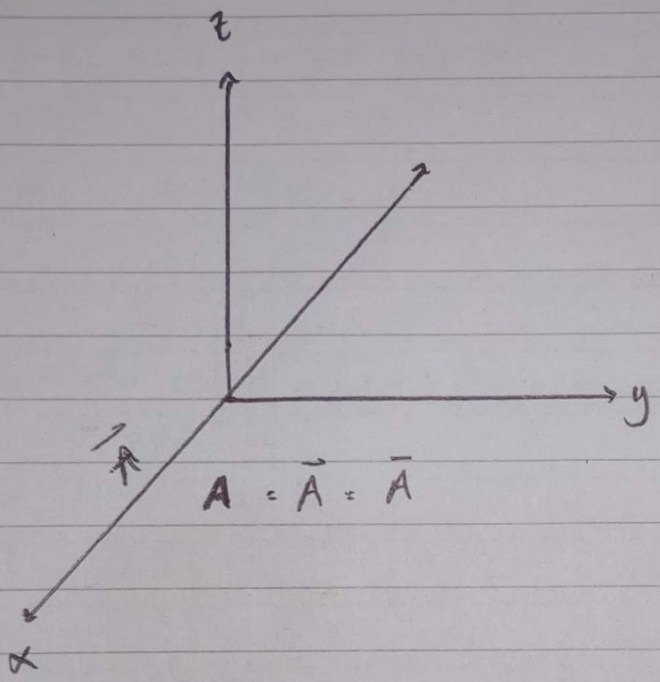
بسم الله الرحمن الرحيم

No. Senin
Date 19 . 02 . 2024

KELISTRIKAN DAN KEMAGNETAN

Analisis Vektor



$$\vec{A} = x\hat{i} + y\hat{j} + z\hat{k}$$

$$|\vec{A}| = \sqrt{x^2 + y^2 + z^2}$$

$$\hat{A} = \frac{\vec{P}}{|A|} = \frac{x\hat{i} + y\hat{j} + z\hat{k}}{\sqrt{x^2 + y^2 + z^2}}$$

Contoh :

$$\vec{A} = 4\hat{i} + 5\hat{j} + 2\hat{k}$$
$$\vec{B} = 2\hat{i} + \hat{j} + 3\hat{k}$$

Penjumlahan : $\vec{A} + \vec{B}$

$$6\hat{i} + 4\hat{j} + 5\hat{k}$$

Perkalian Vektor

a.) dot (·)

$$\vec{A} \cdot \vec{B} = |\vec{A}| \cdot |\vec{B}| \cdot \cos\theta$$

Date

$\vec{A} \cdot \vec{B} = (4\hat{i} + 3\hat{j} + 2\hat{k}) \cdot (2\hat{i} + \hat{j} + 3\hat{k})$

$= 8 + 3 + 6$

$= 17$

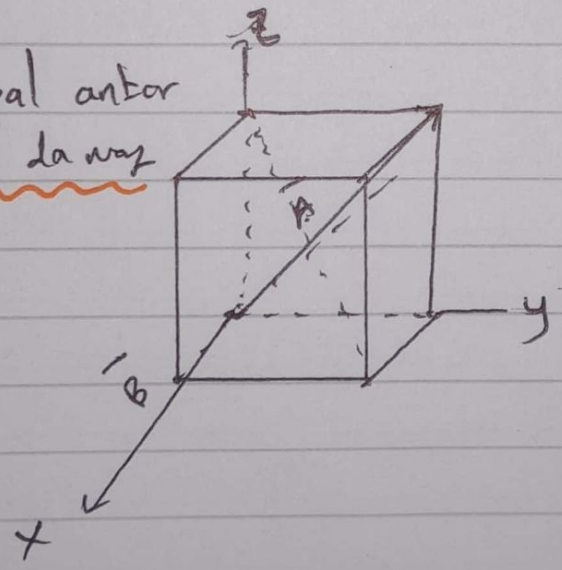
$|\vec{A}| = \sqrt{16 + 9 + 4}$

$|\vec{B}| = \sqrt{4 + 1 + 9}$

$17 = \sqrt{29} \cdot \sqrt{14} \cos\theta$

$\theta = \arccos \frac{17}{\sqrt{29} \cdot \sqrt{14}}$

Diagonal antar bidang datar



$\vec{A} = 0\hat{i} + \hat{j} + \hat{k}$

$\vec{B} = 1\hat{i} + 0\hat{j} + \hat{k}$

$\vec{A} \cdot \vec{B} = (0\hat{i} + \hat{j} + \hat{k}) \cdot (\hat{i} + 0\hat{j} + \hat{k})$

