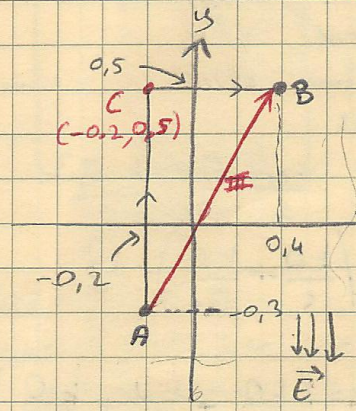
Örnek Problemler

1- 

Şekildeki gibi düzgün bir elektrik alanı negatif y doğrultusunda ve 325 V/m şiddetindedir. A noktasının koordinatları (-0,2, -0,3)m ve B noktasının (0,4, 0,5)m 'dir. $V_B - V_A$?

$\vec{E} = (-325\,\hat{j}\ V/m)$

$$V_B - V_A = -\int_A^B \vec{E}\,d\vec{\ell} = -\int_A^C \vec{E}\,d\vec{\ell} - \int_C^B \vec{E}\,d\vec{\ell}$$

$d\vec{\ell} = dy\,\hat{j}$ $\qquad$ $d\vec{\ell} = dx\,\hat{i}$

$$V_B - V_A = -\int_A^C (-325\,\hat{j}).dy.\hat{j} - \int_C^B (-325\,\hat{j}).dx.\hat{i}$$

$\hat{j}.\hat{j} = 1 \rightarrow \cos\vartheta = \cos 0° = 1$ $\qquad$ $\hat{j}.\hat{i} = 0 \rightarrow \cos\vartheta = \cos 90° = 0$

$$-\int_A^C (-325)\,dy \rightarrow 325.y\Big|_{-0,3}^{0,5} \rightarrow 325.0,8 = \underline{260\ volt}$$

Ek: III. yoldan: $\vec{E} = (-325\,\hat{j})\ V/m$

$$V_B - V_A = -\int_A^B \vec{E}\,d\vec{\ell} \rightarrow -\int_A^B (-325)\,\hat{j}.(0,6.\hat{i} + 0,8\,\hat{j}) \rightarrow -\int_A^B (-325).(0,8)$$

$d\ell\cos\vartheta + d\ell\sin\vartheta$ $\qquad$ 0 $\qquad$ 1

$325.0,8 = 260$ Volt

2- Uzayın belirli bir bölgesinde elektriksel potansiyel $V = 5x - 3x^2y + 2yz^2$ olarak veriliyor. Elektrik alan vektörünü bulunuz ve P = (1, 0, -2) noktasındaki şiddetini (büyüklüğünü) elde ediniz.

$V = V(x, y, z) \rightarrow$

$E_x = -\frac{\partial V}{\partial x} \rightarrow -(5 - 6xy) = 6xy - 5$

$E_y = -\frac{\partial V}{\partial y} \rightarrow -(-3x^2 + 2z^2) = 3x^2 - 2z^2$

$E_z = -\frac{\partial V}{\partial y} \rightarrow -4yz = -4yz$

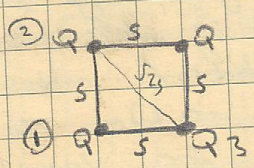
$\vec{E} = E_x\hat{i} + E_y\hat{j} + E_z\hat{k}$

$= (6xy - 5)\hat{i} + (3x^2 - 2z^2)\hat{j} - 4yz\hat{k}$

$\vec{E}\,|_{(P)} = \vec{E}\,|_{(1,0,-2)} = -5\hat{i} - 5\hat{j} + 0\hat{k}$

$\rightarrow -5\hat{i} - 5\hat{j}$

3- Bir kenarı "s" olan bir karenin köşelerine "q" büyüklüğünde özdeş yükler yerleştirmek için ne kadarlık iş yapmak gerekir?



$U_1 = "0"$

$U_2 = V_1 \cdot q_2 = \frac{k \cdot q}{s} \cdot q = \frac{k q^2}{s}$

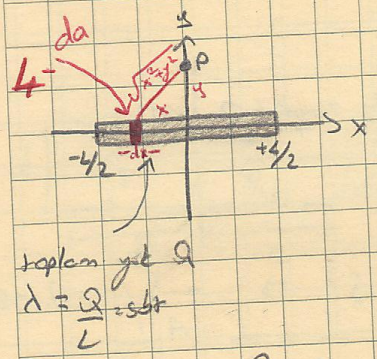
$U_3 = V_{12} \cdot q_3 = \left(\frac{kq}{s} + \frac{kq}{\sqrt{2}s}\right) \cdot q$

$U_4 = V_{123} \cdot q_4 = \left(\frac{kq}{\sqrt{2}s} + \frac{kq}{s} + \frac{kq}{s}\right) \cdot q$

Toplam iş: $W = 4 \cdot \frac{kq^2}{s} + 2\frac{kq^2}{\sqrt{2}s} = \frac{kq^2}{s}(4 + \sqrt{2})$ ✓

$\sqrt{2} \approx 1,41$

$5,41 \cdot \frac{kq^2}{s}$ ✓



toplam yük q

$\lambda = \frac{q}{L}$ = sabit

$V_{(P)} = ?$

$V = \int \frac{k\,dq}{r}$ genel formül

$V = \int \frac{k\,dq}{r} = \int_{-L/2}^{L/2} \frac{k\lambda\,dx}{\sqrt{x^2+y^2}} = k\lambda \int_{-L/2}^{L/2} \frac{dx}{\sqrt{x^2+y^2}}$

$V = k\lambda \cdot \ln\left(x + \sqrt{x^2+y^2}\right)\Big|_{-L/2}^{L/2}$

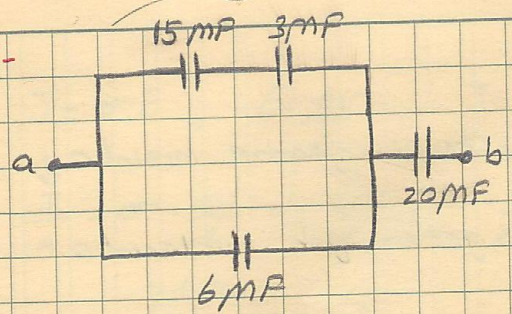
$V = k\lambda \left[\ln\left(L/2 + \sqrt{(L/2)^2+y^2}\right) - \left(-L/2 + \sqrt{(-L/2)^2+y^2}\right)\right]$

$= \frac{kq}{L} \ln \frac{\left(L/2 + \sqrt{(L/2)^2+y^2}\right)}{\left(-L/2 + \sqrt{(-L/2)^2+y^2}\right)} = V_{(y)}$

?

5/2

5-



a) $C_{es} = ?$

b) $V_{ab} = 15$ ise her bir kondansatörün yükü $= ?$

a) → 15 ve 3 seri

$$\frac{1}{C_{12}} = \frac{1}{15} + \frac{1}{3} = \frac{6}{15} \qquad C_{12} = \frac{5}{2}\ mF$$

b) $5/2$ ve 6 paralel

$$C_{123} = 5/2 + 6 = \frac{17}{2}\ mF$$

c) $17/2$ ve 20 seri

$$\frac{1}{C_{es}} = \frac{2}{17} + \frac{1}{20} = \frac{57}{340}$$

$$C_{es} = 340/57\ mF = \frac{340}{57} \cdot 10^{-6}\ F$$ ✓

b) = a — q — b $V_{ab} = 15V$

$C = 340/57$

$$Q = CV = \frac{340}{57} \cdot 15 = \frac{1700}{19} C$$