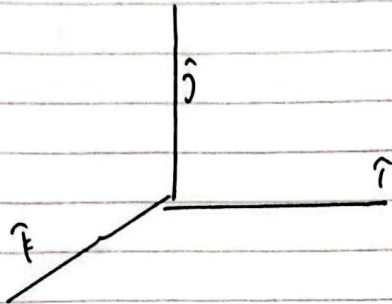


Role of Mathematics in Physics

$$\vec{X} = x_1 \hat{i} + x_2 \hat{j} + x_3 \hat{k}$$

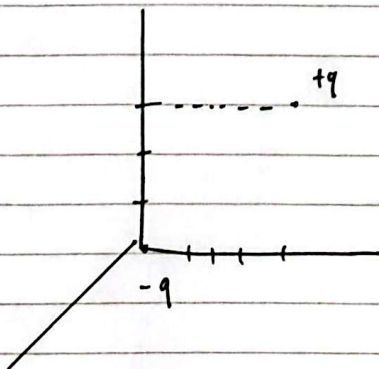
$$\vec{V} = v_1 \hat{i} + v_2 \hat{j} + v_3 \hat{k}$$



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

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

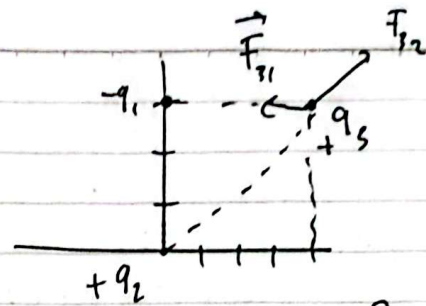
example :



$$F_{+q} = k \frac{q_1 q_2}{r^2} \hat{r}$$

$$k \frac{q_1 q_2}{\sqrt{3^2 + 4^2}} \frac{(-4\hat{i} - 3\hat{j})}{5^2}$$

$$\vec{F}_{-q} = k \frac{q_1 q_2}{r^2} \hat{r} = k \frac{q_1 q_2}{5^2} \left(\frac{4\hat{i} - 3\hat{j}}{5} \right)$$



$$\vec{F}_{23} = \vec{F}_{31} + \vec{F}_{32}$$

$$= k q_3 \left[\frac{q_1 (-\hat{i})}{4^2} + \frac{q_2 (4\hat{i} + 3\hat{j})}{5^2} \right]$$

$$\vec{r} = \frac{\vec{r}}{|\vec{r}|} = \frac{4\hat{i} + 3\hat{j}}{\sqrt{4^2 + 3^2}} = \frac{4\hat{i} + 3\hat{j}}{5}$$

$$\vec{V}_1 = 4\hat{i} + 2\hat{j} + \hat{k}$$

$$\vec{V}_2 = 2\hat{i} + 3\hat{k}$$

$$\vec{V}_1 \cdot \vec{V}_2 = 4\hat{i} \cdot 2\hat{i} + 2\hat{j} \cdot 0$$

$$8 + 0 = 8$$

$$\vec{a} = 3\hat{i} + 4\hat{j} - 3\hat{k}$$

$$\vec{b} = 2\hat{i} - 3\hat{j} + 2\hat{k}$$

$$a) \vec{a} \cdot \vec{a} = (3 \cdot 3) + (4 \cdot 4) + (-3 \cdot -3) = 16$$

$$b) \vec{a} \cdot \vec{b} = 6 - 12 - 6 = -12$$

$$c) \vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 4 & -3 \\ 2 & -3 & 2 \end{vmatrix}$$

$$A_x \ A_y \ A_z \quad 3 \ 4 \ -3$$

$$B_x \ B_y \ B_z \quad 2 \ -3 \ 2$$

$$(3 \cdot 2 - (-3 \cdot -3))\hat{i} + (-3 \cdot 2 - 4 \cdot 2)\hat{j} + (4 \cdot 2 - (-3 \cdot -3))\hat{k}$$

$$(6 - 9)\hat{i} + (-6 - 8)\hat{j} + (8 - 9)\hat{k}$$

$$(-3)\hat{i} - 14\hat{j} - \hat{k}$$

$$(4 \cdot 2 - (-3 \cdot -3)) = -1 \quad 12 + 17$$

Positif = kiri + kiri kanan
Negatif = kiri + kanan + kiri

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 4 & -3 \\ 2 & -3 & 2 \end{vmatrix}$$

$$\begin{aligned} &= (4 \cdot 2 - (-3 \cdot -3))\hat{i} + \\ &+ (3 \cdot 2 - 2 \cdot (-3))\hat{j} + \\ &+ (4 \cdot 2 - (-3)(-3))\hat{k} = \\ &= -1\hat{i} + 12\hat{j} - 17\hat{k} \end{aligned}$$

$$\begin{aligned} \vec{a} &= 4\hat{i} - 5\hat{j} + \hat{k} \\ \vec{b} &= 2\hat{i} + 3\hat{j} - 2\hat{k} \end{aligned}$$

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & -5 & 1 \\ 2 & 3 & -2 \end{vmatrix}$$

$$\begin{aligned} &= -5 \cdot 2 - (1 \cdot 3) + (4 \cdot 2) - (2 \cdot 1) + \\ &+ (5 \cdot 2) - (3 \cdot 4) \\ &= -13\hat{i} - 10\hat{j} - 22\hat{k} \end{aligned}$$