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UTS Falisma

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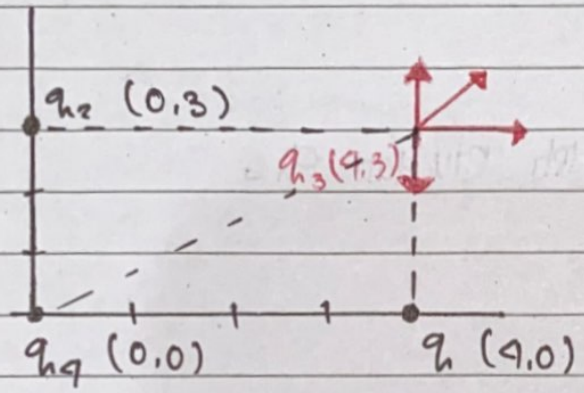
Kelas : 2 2C

1. q_1 (4,0) : +2 Start .C
   q_2 (0,3) : +5 Start .C
   q_3 (4,3) : +10 Start .C
   q_4 (0,0) , -1 Start .C

k : 1 dyne .cm²/start C



+ Medan listrik Pada Posisi (0,0)
(6) arak dari q_4 ke titik (0,0) adalah 0 cm. maka medan listrik Pada Posisi (0,0) adalah

$$E = \frac{k.q_1}{r^2}$$

$$E_{q_4} = \frac{1 \cdot (-1)}{(0)^2} = \frac{-1}{0} = \infty \text{ dyne / start .C}$$

+ Gaya Coulomb q_4

$$* F_{q_1} = \frac{k q_4 \cdot q_1}{r^2}$$

$$= \frac{1.(-1 \cdot 2)}{4^2} = \frac{2}{16} = \frac{1}{8} \text{ dyne}$$

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* $F_{q_2} = \frac{k \cdot q_4 \cdot q_2}{r^2}$

$= \frac{1 \cdot (-1 \cdot 5)}{3^2}$

$= \frac{5}{9}$ dyne

* $F_{q_3} = \frac{k \cdot q_4 \cdot q_3}{r^2}$

$= \frac{1 \cdot (-1 \cdot 10)}{5^2}$

$= \frac{10}{25} = \frac{2}{5}$ dyne

Gaya Coulomb yang dialami oleh muatan q_4

$F_{q_4} = F_{q_1} + F_{q_2} + F_{q_3}$

$= \frac{1}{8} + \frac{5}{9} + \frac{2}{5}$

$= \frac{45 + 200 + 144}{360}$

$= \frac{389}{360} = 1,0805$

Potensial listrik Pada titik (0,0)

Jarak dan q_4 ke titik (0,0) adalah 0 cm. Potensial listrik disebabkan oleh q_4 di titik (0,0) adalah

$V = \frac{k \, q_4}{r_4}$

$= \frac{1 \cdot (-1)}{0}$

$= \infty$ start V

Potensial listrik yang tak terhingga menunjukkan bahwa ada Potensial listrik yang sangat besar di titik (0,0) akibat q_4.

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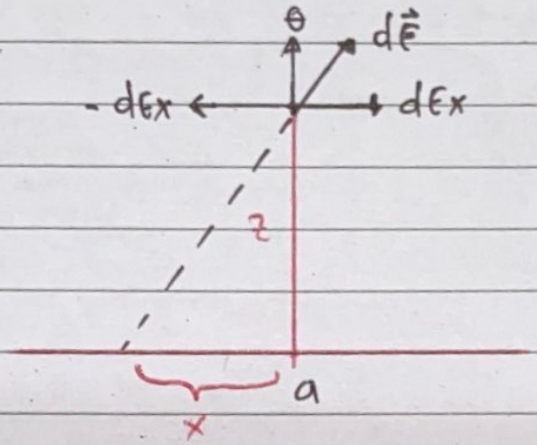
2. Sebuah kawat lurus panjangnya a, membawa muatan seragam λ. hitung medan listrik di titik P di ~~atas~~ aris kawat yang berjarak z di tengah-tengah kawat



$d\vec{E} = dE_y + dE_x$

$d\vec{E} = dE_y$

$dE_y = dE \cos\theta$

$$E = \frac{1}{4\pi\varepsilon_0}\int_0^a \frac{\lambda dx}{r^2}\cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0}\int_0^a \frac{\lambda dx}{(x^2+z^2)}\cos\theta$$

$$= \frac{xz}{4\pi\varepsilon_0}\int_0^a \frac{\lambda dx}{(x^2+z^2)}\cos\theta$$

$$= \frac{\lambda z}{4\pi\varepsilon_0}\int_0^a \frac{dx}{(x^2+z^2)^{3/2}}$$

$$= \frac{\lambda z}{4\pi\varepsilon_0}\left[\frac{x}{z^2\sqrt{x^2+z^2}}\right]\Big|_0^a$$

$$= \frac{\lambda z}{4\pi\varepsilon_0}\left[\frac{a}{z^2\sqrt{a^2+z^2}} - 0\right]$$

$$= \frac{\lambda z}{4\pi\varepsilon_0}\left[\frac{a}{z^2\sqrt{a^2+z^2}}\right]$$

