Date :

1. Dik : q_1 (4,0) = 2 statC $k = 1$ dyne.cm³/stat

q_2 (0,3) = 5 statC

q_3 (4,3) = 10 statC

q_4 (0,0) = -1 statC

Jwb :

a. Gaya coulomb yang dialami muatan q_1,

▷ Mencari jarak

$q_4 + q_1 = \sqrt{((0-4)^2 + (0-0)^2)} = 4$

$q_4 + q_2 = \sqrt{((0-0)^2 + (0-3)^2)} = 3$

$q_4 + q_3 = \sqrt{((0-4^2) + (0-3)^2)} = 5$

▷ Gaya Coulomb

$q_4 + q_1 = \frac{k(2(-1))}{4^2} = 0,125$ dyne

$q_4 + q_2 = \frac{k(5(-1))}{3^2} = 0,556$ dyne.

$q_4 + q_3 = \frac{k((10)(-1))}{5^2} = 0,4$ dyne

Jadi total gaya coloumb yang dialami muatan q_4 yaitu

0,125 + 0,556 + 0,4 = 1,081 dyne

b. Medan listrik pada titik (0,0) atau muatan q_4

▷ mencari jarak

q_4 dan $q_1 = \sqrt{((0-4^2) + (0-0)^2)} = 4$

q_4 dan $q_2 = \sqrt{((0-0)^2 + (0-3)^2)} = 3$

q_4 dan $q_3 = \sqrt{((0-4)^2 + (0-3)^2)} = 5$

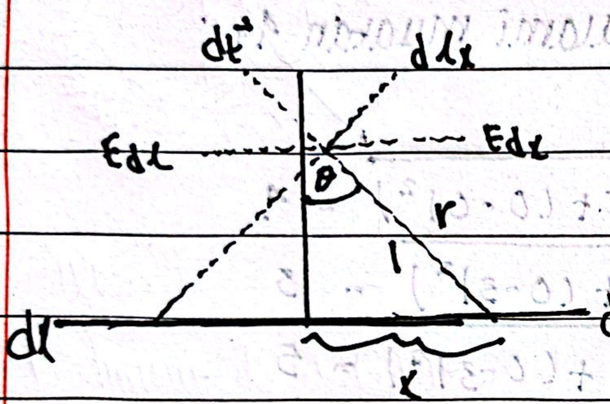
q_4 dan $q_4 = \sqrt{((0-0)^2 + (0-0)^2)} = 0$

b. Medan listrik

$$q_4(0,0) = k\left(\frac{|2|}{4^2} + \frac{|5|}{3^2} + \frac{|10|}{5^2} + \frac{|-1|}{6}\right)$$

$$= 1,667 \text{ dyne / statC}$$

2.



$$r = (x^2 + z^2)^{\frac{1}{2}}$$

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

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

$$d\vec{E} = dE \cos\theta$$

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

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

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

Dipindai dengan CamScanner

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

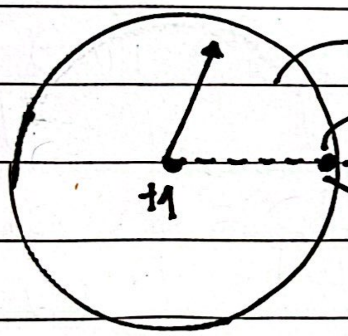
$$= \frac{\lambda z}{4\pi\varepsilon_0} \int_0^a \frac{dx}{(x^2+z^2)^{3/2}}$$

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

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

$$= \frac{\lambda z}{4\pi\varepsilon_0} \left[\frac{a}{z^2\sqrt{a^2+3^2}} \right]$$

3.



Permukaan gauss (bentuk bola)

elemen luas permukaan gauss

dA

E (fokus listrik pada permukaan gauss)

$\phi_c = \oint E \cdot dA = \oint E dA$

$= E \oint dA$

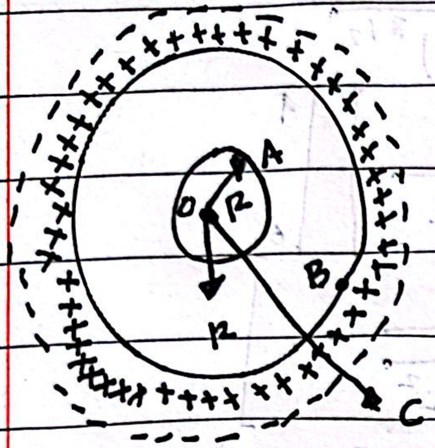
$= \left(\frac{1}{\cancel{4\pi}\varepsilon_0} \frac{q}{\cancel{r^2}} \right) \left(\cancel{4\pi r^2} \right)$

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

fokus listrik pada permukaan bola sebanding dengan muatan yang ada didalamnya

Hukam Gauss diterapkan dalam situasi dimana distribusi muatan memiliki simetri tertentu

Contohnya :



Medan listrik kulit bola

Berapakah medan listrik di kulit ?

Jwb :

E dikulit bola (titik B)

$r = R$

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

$E = k \dfrac{Q}{R^2}$

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

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

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

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

$$\hat{k}\left(\frac{\partial 3xz^2}{\partial x} - \frac{\partial x^2}{\partial y}\right)$$

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

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

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

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

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

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

$$\hat{k}\left(\frac{\partial 2yz}{\partial x} - \frac{\partial xy}{\partial y}\right)$$

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

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