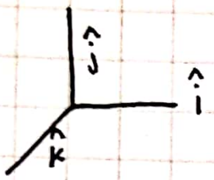
KALISMA. 14-02-2024

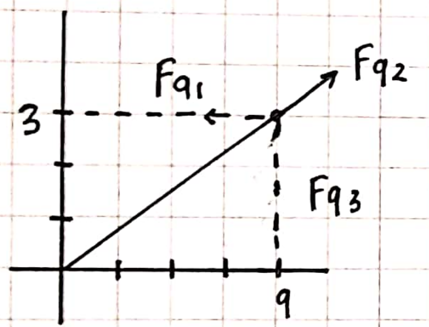
$$\vec{x} = x_1\hat{i} + x_2\hat{j} + x_3\hat{k}$$
$$\vec{v} = v_1\hat{i} + v_2\hat{j} + v_3\hat{k}$$



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

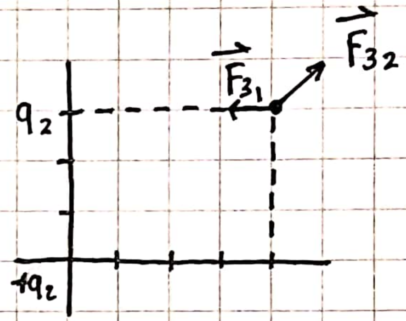
$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

example



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

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



$$F_{q_3} = \vec{F}_{31} + \vec{F}_{32}$$
$$= kq_3\left[\frac{q_1(-\hat{i})}{4^2} + \frac{q_2}{5^2}\frac{(4\hat{i}+3\hat{j})}{5}\right]$$

$\vec{V_1} = 4\hat{i} + 2\hat{j} + \hat{k}$

$\vec{V_2} = 2\hat{i} + 3\hat{k}$

$\vec{V_1} \cdot \vec{V_2} = 4\hat{i} \cdot 2\hat{j} + \hat{k} \cdot 3\hat{k}$

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

$= 8 + 3 = 11$

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

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

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

$= 9 + 16 - 9$

$= 25 - 9 = 34.$

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

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

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

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

$= 6 - 12 - 6$

$= -12$

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

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

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