No 22-02-2024

Date :

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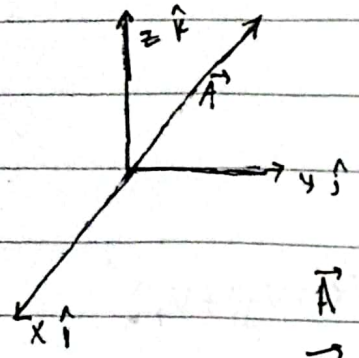
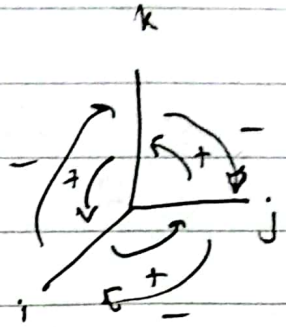
Operator Dalam Fisika

i.) Analisa vektor



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

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



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

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

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

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

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

$$\vec{A} \cdot \vec{B} = (x^2y \cdot z)\hat{i}\cdot 1 + (x^2y \cdot 2yx)ij + (x^2y \cdot 3xz)ik$$
$$+ (3yz \cdot z)ij + (3yz \cdot 2yx)j\cdot j + (3yz \cdot 3xz)j\cdot k$$
$$+ (2xy \cdot z)ik + (2xy \cdot 2yx)kj + (2xy \cdot 3xz)kk$$
$$= x^2yz + 3y^2z + 6x^2y^2$$

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

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

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

Operasi Nabla (∇)

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

Gradien

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

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

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

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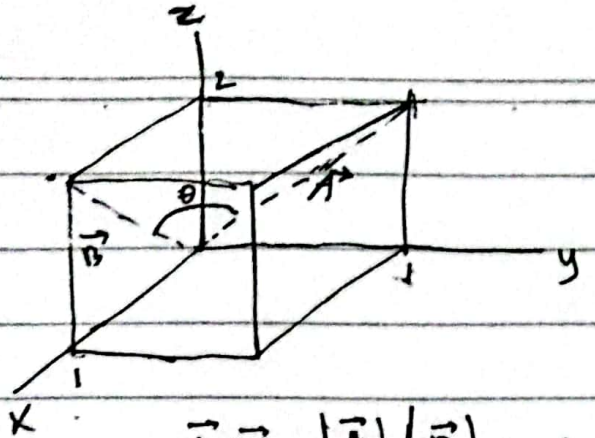

$\vec{A} = x\hat{i} + y\hat{j} + z\hat{k}$

$= 0\hat{i} + 1\hat{j} + 2\hat{k}$

$\vec{B} =$

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

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

$= |0\hat{i} + \hat{j} + 2\hat{k}|\,|\hat{i} + 0\hat{j} + 2\hat{k}| \cos\theta$

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

$\nabla \cdot \vec{A} = \left(\frac{\partial}{\partial x}\right)\hat{i} + \left(\frac{\partial}{\partial y}\right)\hat{j} + \frac{\partial}{\partial z}\hat{k} \cdot (V_x\hat{i} + V_y\hat{j} + V_z\hat{k})$

$\nabla \cdot \vec{A} = \frac{\partial V_x}{\partial x} + \frac{\partial V_y}{\partial y} + \frac{\partial V_z}{\partial z} = 1$

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

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

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

$= 0$

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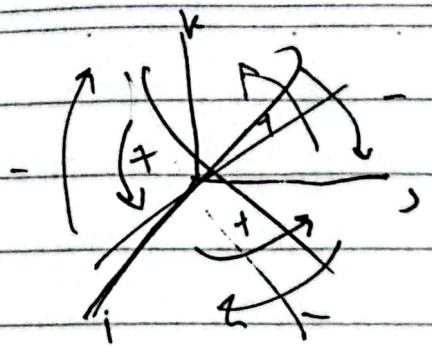

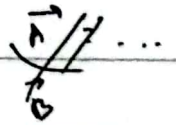

$\vec{A} = \hat{i} + 0\hat{j} + 2\hat{k}$

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

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

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

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

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

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

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

$= \sqrt{6}$

$|\vec{B}| = \sqrt{-1^2 + (-1)^2 + 2^2}$

$= \sqrt{6}$