1. A force $\vec{F} = 9i+3j-6k$ passes through a point A, whose position vector is $4i-2j+9k$. Find the moment of force about a point B, whose position vector is $6i-3j-7k$.

$\vec{F} = 9i+3j-6k$

Position vector of A, $\vec{r}_{OA} = 4i-2j+9k$

Position vector of B, $\vec{r}_{OB} = 6i-3j-7k$.

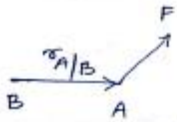
As Position vectors given,

$$\vec{M} = (\vec{r}_{OA} - \vec{r}_{OB}) \times \vec{F}$$

$$= [(4i-2j+9k) - (6i-3j-7k)] \times \vec{F}$$

$$= (-2i+j+16k) \times \vec{F}$$

$$= (-2i+j+16k) \times (9i+3j-6k)$$



$$= \begin{vmatrix} i & j & k \\ -2 & 1 & 16 \\ 9 & 3 & -6 \end{vmatrix}$$

$$= -54i + 132j - 15k.$$

2. A force $\vec{F} = 6i+2j-3k$ acts at A of coordinates $(1, 2, 3)$. Find the moment of this force about B of coordinates $(-2, 3, 4)$

Force Vector $\vec{F} = 6i+2j-3k$

Coordinates of A (1, 2, 3)
Coordinates of B (-2, 3, 4)

Its Coordinates are given,

$$\vec{M} = \begin{vmatrix} i & j & k \\ (x_A - x_B) & (y_A - y_B) & (z_A - z_B) \\ F_x & F_y & F_z \end{vmatrix}$$

$$= \begin{vmatrix} i & j & k \\ (1+2) & (2-3) & (3-4) \\ 6 & 2 & -3 \end{vmatrix}$$

$$= \begin{vmatrix} i & j & k \\ 3 & -1 & -1 \\ 6 & 2 & -3 \end{vmatrix}$$

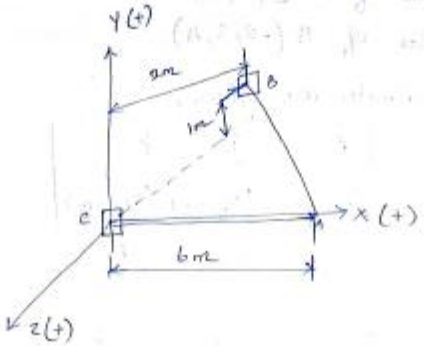
$$= i(3+2) - j(-9+6) + k(6+6)$$

$$= 5i + 3j + 12k$$

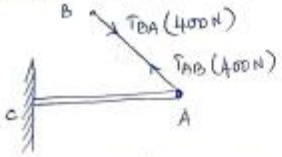
1. A Pipe AC, 6m long is fixed at C & stretched by a cable from A to a point B on the vertical wall as shown in figure. If the tension in the cable is 400N, determine

(i) Moment of the force exerted at A, about C &

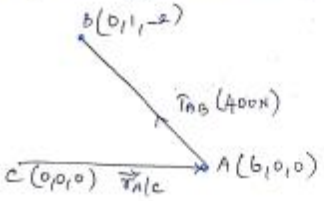
(ii) Moment of the force exerted at B, about C.



Tension in cable AB & the pipe AC is shown



∴ Moment of force exerted at A, about C.



In this, force directed from A to B.

A (6, 0, 0)

B (0, 1, -2)

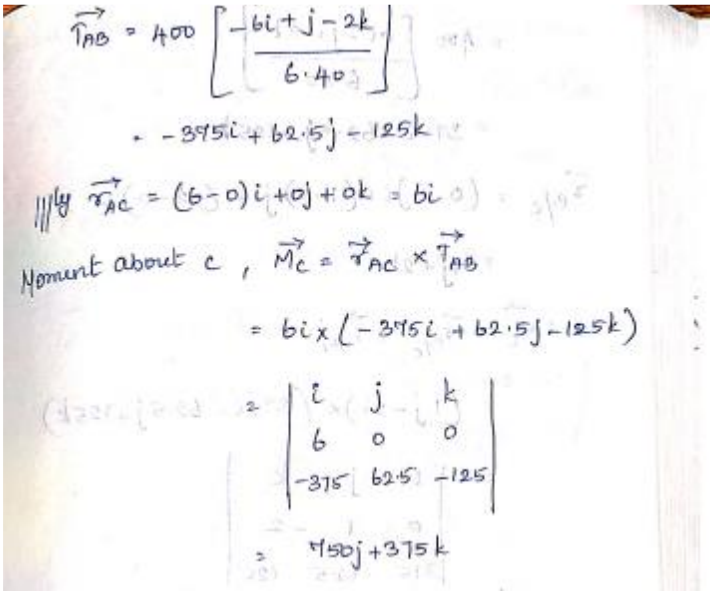
C (0, 0, 0)

→ T_{AB} in vector form

$$\vec{T}_{AB} = T_{AB} \cdot \lambda_{AB}$$

$$\lambda_{AB} = \frac{(0-6)i + (1-0)j + (-2-0)k}{\sqrt{(-6)^2 + (1)^2 + (-2)^2}}$$

$$= -6i + 1j - 2k$$



$$\vec{T}_{AB} = 400\left[\frac{-6i+j-2k}{6.40}\right]$$

$$= -375i + 62.5j - 125k$$

$$\vec{r}_{AC} = (6-0)i + 0j + 0k = 6i$$

Moment about C, $\vec{M}_C = \vec{r}_{AC} \times \vec{T}_{AB}$

$$= 6i \times (-375i + 62.5j - 125k)$$

$$= \begin{vmatrix} i & j & k \\ 6 & 0 & 0 \\ -375 & 62.5 & -125 \end{vmatrix}$$

$$= 750j + 375k$$