SINAVA YÖNELİK TEKRAR

1) diverjans = 0 bunun anlamı ve tanımı çıkabilir.

$$\int \nabla \cdot \hat{A}\, dv = \oint \hat{A}\, d\hat{s} \qquad \int_S \nabla \times \hat{A}\, dv = \oint \hat{A} \cdot d\hat{\ell} \quad \Big\}\ \text{teoremler}$$

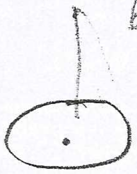
$$\nabla \cdot E = \frac{\rho}{\varepsilon_0}$$

$\nabla \times \hat{E} = 0$ yük noktasal ise $\nabla \cdot \hat{E} = \frac{q}{\varepsilon_0}$ 'e eşittir diverjans.

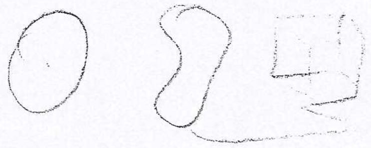
$$dq = J \cdot ds' = J\, dx\, dy$$

$$\nabla V = \frac{dV_x}{dx}\hat{x} + \frac{dV_y}{dy}\hat{y} + \frac{dV_z}{dz}\hat{z} \qquad \boxed{\hat{E} = -\nabla V}$$

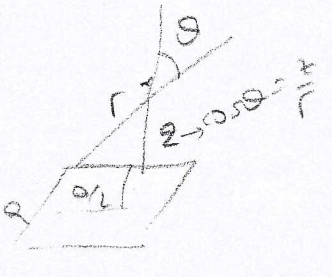
$$\hat{E} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{|R|^2} \text{ in } \quad \hat{F} = Q\hat{E}$$



bileşenler z yönündedir yönü +'dır.



$\frac{q}{\varepsilon_0} = \Phi$ noktasal yükse.



$$\hat{E} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{2\lambda\frac{a}{2}}{r\sqrt{r^2 + \frac{a^2}{2}}} \cdot \frac{z}{r} \cdot 4$$

ÖRN

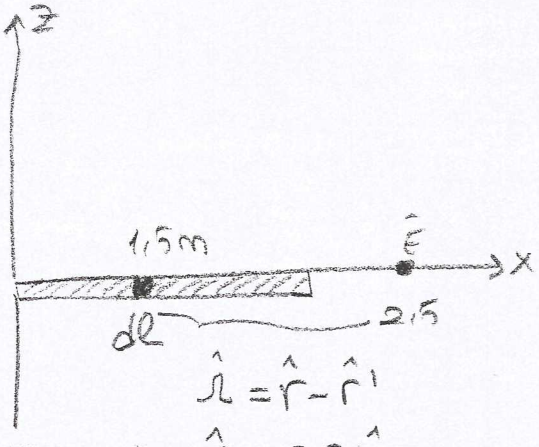
Düzgün çizgisel yük yoğunluğu $\lambda = 2\mu C/m$ olan çubuk 1,5 metredir ve x ekseni üzerindedir. $x = 2,5$ m deki Elektrik alanı bulunuz.

a) Elektrik alanın yönü nedir?

b) Elektrik alanı belirleyerek integrali ifade edin.

c) elektrik alan nedir

d) $Q = 4\pi \frac{\mu C}{m}$ bir yük varsa ($x = 2.5$ de) Q ya etkiyen elektriksel kuvvet nedir?



a) x yönündedir

b) önce dq belirle

$dq = \lambda\, dx$ eşittir

$dE =$

$\hat{\mathscr{r}} = \hat{r} - \hat{r}'$

$\hat{r} = 2{,}5\,\hat{x}$

$r' = x \cdot dx$ ↳ 2,5

$r' = x \cdot \hat{x}$

$\hat{\mathscr{r}} = (2{,}5 - x) \cdot \hat{x}$

$|\hat{\mathscr{r}}| = \text{boyu} = \sqrt{(2{,}5 - x)^2}$

$$dE = \frac{1}{4\pi\varepsilon_0} \cdot \frac{dq}{|\hat{\mathscr{r}}|^2}\, \hat{\mathscr{r}} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{dq}{|\hat{\mathscr{r}}|^3}\, \mathscr{r}$$

$$E = \int_0^{1{,}5} \frac{1}{4\pi\varepsilon_0} \cdot \frac{\lambda\, dx}{|2{,}5 - x|^3} \cdot |2{,}5 - x|\, \hat{x}$$

$$E = \frac{\lambda}{4\pi\varepsilon_0} \int_0^{1{,}5} \frac{1}{\underbrace{(2{,}5 - x)}_{u}{}^2}\, dx \cdot \hat{x} \quad = \quad 2{,}5 - x = u$$

$$-dx = du$$

$$\int -u^{-2}\, du = u^{-1} \qquad \frac{1}{u} \Rightarrow \frac{1}{2{,}5 - x}\Big|_0^{1{,}5} = \frac{1}{1} - \frac{1}{2{,}5} = \frac{3}{5}$$

$$E = \frac{\lambda}{4\pi\varepsilon_0} \cdot \frac{3}{5}\, \hat{x} = 10.800 \left(\frac{N}{C}\right) \hat{x}$$

$$\varepsilon_0 = 8{,}85 \cdot 10^{-12}\, \frac{C^2}{N \cdot m}$$

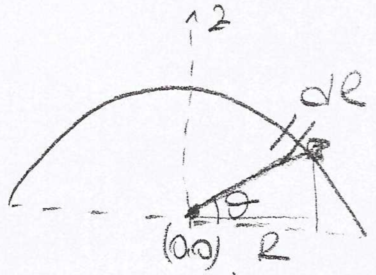
d) $F = Q \cdot \hat{E} = 4\,\mu C \cdot 10\,800\, \frac{N}{C}$

