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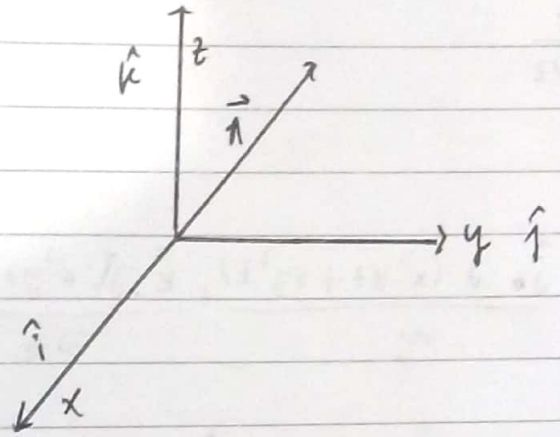
Kelistrikan dan Kemagnetan

No. 22 februari 2024 Date:

Operator dalam fisika

(1.) Analisis Vektor



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

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

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

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

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

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

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

$= \hat{i}(3xyz \cdot 3xz - 2xy \cdot 2yx) + \hat{j}(2xy \cdot z - x^2y \cdot 3xz) + \hat{k}(x^2y \cdot 2yz - 3yz \cdot z)$

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

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Operator Nabla (∇)

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

gradien

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

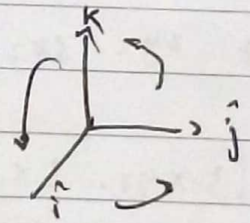
$$\nabla T = \hat{i}\cdot\frac{\partial(x^2yz + 3y^2z)}{\partial x} + \hat{j}\cdot\frac{\partial(x^2yz + 3y^2z)}{\partial y} + \hat{k}\cdot\frac{\partial(x^2yz + 3y^2z)}{\partial z}$$

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

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

$$\nabla\cdot\vec{A} = \frac{\partial v}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial v}{\partial z} = 2 + 3 - 4 = 1.$$

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



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

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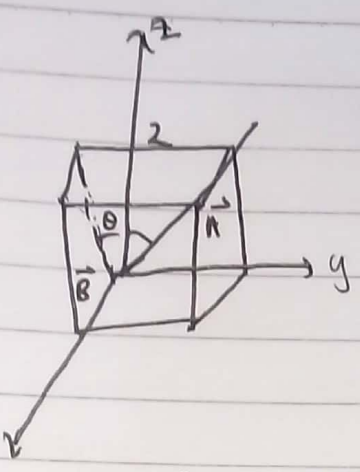


$\vec{A} = 0\hat{i} + \hat{j} + 2\hat{k}$

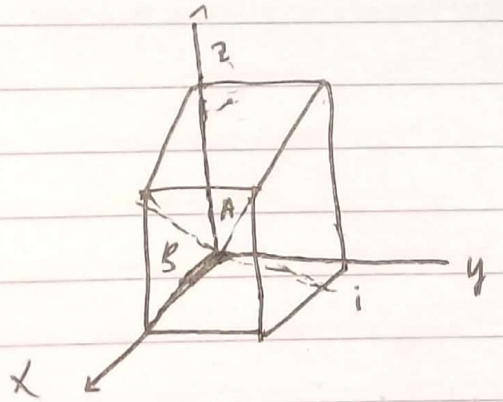
$\vec{B} = \hat{i} + 0\hat{j} + 2\hat{k}$

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

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

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

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



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

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

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

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

$\cos\theta = \frac{2}{6} = \frac{1}{3}$

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

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