$= 0 + 0 + 1$

$= 1$

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$|\vec{A}| = \sqrt{0+1+1} = \sqrt{2}$

$|\vec{B}| = \sqrt{1+0+1} = \sqrt{2}$

$\vec{A} \cdot \vec{B} \cdot B = \sqrt{2} \cdot \sqrt{2} \cos\theta$

$1 = 2 \cos\theta$

$\theta = \text{arc} \cos \frac{1}{2}$

Hitunglah sudut antara diagonal ruang

$\vec{A} = \hat{i} + \hat{j} + \hat{k}$

$\vec{B} = -\hat{i} + \hat{j} + \hat{k}$

$\vec{A} \cdot \vec{B} = (\hat{i} + \hat{j} + \hat{k}) + (-\hat{i} + \hat{j} + \hat{k})$

$= -1 - 1 + 1$

$= -1$

$-1 = \sqrt{3} \cdot \sqrt{-1} \cos\theta$

$\theta = \text{arc} \cos \frac{-1}{\sqrt{3} \cdot \sqrt{-1}}$

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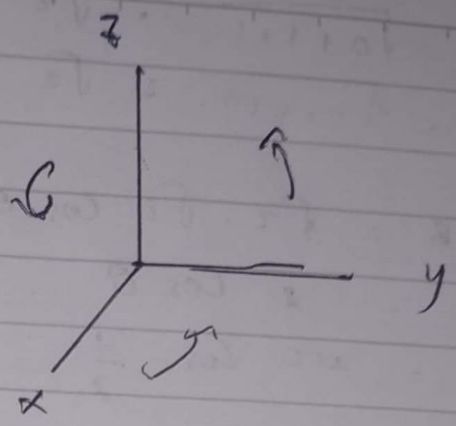
$\vec{A} = 2\hat{i} + 3\hat{j} + \hat{k}$

$\vec{B} = 3\hat{i} + 2\hat{j} + 2\hat{k}$



$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 1 \\ 3 & 2 & 2 \end{vmatrix}$$

$$= \hat{i}(6-2) - \hat{j}(4-3) - \hat{k}(\text{coba})$$

Operator Nabla (∇)

$$\nabla = \hat{i}\frac{\partial}{\partial x} + \hat{j}\frac{\partial}{\partial y} + \hat{k}\frac{\partial}{\partial z}$$

$T = x + 2y + 5t^2$ (skalar)

$$\nabla \cdot T = \hat{i} + \hat{j}(2) + \hat{k}(6t)$$
$$= \hat{i} + 2\hat{j} + 6t\hat{k}$$

$$\vec{V} = 3x^2\hat{i} + 2xy\hat{j} + 4xyz\hat{k}$$

$$\nabla V_1 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2 & 3xz^2 & -2xz \end{vmatrix} =$$

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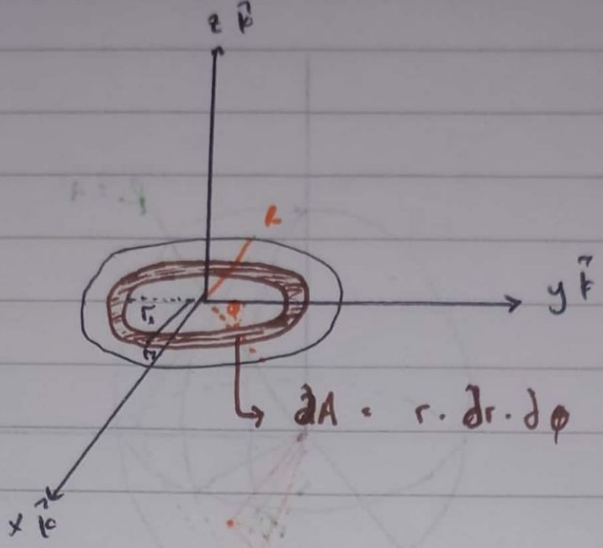
Kelistrikan dan Kemagnetan

