

sistem koordinat per.3

1. Koordinat Cartesius (x, y, z)

$$d\vec{r} = \hat{i}dx + \hat{j}dy + \hat{k}dz$$

$$d\tau = dx dy dz$$

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

- Divergensi : $\nabla \cdot \vec{V} = \frac{\partial V_x}{\partial x} + \frac{\partial V_y}{\partial y} + \frac{\partial V_z}{\partial z}$

- Rotasi : $\nabla \times \vec{V} = \hat{i} \left(\frac{\partial V_z}{\partial y} - \frac{\partial V_y}{\partial z} \right) + \hat{j} \left(\frac{\partial V_x}{\partial z} - \frac{\partial V_z}{\partial x} \right) + \hat{k} \left(\frac{\partial V_y}{\partial x} - \frac{\partial V_x}{\partial y} \right)$

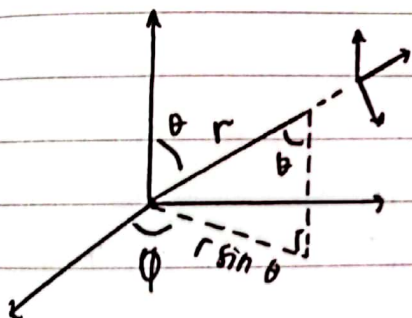
$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ V_x & V_y & V_z \end{vmatrix}$$

Catatan:



yang diarsir yang diambil bagiannya yang menyatukan semua bagian bola.

2. Koordinat bola (



$$d\vec{s} = \rho \times e$$

$$= r \sin \theta \, d\phi \cdot r \, d\theta$$

$$= r^2 \sin \theta \, d\theta \, d\phi$$

$$d\vec{r} = \hat{r} \, dr + \hat{\theta} \, r \, d\theta + \hat{\phi} \, r \sin \theta \, d\phi$$

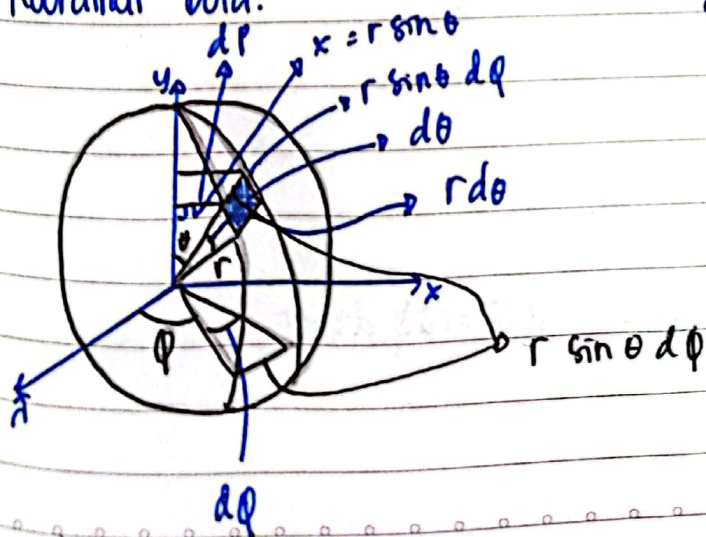
$$d\tau = \rho \times e \times e$$

$$= r \sin \theta \, d\phi \cdot r \, d\theta \cdot dr$$

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

Sistem Koordinat

1. Koordinat bola.



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

$$x = r \sin \theta$$

$$da = d\rho \times d\ell$$

$$= r \, d\theta \cdot r \sin \theta \, d\phi$$

$$= r^2 \sin \theta \, d\theta \, d\phi$$

$$d\tau = d\rho \cdot d\theta \cdot d\phi$$

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

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

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

Ohayō!

$$\nabla \cdot \mathbf{T} =$$

$$\nabla \times \mathbf{T} =$$

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

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

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

$$= 2\pi r^2 \left[-\cos \theta \right]_0^\pi$$

$$= 4\pi r^2$$

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

$$= \int_0^\pi \sin \theta \, d\theta \int_0^{2\pi} d\phi \int_0^r r^2 \, dr \quad : \left[-\cos \theta \right]_0^\pi$$

$$= 2 \cdot (2\pi) \int_0^r r^2 \, dr$$

$$= -[\cos \theta]_0^\pi$$

$$= 4\pi \left(\frac{1}{3} r^3 \right)$$

$$= -[-1 - 1]$$

$$= -(-2)$$

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

$$= 2$$

2. Koordinat Silinder

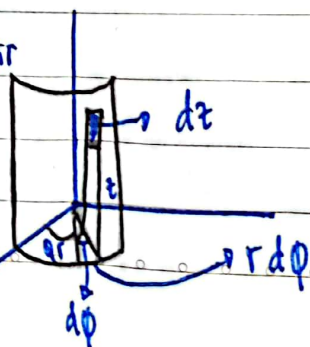
yang diarsir

bagian

mencakup

semuanya

Ohayo!



$$dA = dr \times dz$$

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

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

Listrik Statis (fotocopy, tv tabung, print)

Gaya Coulumb

Medan listrik

o diskrit

o non diskrit

Coulumb

Gau

Stokes

Catatan:

- Perbedaan gaya q_1 dan q_2 akan sama besar

- Dilihat per lagi bagian posisi mana yang lebih besar.

Potensial

o Diskrit

o non Diskrit

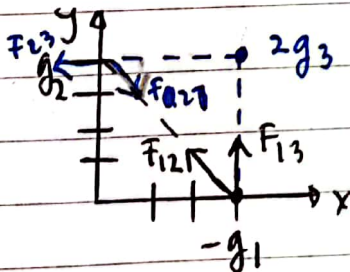
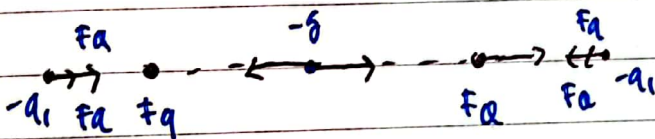
Usaha dan Energi

Muatan Listrik

(kelebihan muatan, karena panas sehingga membuang muatan yang kelebihan)

catatan

$$k = \frac{1}{4\pi\epsilon_0}$$



$$\vec{F}_{g1} =$$

$$\vec{F}_{13} = k \frac{q_1(2q_3)}{4^2} \hat{j}$$

$$\vec{F}_{12} = k \frac{q_1 q_2}{5^2} \left(\frac{-3\hat{i} + 4\hat{j}}{5} \right)$$

$$\begin{aligned} \vec{F}_{21} &= k \frac{q_2 q_1}{5^2} \left(\frac{3\hat{i} - 4\hat{j}}{5} \right) \\ &= \frac{3k q_2 q_1}{125} \hat{i} - \frac{4k q_2 q_1}{125} \hat{j} \end{aligned}$$

$$\vec{F}_{12} = \frac{-3k q_1 q_2}{125} \hat{i} + \frac{4k q_1 q_2}{125} \hat{j}$$

$$\vec{F}_{total} = \frac{-3k q_1 q_2}{125} \hat{i} + \left(\frac{2k q_1 q_2}{16} + \frac{4k q_1 q_2}{125} \right) \hat{j}$$

$$\begin{aligned} \vec{F}_{23} &= -k \frac{q_2 2q_3}{3^2} \hat{i} \\ &= -2k \frac{q_2 2q_3}{9} \hat{i} \end{aligned}$$