$43200 \cdot 10^{-6}\, N$

Soru: Düzgün çizgisel bir λ yükü yarım çember üzerine dağılmıştır. Çemberin merkezindeki elektrik alan nedir.

a) yönü b) integrali c) $\vec{E}$ = ?

d) Eğer $\lambda = \lambda_0 \sin\theta$ ise integral ifadesi ve $\vec{E}$ = ?



λ düzgün dağılmamıştır.

orijinden dl ye olan vektör r'

a) $-\hat{z}$

$dl = r \cdot d\theta$

$dq = \lambda dl$

$dl = R \cdot d\theta$

$dq = \lambda R \cdot d\theta$

$\hat{r} = 0 \cdot \hat{x} + 0 \cdot \hat{y} = 0$

$\hat{r}' = R \cdot \cos\theta \hat{x} + R \cdot \sin\theta \cdot \hat{y}$

$\hat{\mathscr{r}} = \hat{r} - \hat{r}' = -R\cos\theta \hat{x} - R\sin\theta \hat{z}$

$d\vec{E} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{dq}{|\mathscr{r}|^2} \hat{e}_n = \frac{1}{4\pi\varepsilon_0} \cdot \frac{\lambda R \, d\theta}{R^3} \cdot (-R\cos\theta\hat{x} - R\sin$

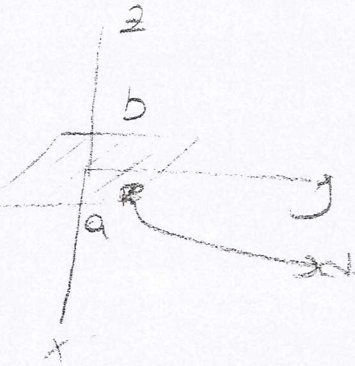
$|\hat{\mathscr{r}}| = \sqrt{(-R\cos\theta)^2 + (R\sin\theta)^2} = \sqrt{R^2(\cos^2\theta + \sin^2\theta)} = R$

$$\hat{E} = -\frac{1}{4\pi\varepsilon_0} \int_0^{\pi} \frac{\lambda}{R} (\cos\theta\hat{x} + \sin\theta\hat{z}) \, d\theta$$

$$d) \; \hat{E}_{\lambda_0 \sin\theta} = \frac{1}{4\pi\varepsilon_0} \int_0^{\pi} \frac{\lambda_0 \cdot \sin\theta}{R} (\cos\theta \hat{x} + \sin\theta \hat{z}) \, d\theta$$

kitaptan syf 65 - 69 'a kadar.

$\nabla E = \frac{1}{\varepsilon_0} \rho$ ispat elektrostatiğin 1. kuralına bak.



Düzgün dağılmış bir σ yüzü için karenin orta noktasından b kadar uzaktaki elektrik alanı nedir?

$\Rightarrow dq = \sigma \cdot ds'$ $\quad dq = \sigma\, dx\, dy$

$ds' = dx\,dy$ $\quad \vec{r} = b\cdot\hat{z}$

$\vec{r}\,' = x\cdot\hat{x} + y\cdot\hat{y}$

$\vec{\mathscr{r}} = r - \vec{r}\,'$

$= b\hat{z} - x\hat{x} - y\cdot\hat{y}$

$|\vec{\mathscr{r}}| = \sqrt{b^2+x^2+y^2}$

$d\vec{E} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{dq}{|\mathscr{r}|^2}\,\hat{e}_{\mathscr{r}}$

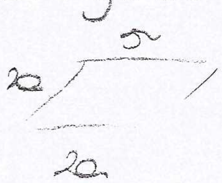
$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_{-a}^{a}\int_{-a}^{a}\frac{\sigma\,dx\,dy}{(b^2+x^2+y^2)^{3/2}}\cdot(b\hat{z}-x\hat{x}-y\hat{y})$

$= \frac{\sigma b}{4\pi\varepsilon_0}\int_{-a}^{a}\int_{-a}^{a}\frac{dx\,dy}{(b^2+x^2+y^2)^{3/2}}\cdot\hat{z}$

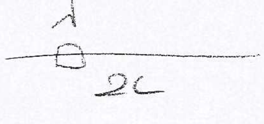
$\int dq$

$\int_{-a}^{a}\int_{-a}^{a}\sigma\,dx\,dy = 4a^2\sigma$

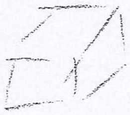
eğer $b \gg a$ ise yük bir noktasal yüke benzer.



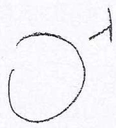
$E = \frac{1}{4\pi\varepsilon_0}\,\frac{4a^2\sigma}{b^2}$



$2L\cdot\lambda \Rightarrow$ yük



$q = 0$?



$\rightarrow \lambda\cdot 2\pi R$