r, θ, ϕ

$\downarrow$

(i, j, k)



$$\int_{A_1}^{A_2} dA = \int_{r_1}^{r_2} r\, dr \cdot \int_{\theta_1}^{\phi_2} d\phi$$

$$\left[A\right]_{A_1}^{A_2} = \left[\frac{1}{2} r^2\right]_{r_1}^{r_2} \cdot \left[\phi\right]_{\phi_1}^{\phi_2}$$

$$(A_2 - A_1) = \frac{1}{2}\left(r_2^2 - r_1^2\right) \cdot \left(\phi_2 - \phi_1\right)$$

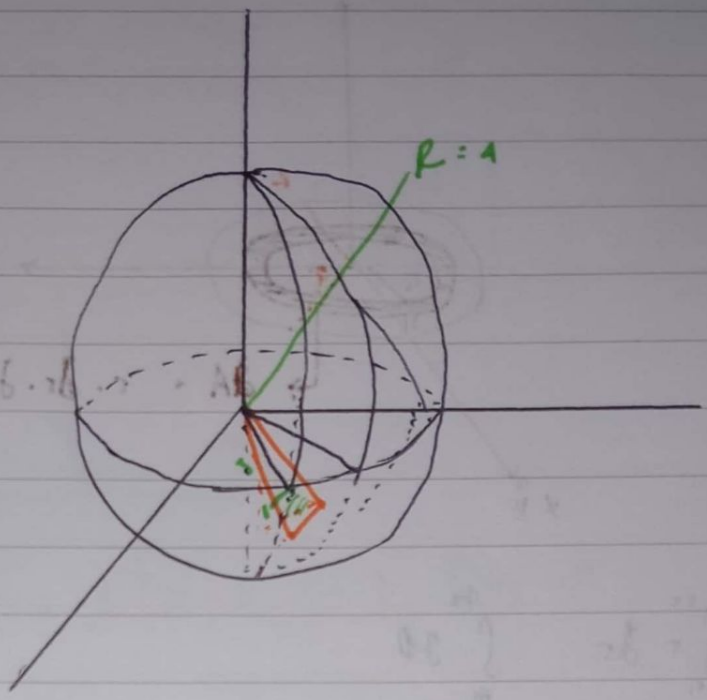
$$A = \frac{1}{2} \cdot r^2 \cdot 2\pi$$

$$= \pi r^2$$

- Rapat muatan luas (σ)

$$\sigma = \frac{dq}{dA}$$

$$= \frac{q}{A}$$



$$\partial L r = \partial r$$
$$\partial L \theta = r \cdot \partial \theta$$
$$\partial L \phi = r \cdot \sin\theta \; \partial \phi$$

$$\partial \tau = \partial L r \cdot \partial L \theta \cdot \partial L \phi$$
$$= \partial r \cdot r \cdot \partial \theta \; r \sin\theta \cdot \partial \phi$$

$$V = \int \partial \tau$$
$$= \int_0^R r \, \partial r \int_0^{\theta=\pi} r \, \partial \theta \cdot \int_0^{\phi=2\pi} \sin\theta \; \partial \phi$$
$$= \int_0^R R^2 \, \partial r \int_0^{\theta=\pi} \sin\theta \, \partial \theta \int_0^{\phi=2\pi} \partial \phi$$
$$= \frac{1}{3} R^3 \left(-\cos\theta\right)_0^{\pi} \cdot \left(\phi\right)_0^{2\pi}$$
$$= \frac{1}{3} R^3 \left[\left(-\cos\pi\right) - \left(-\cos 0\right)\right] \cdot \left(2\pi - 0\right)$$
$$= \frac{1}{3} R^3 \cdot 2 \cdot 2\pi$$
$$= \frac{4}{3} \pi r^3$$

$R_2 = 4$

$R_1 = 3$

$\theta_2 = \pi$

$\theta_1 = \frac{1}{2}\pi$

$\phi_2 = 2\pi$

$\phi_1 = \frac{1}{2}\pi$

berapa volume sampel dri bola yg berukuran R=4 jika $\frac{1}{8}$ dr

Jawab :

