

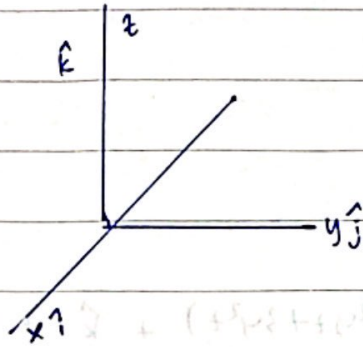
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Operator dalam Fisika

1. Analisis Vektor



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

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

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

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

$$\vec{A} + \vec{B} = (x + z)\hat{i} + \dots$$

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

$$+ (2xy)(3xz)\hat{k}$$

$$= x^2yz + 6y^2xz + 6x^2yz$$

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

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

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

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

Operator Nabla (∇)

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

Gradien

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

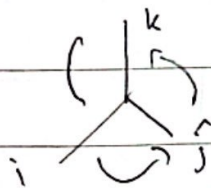
$$\nabla T = \hat{i} \frac{\partial (x^2 y z + 3 y^2 z)}{\partial x} + \hat{j} \frac{\partial (x^2 y z + 3 y^2 z)}{\partial y} + \hat{k} \frac{\partial (x^2 y z + 3 y^2 z)}{\partial z}$$

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

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

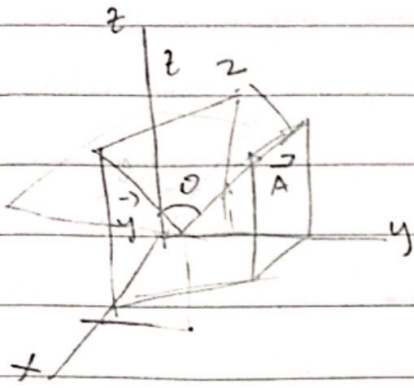
$$\nabla \cdot \vec{A} =$$

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



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

$$- \left(\frac{\partial}{\partial x} (-4z) \right) \hat{j} - \left(\frac{\partial}{\partial y} (2x) \right) \hat{k}$$

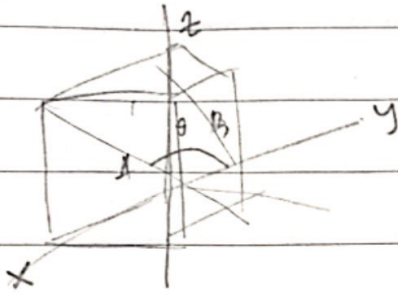


$$\vec{A} = 0\hat{i} + \hat{j} + 2\hat{k}$$

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

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

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



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

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

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

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

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

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