

5) kelistrikan dan kemagnetan

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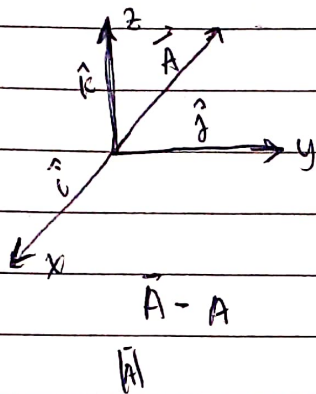
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No.: Per.1

Operator dalam fisika

(1) Analisa Vektor



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

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

$$\vec{A} = x^2 y \hat{i} + 3 y z \hat{j} + 2 x y \hat{k}$$

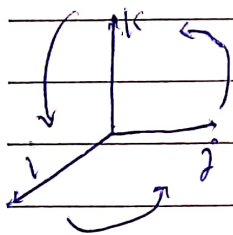
$$\vec{B} = z \hat{i} + 2 y x \hat{j} + 3 x z \hat{k}$$

$$= \vec{A} + \vec{B} = (x^2 y + z) \hat{i} + (3 y z + 2 y x) \hat{j} + (2 x y + 3 x z) \hat{k}$$

$$\vec{A} \cdot \vec{B} = (x^2 y)(z) \hat{i} + (3 y z)(2 y x) \hat{j} + (2 x y)(3 x z) \hat{k}$$

$$= x^2 y z + 6 y^2 x z + 6 x^2 y z$$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x^2 y & 3 y z & 2 x y \\ z & 2 y x & 3 x z \end{vmatrix}$$



$$= [(3 y z \cdot 3 x z) \hat{i} + (2 x y \cdot z) \hat{j} + (x^2 y \cdot 2 y x) \hat{k}] - [(x^2 y \cdot 2 y x) \hat{i} + (3 y z \cdot z) \hat{j} + (2 x y \cdot 2 y x) \hat{k}]$$

$$= (9 x y z^2 - 4 x^2 y^2) \hat{i} + (2 x y z - 3 x^3 y z) \hat{j} + (x^3 2 y^2 - 3 y z^2) \hat{k}$$

(2) Operator Nabla (∇)

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

Gradien

$$T = x^2 y z + 3 y^2 z$$

$$\nabla T = \hat{i} \frac{\partial (x^2 y z + 3 y^2 z)}{\partial x} + \hat{j} \frac{\partial (x^2 y z + 3 y^2 z)}{\partial y} + \hat{k} \frac{\partial (x^2 y z + 3 y^2 z)}{\partial z}$$

$$\nabla T = \hat{i}(2xyz + 3y^2z) + \hat{j}(x^2z + 6yz) + \hat{k}(x^2y + 3y^2)$$

$$\vec{A} = 2x\hat{i} + 3y\hat{j} - 4z\hat{k}$$

$$\nabla \cdot \vec{A} = 2 + 3 - 4 = 1$$

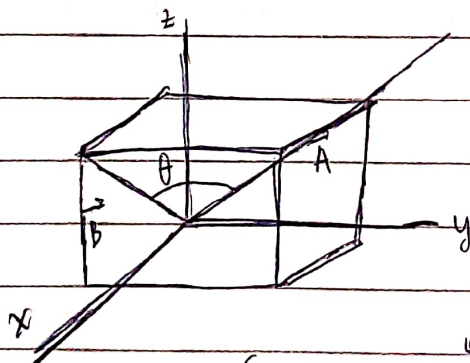
$$\nabla \times \vec{A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ 2x & 3y & -4z \end{vmatrix}$$

$$= \hat{i} \left(\frac{\partial(-4z)}{\partial y} - \frac{\partial(3y)}{\partial z} \right) + \hat{j} \left(\frac{\partial(2x)}{\partial z} - \frac{\partial(-4z)}{\partial x} \right) +$$

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

=

Sudut diagonal sisi



$$|\vec{A}| = \sqrt{0^2 + 1^2 + 2^2} = \sqrt{5}$$

$$\vec{A} = 0\hat{i} + \hat{j} + 2\hat{k}$$

$$\vec{B} = \hat{i} + 0\hat{j} + 2\hat{k}$$

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

$$4 = \sqrt{5} \sqrt{5} \cos \theta$$

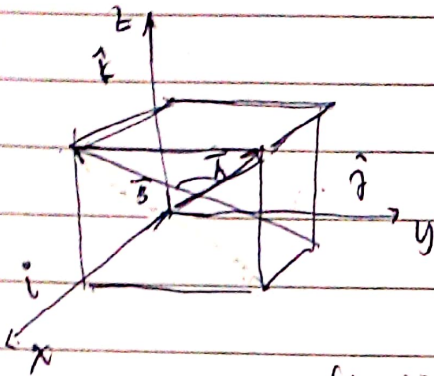
$$((0.1)\hat{i} + (0.1)\hat{j} + (2.2)\hat{k}) \cdot 4 = 5 \cos \theta$$

$$\cos \theta = \frac{4}{5}$$

=

$$\theta = \cos^{-1} \frac{4}{5}$$

Sudut diantara diagonal Ruang



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

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

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

$$(1-1)\hat{i} + (1-1)\hat{j} + (1+1)\hat{k} = \sqrt{6} \sqrt{6} \cos \theta$$

$$2 = 6 \cos \theta$$

$$\cos \theta = \frac{2}{6}$$

$$\cos \theta = \frac{1}{3}$$

$$\theta = \cos^{-1} \frac{1}{3}$$