$V = \partial T$

$= \int r\,dr \cdot \int r\,\partial\theta \int \sin\theta\,\partial\phi$

$= \int_3^4 r^2\,dr \int_{\frac{1}{2}\pi}^{\pi} \sin\theta\,\partial\theta \cdot \int_{\frac{1}{2}\pi}^{2\pi} \partial\phi$

$V = \left(\frac{1}{3}R^3\right|_3^4 \cdot \left(-\cos\theta\right|_{\frac{1}{2}\pi}^{\pi} \quad \left(\phi\right|_{\frac{1}{2}\pi}^{2\pi}$

$= \frac{1}{3}(4^3 - 3^3) \cdot \left((-\cos 180^\circ - (-\cos 90)\right) \cdot \left(2\pi - \frac{1}{2}\pi\right)$

$= \left(\frac{1}{3}\cdot(64-27)\right) \quad (1-0) \quad \left(\frac{3}{2}\pi\right)$

$= \frac{1}{3} \cdot 37$

$2 \cdot 10 \cdot 5$ —

$V_{tot} = 267,9$

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$$\nabla = \frac{\partial}{\partial x}\hat{i} + \frac{\partial}{\partial y}\hat{j} + \frac{\partial}{\partial z}\hat{k}$$

$$\bigcirc\ \nabla = \frac{\partial}{\partial r}\hat{r} + \frac{\partial}{r\,\partial\theta}\hat{\theta} + \frac{\partial}{r\sin\theta\,\partial\phi}\hat{\phi}$$

$$\nabla T = \frac{\partial (T)}{\partial r}\hat{r} + \frac{\partial (T)}{r\,\partial\theta}\hat{\theta} + \frac{\partial (T)}{r\sin\theta\,\partial\phi}\hat{\phi}$$

PR = 55 (hal genap)

$\frac{5\pi}{2}$

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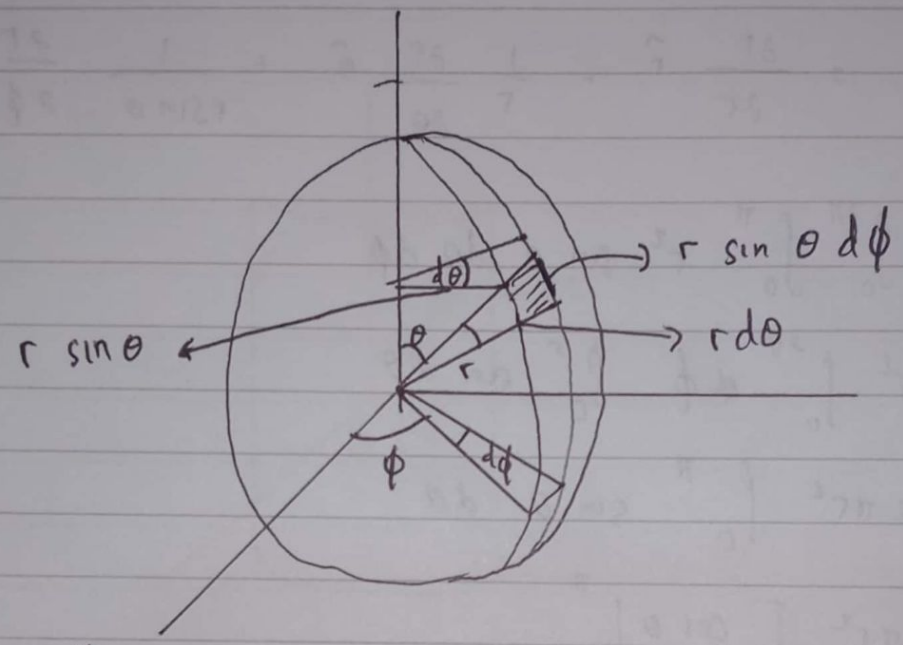
No. Senin

Date 04 . 03 . 24

Kelistrikan dan Kemagnetan

Sistem Koordinat Bola



$\sin\theta = \frac{x}{r}$

$x = r \sin\theta$

- Satuan luas

$$dA = d\rho \cdot d\ell$$
$$= r\,d\theta \cdot r \sin\theta\, d\phi$$
$$= r^2 \sin\theta\, d\theta\, d\phi$$

