla}\vec{E}$

0 jer $\hat{i}\cdot\hat{x}=0$

$\Rightarrow \vec{\nabla}\vec{E} = \frac{1}{16}\left[\frac{\partial}{\partial x}\left(\cancel{\frac{(x+2y)\hat{i}}{(x^2+y^2)^{3/2}}} + \frac{(-2x+y)}{(x^2+y^2)^{3/2}}\hat{j}\right)\hat{x} + \right.$ $\qquad \hat{j}\cdot\hat{i} = -\hat{k} = \hat{z}$

$\left. + \frac{\partial}{\partial y}\left(\frac{(x+2y)\hat{i}}{(x^2+y^2)^{3/2}} + \cancel{\frac{(-2x+y)}{(x^2+y^2)^{3/2}}\hat{j}}\right)\hat{y}\right] + z$

$\Rightarrow \vec{\nabla}\vec{E} = \frac{1}{16}\left(\frac{(-2x+y)'(x^2+y^2) - (-2x+y)(x^2+y)'}{(x^2+y^2)^2} + \frac{(x+2y)'(x^2+y^2) - (x+2y)(x^2+y^2)'}{(x^2+y^2)^2}\right.$

$\vec{\nabla}\vec{E} = \frac{1}{16}\left(\frac{-2(x^2+y^2) - (y-2x)\cdot 2x}{(x^2+y^2)^2}(-\hat{z}) + \frac{2(x^2+y^2) - (x+2y)\cdot 2y}{(x^2+y^2)^2}(\hat{z})\right)$

$\vec{\nabla}\vec{E} = \frac{\hat{z}}{16(x^2+y^2)^2}\left(2(x^2+y^2) - 2x(y-2x) + 2(x^2+y^2) - 2y(x+2y)\right)$ prema nama

$4(x^2+y^2) - 2xy + 4x^2 - 2xy - 4y^2$

$4(x^2+y^2) - 4xy + 4(x^2-y^2)$

$\nabla\vec{E} = \hat{z} = \frac{x^2 + \cancel{y^2} + x^2 - \cancel{y^2} - xy}{4(x^2+y^2)^2} = \frac{2x^2 - xy}{4(x^2+y^2)^2}$

div je manja od nule.

idk?

3.

$Q = 0{,}001$

$v_0 = (\vec{i}\,30 + \vec{k}\,25)\ m/s$

$B = \vec{i}\,0{,}9\,T$

$$F_L = q\, v \times B = q \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 30 & 0 & 25 \\ 0{,}9 & 0 & 0 \end{vmatrix}$$

$$q\left(\hat{x}\cdot 0 + \hat{y}\cdot 25\cdot 0{,}9 + \hat{z}\cdot 0\right)$$

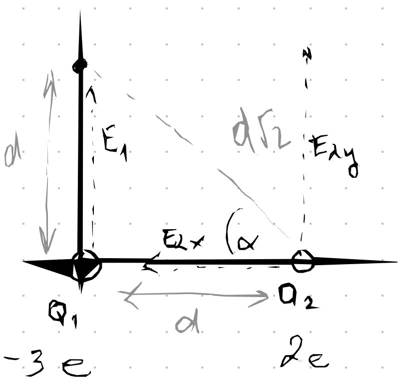
$$\Rightarrow F_L = 0{,}001 \cdot 25 \cdot 0{,}9 = \underbrace{0{,}0225}_{F_y}$$

$F_z = 0$

$F_x = 0$

4.

$$E = \frac{1}{4\pi\varepsilon_0}\,\frac{e}{d^2} \quad \text{- općenito svugdje}$$



$\operatorname{tg}\alpha = ? \rightarrow \dfrac{E_y}{E_x} \longrightarrow E_y = E_{2y} + E_1$

$E_x = E_{2x}$

$$E_1 = \frac{1}{4\pi\varepsilon_0}\,\frac{-3e}{d^2} \qquad E_2 = \frac{1}{4\pi\varepsilon_0}\,\frac{2e}{2d^2}$$

$E_1 = -3E$

$E_2 = E$

$E_{2y} = \sin\alpha \cdot E \qquad E_{2x} = \cos\alpha \cdot E$

$\hookrightarrow \dfrac{\sqrt{2}}{2}E$

$\alpha = 45°$ jer su jednaki d

$$\operatorname{tg}\alpha = \frac{\frac{\sqrt{2}}{2}E - 3E}{\frac{\sqrt{2}}{2}E} = \frac{\frac{\sqrt{2}}{2} - 3}{\frac{\sqrt{2}}{2}} = -3{,}243$$