22.02.24

Kelistrikan dan Kemagnetan

Operator Dalam Fisika

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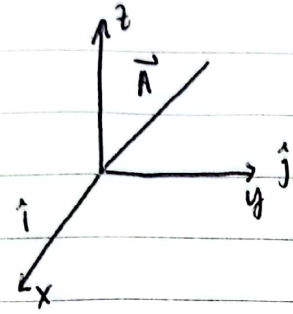
2213022055
22B

1. Analisis Vektor



$\vec{A}+\vec{B} = (x^2y+z)\hat{i} + (6y^2z + x)\hat{j} + (5x^2+y+z)\hat{k}$

$\vec{A}.\vec{B} = (x^2y+z)\hat{i} + (6y^2z + x)\hat{j} + (6x^2+y+z)\hat{k}$

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

$= \hat{i}(3yz - 3xz) + \hat{j}(2xy - 2zx)$

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

$- \hat{j}(2xy + z) - \hat{k}(x^2y + 2yx)$

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

$- \hat{i}(2yx\ \ 2xy) - \hat{i}(3xz\ \ x^2y)$

$= \vec{0}$

Operator Nabla (∇)

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

gradien

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

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

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

Ohayō!

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

$\nabla \cdot A =$

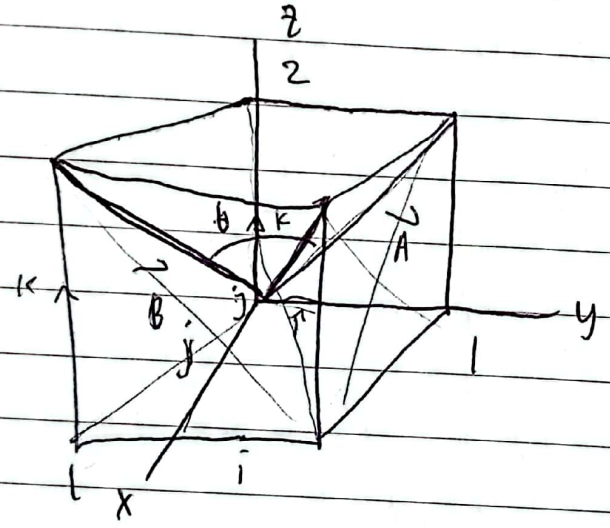
$\nabla \times \vec{A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ 2x & 3y & -4z \end{vmatrix}$

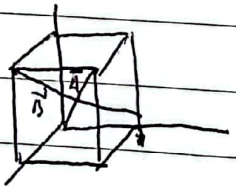
$= \left(\frac{\partial(-4z)}{\partial y} - \frac{\partial(3y)}{\partial z}\right)i + \left(\frac{\partial(2x)}{\partial z} - \frac{\partial(-4z)}{\partial x}\right)$

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

$= (0-0)i + (0-0)j + (0-0)$

$= 0$





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

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

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

$\vec{A} \cdot B =$

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

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

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

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

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

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

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

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

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