- Satuan volume

$$dV = d\rho\, d\ell\, dr$$
$$= r^2 \sin\theta\, d\theta\, d\phi\, dr$$

Gradien :

$$\nabla T = \frac{\partial T}{\partial x}\hat{i} + \frac{\partial T}{\partial y}\hat{j} + \frac{\partial T}{\partial z}\hat{k}$$

$$= \frac{\partial T}{\partial r}\hat{r} + \frac{1}{r}\frac{\partial T}{\partial \theta}\hat{\theta} + \frac{1}{r\sin\theta}\frac{\partial T}{\partial \phi}\hat{\phi}$$

Luas :

$$A = \int_0^{2\pi}\int_0^{\pi} r^2 \sin\theta \, d\theta \, d\phi$$

$$= r^2 \int_0^{2\pi} d\phi \int_0^{\pi} \sin\theta \, d\theta$$

$$= 2\pi r^2 \int_0^{\pi} \sin\theta \, d\theta$$

$$= 2\pi r^2 \left[-\cos\theta \right|_0^{\pi}$$

$$= 2\pi r^2 \left(1 - (-1)\right)$$

$$= 4\pi r^2$$

Volume :

$$V = \int_0^{\pi}\int_0^{2\pi}\int_0^{r} r^2 \sin\theta \, d\theta \, d\phi \, dr$$

$$= \left(\int_0^{\pi} \sin\theta \, d\theta\right)\left(\int_0^{r} r^2 \, dr\right)\left(\int_0^{2\pi} d\phi\right)$$

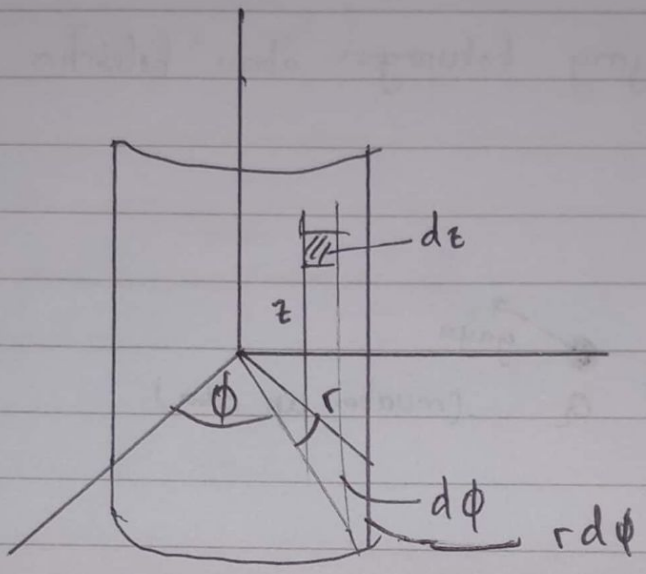
$$= \left(-\cos\left|_0^{\pi}\right.\right)\left(\frac{1}{3}r^3\right)(2\pi)$$

$$= 2\left(\frac{r^3}{3}\right)(2\pi)$$

$$= \frac{4}{3}\pi r^3$$

Date

1| Sistem Koordinat Silinder



Luas :

$$dA = d\phi \times dl$$
$$= r\, d\phi\, dz$$

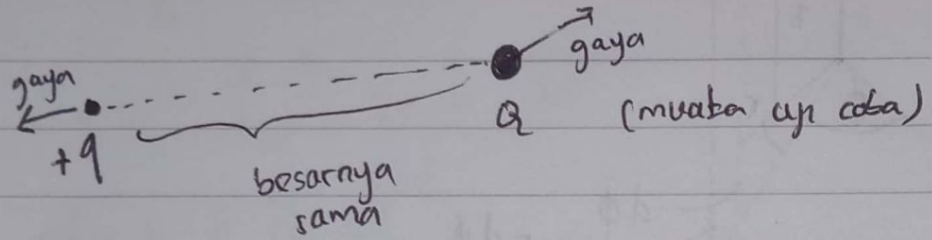
Volume :

