

VECTOR ALGEBRA

①

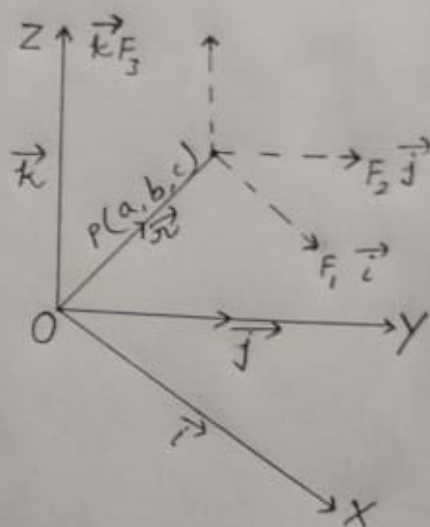
Q.4) A vector with components $[F_1, F_2, F_3]$ acts at the point (a, b, c) . Find its moment about the origin and also the coordinate axis.

The given vector is

$$\vec{F} = iF_1 + jF_2 + kF_3$$

The given point P on the line of action of \vec{F} is

$$\vec{r} = a\vec{i} + b\vec{j} + c\vec{k}$$



① The moment of \vec{F} about O is given by

$$\vec{G} = \vec{r} \times \vec{F} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ a & b & c \\ F_1 & F_2 & F_3 \end{vmatrix}$$

$$= (bF_3 - cF_2)\vec{i} + (cF_1 - aF_3)\vec{j} + (aF_2 - bF_1)\vec{k}$$

② The moment of \vec{F} about x-axis

$$\begin{aligned} &= [\vec{i} \ \vec{r} \ \vec{F}] \\ &= \vec{i} \cdot (\vec{r} \times \vec{F}) \\ &= i \cdot \{ (bF_3 - cF_2)\vec{i} + (cF_1 - aF_3)\vec{j} + (aF_2 - bF_1)\vec{k} \} \\ &= bF_3 - cF_2 \end{aligned}$$

(2)

(3) The moment of \vec{F} about y-axis is
similarly $= cF_1 - aF_3$

and (4) the moment of \vec{F} and z-axis is
 $= aF_2 - bF_1$

(1), (2), (3) and (4) give the required
solution of the problem.

Special cases

(i) $F_1 = 1, F_2 = 2, F_3 = 3$
 $a = 3, b = 2, c = 1$

(ii) $F_1 = 1, F_2 = 2, F_3 = 3$
 $a = 3, b = 4, c = 5$