Role of Mathematic in physics

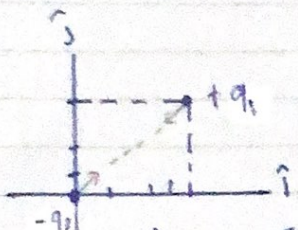
$\vec{X} = x_1\hat{i} + x_2\hat{j} + x_3\hat{k}$

$\vec{V} = V_1\hat{i} + V_2\hat{j} + V_3\hat{k}$

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

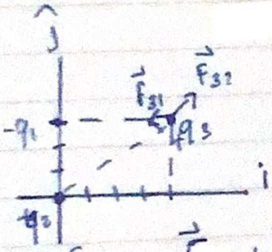
$$\vec{P} = x\hat{i} + y\hat{j} + z\hat{k}$$

example :



$$\vec{F}_{q} = k\frac{q_1 q_2}{R^2}\hat{R}$$

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



$$F_{q3} = \vec{F}_{31} + \vec{F}_{32}$$

$$= kq_3\left[\frac{q_1(-\hat{i})}{4^2} + \frac{q_2}{5^2}\frac{(4\hat{i}+3\hat{j})}{5}\right]$$

$$\hat{P} = \frac{\hat{P}}{|P|} = \sqrt{4^2+3^2} = 5$$

$$\hat{P} = \frac{-4+0+0}{\sqrt{4^2+0^2+0^2}} = -\hat{i}$$

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

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

$\vec{v}_1 \cdot \vec{v}_2 = 4\hat{i} \cdot 2\hat{j} + \hat{k} \cdot 3\hat{k}$

$= 8 \cdot 1 + 3 \cdot 1$

$= 8 + 3 = 11$

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

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

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

$= 9 + 16 - 9$

$= 25 - 9 = 34$

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

c) $\vec{a} \cdot \vec{b} = (3 \cdot 2) - (4 \cdot 3) - (3 \cdot 2)$

$= 6 - 12 - 6$

$= -12$

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

$= -\hat{i} + 12\hat{j} - 17\hat{k}$

$\vec{a} = 4\hat{i} - 5\hat{j} + \hat{k}$

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

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

$= \hat{i}(10 - 3) - \hat{j}(-8 - 2) + k(\quad)$