$$dV = r\, d\phi\, dz\, dr$$

Gaya Listrik

- Muatan listrik
  Ion adalah atom yang kekurangan atau kelebihan elektron

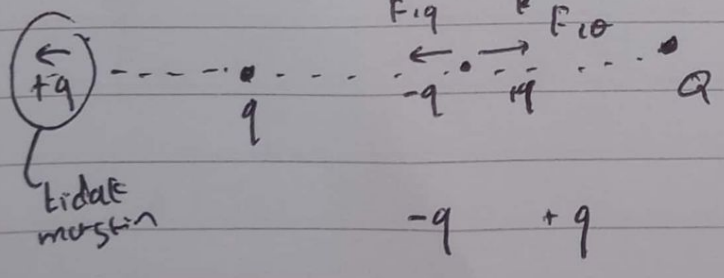
$$q = \pm Ne$$



$$\vec{F} = \frac{1}{4\pi\varepsilon_0} \frac{qQ}{r^2} \cdot \hat{r}_0$$

$$\hat{r}_0 = \frac{\vec{r}}{|r|}$$

Contoh :



$$F_{.q} = F_{.Q}$$

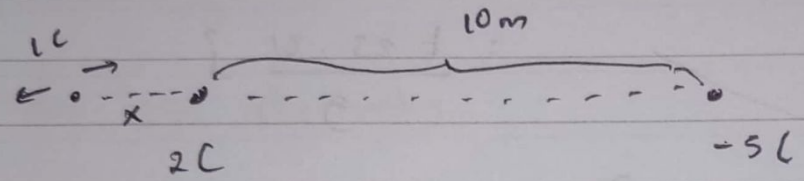
$$k \cdot \frac{q_{.Q}}{(r-x)^2} = k \frac{q_{.q}}{(x^2)}$$

x ... ?

$$\frac{Q}{(\rho^2 - 2\rho x + x^2)} = \frac{q}{x^2}$$

$$Q x^2 = q(\rho^2 - 2\rho x + x^2)$$

Contoh :



1C

$F_{12} = F_{13}$

$\frac{1c}{x^2} \quad \frac{1c}{} = \frac{+1.3}{(10+x)^2}$

$\frac{2}{x^2} = \frac{3}{x^2 + 20x + 100}$

$3x^2 = 2x^2 + 40x + 200$

$3x^2 - 2x^2 - 40x = 200$

$x^2 - 40x = 200$

$x^2 - 40x - 200 = 0$

( ) ( )

Rumus abc

$$x = -b \pm \sqrt{\frac{b^2 - 4ac}{2a}}$$

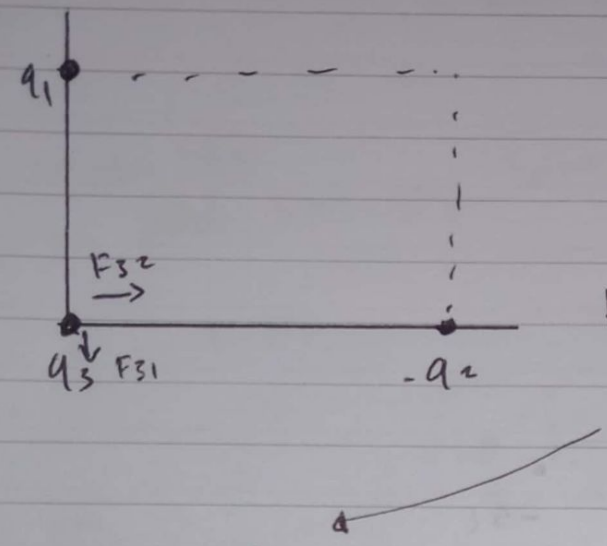
$$x = -40 \pm \sqrt{\frac{(-40)^2 - (4 \cdot 1 \cdot -2}{2}}$$

$x = -40 \pm \sqrt{1600}$

$= -40 \pm 20$

(+) $= -40 + 20 = -20$

(-) $= -40 - 20 = -60$



$$F_{32} = \frac{k\, q_3 q_2}{4^2} \frac{3\hat{i} + 0\hat{j}}{\sqrt{3^2+0^2}}$$

$$= k\frac{q_3 q_2}{16}\hat{i}$$

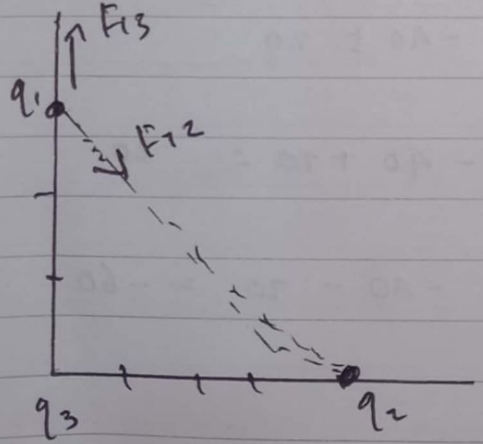
$$F_{31} = \frac{k\, q_3 q_1}{3^2}(-\hat{j})$$