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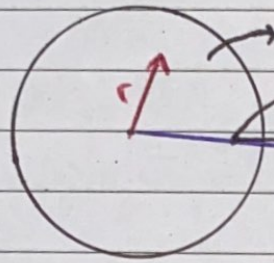
3. Hukum Gauss adalah besar fluks atau garis gaya listrik yang keluar dari suatu permukaan tertutup sebanding muatan yang dilingkupi oleh luasan tertutup.



→ Permukaan gauss (berbuk bola)
→ elemen luas permukaan gauss
[fluks listrik pada permukaan gauss]

$\Phi_c = \oint E \cdot dA = \oint E\, dA$
$= E \oint dA$
$= \left[\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\right](4\pi r^2)$

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

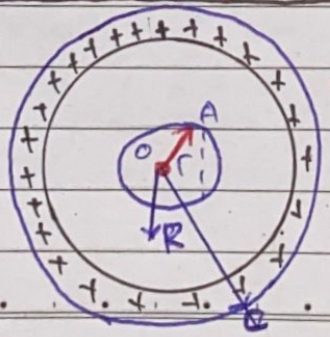
$\oint dA = A$
$= 4\pi r^2$

$\Phi_c = \frac{q}{\varepsilon_0}$

→ Fluks listrik pada permukaan bola sebanding dengan muatan yang ada di dalamnya.

Hukum gauss diterapkan dalam situasi dimana distribusi muatan memiliki listrik tertentu

contoh:



medan listrik kulit bola

Berapakah medan listrik di kulit?

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Jawab:

E di kulit bola (titik B)

$r = R$

$E = k \frac{Q}{r^2}$

$$E = k \frac{Q}{r^2}$$

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4. Hitunglah Curl atau rotasi dari fungsi vektor :

a. $V_1 : x^2\hat{i} + 3xz^2\hat{j} - 2xz\hat{k}$

b. $V_2 : xy\hat{i} + 2yz\hat{j} + 3xz\hat{k}$

Jawab :

a. $V_1 : x^2\hat{i} + 3xz^2\hat{j} - 2xz\hat{k}$

$$\nabla \times V = \left(\frac{\partial}{\partial x}\hat{i} + \frac{\partial}{\partial y}\hat{j} + \frac{\partial}{\partial z}\hat{k}\right) \times \left(x^2\hat{i} + 3xz^2\hat{j} - 2xz\hat{k}\right)$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2 & 3xz^2 & -2xz \end{vmatrix}$$

$$= \hat{i}\left(\frac{\partial(-2xz)}{\partial y} - \frac{\partial 3xz^2}{\partial z}\right) + \hat{j}\left(\frac{\partial(-2xz)}{\partial x} - \frac{\partial x^2}{\partial z}\right) - \hat{k}\left(\frac{\partial 3xz^2}{\partial x} - \frac{\partial x^2}{\partial y}\right)$$

$$= \hat{i}(0 - 6xz) + \hat{j}(2z - 0) - \hat{k}(3z^2 - 0)$$

$$= -6xz\,(\hat{i}) + 2z\,(\hat{j}) - 3z^2\,(\hat{k})$$

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b. $V_2 = xy\hat{i} + 2yz\hat{j} + 3xz\hat{k}$

$$\nabla \times V = \left(\frac{\partial}{\partial x}\hat{i} + \frac{\partial}{\partial y}\hat{j} + \frac{\partial}{\partial z}\hat{k}\right) \times \left(xy\hat{i} + 2yz\hat{j} + 3xz\hat{k}\right)$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ xy & 2yz & 3xz \end{vmatrix}$$

$$= \hat{i}\left(\frac{\partial\, 3xz}{\partial y} - \frac{\partial\, 2yz}{\partial z}\right) + \hat{j}\left(\frac{\partial\, xy}{\partial z} - \frac{\partial\, 3xz}{\partial x}\right) + \hat{k}\left(\frac{\partial\, 2yz}{\partial x} - \frac{\partial xy}{\partial y}\right)$$

$$= \hat{i}(0 - 2y) + \hat{j}(0 - 3z) + \hat{k}(0 - x)$$

$$= -2y(\hat{i}) - 3z(\hat{j}) - x(\hat{k})$$