$$= \frac{k\, 23 \cdot 21}{9}\hat{j}$$

$$\vec{F} = k q_3 \left[\frac{q_3}{16}\hat{i} - \frac{q_1}{9}\hat{j} \right]$$

$$|\vec{F}| = k q_3 \sqrt{\left(\frac{q_2}{16}\right)^2 + \left(\frac{q_1}{9}\right)^2}$$

Hitunglah gaya ij di dalam q_1



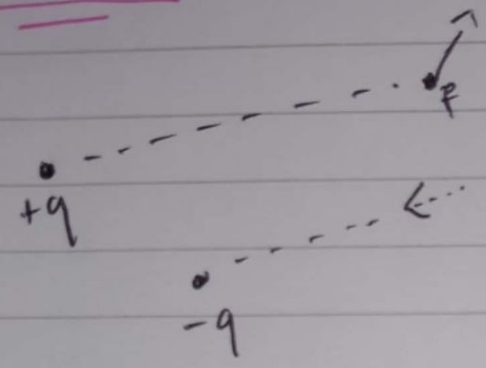
$$F_{13} = \frac{k\, q_1 q_3}{3^2}\hat{j}$$

$$F_{12} = \frac{k\, q_1 q_2}{5^2}\left(\frac{4\hat{i} - 3\hat{j}}{5}\right)$$

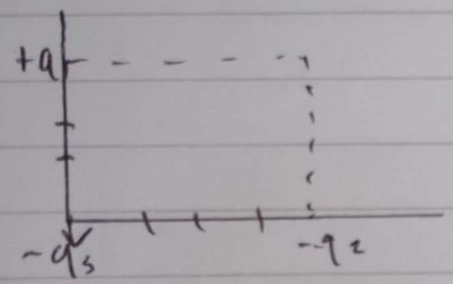
$$= \frac{4k\, q_1 q_2}{125}\hat{i} - \frac{3k\, q_1 q_2}{125}\hat{j}$$

$$\vec{F} = k q_1 \left[\left(\frac{4 q_2}{125}\right)\hat{i} + \left(\frac{q_3}{9} - \frac{3 q_2}{125}\right)\hat{j} \right]$$

Medan Listrik



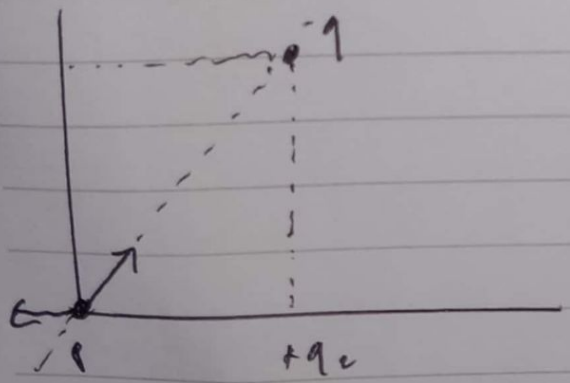
medan hanya saka muatan



$$\vec{E}_{q_3} = \frac{F_{3c}}{-q_3}$$

$$= \pm \frac{q_3 q_c}{q_3} \hat{j}$$

$$F = \pm \frac{q}{r^2} \hat{j}$$



$$\vec{E}_1 = \pm \frac{q_1}{5^2} (-\hat{i})$$

$$= \pm \frac{q_1}{9} \hat{i}$$

$$\vec{E}_2 = \pm \frac{q_2}{5^2} \left(\frac{3\hat{i} + 4\hat{j}}{5} \right)$$

$$= 3\pm \frac{q_2}{125} \hat{i} + 4\pm \frac{q_2}{125} \hat{j}$$

$$\vec{E} = \pm \left[\left(\frac{3q_2}{125} - \frac{q_1}{9} \right) \hat{i} + \frac{4q_2}{125} \hat{j} \right]$$