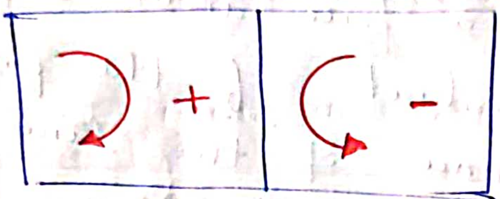
Moment of F_1 about 'O' = $F_1 \times a$ (clockwise)

But downward force F_2 applied on the left hand side of the fulcrum 'O' at the distance 'b', produces anticlockwise moment about 'O'.

Moment of F_2 about 'O' = $F_2 \times b$ (anticlockwise)

Sign Convention.



Unit of Moment:

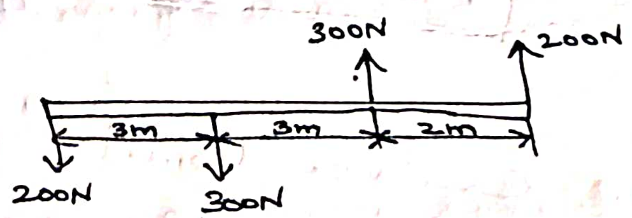
In SI system, Unit of moment is Newton-meter (Nm). i.e, Force is measured in Newton and distance is measured in meter.

① Find the resultant of the force system shown in figure.

Soln:

only vertical forces are present

$\therefore \Sigma H = 0$



$$\Rightarrow \Sigma V = R = -200 - 300 + 300 + 200 = 0$$

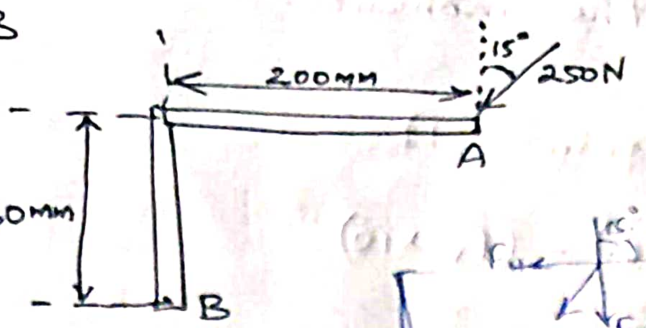
$$\boxed{R = 0}$$

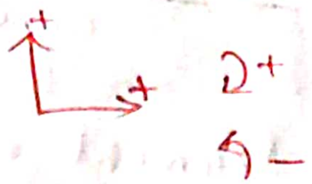
Resultant moment about O; $M_O = 0 + (300 \times 3) - (300 \times 6) - (200 \times 8)$

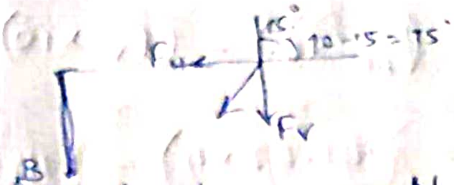
$$M_O = -2500 \text{ Nm}$$

$$\boxed{M_O = 2500 \text{Nm anticlockwise}}$$

② Calculate the moment of the 250N force about point B







Resolving the inclined force 250N into its components

Horizontal component $F\cos\theta = 250 \cos 75°$

$F_H = 64.70N$

Vertical component $F\sin\theta = 250 \sin 75°$

$F_V = 241.48N$

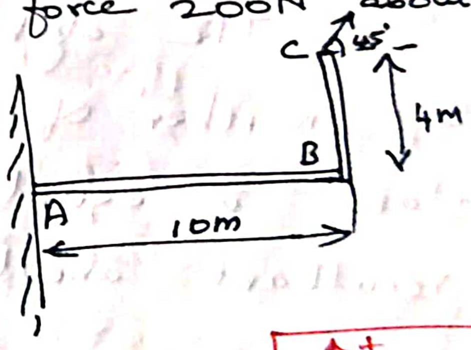
Moment about B, $M_B = -(F_H \times 30) + (F_V \times 200)$

$= ~~\text{...}~~ -(64.7 \times 30) + (241.48 \times 200)$

$\boxed{1MM = 10^{-3}m}$

$\boxed{M_B = 46.355 Nm \text{ clockwise}}$

③ Compute the moments of the force 200N about points A & B



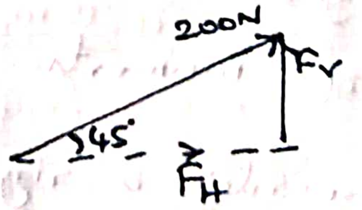
Soln: step 1: Resolve the forces into components

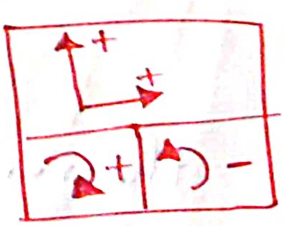
$F_H = 200 \cos 45°$

$= 141.42N$

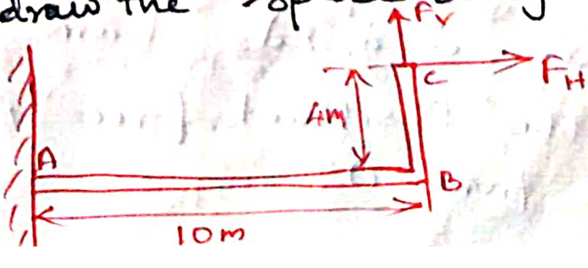
$F_V = 200 \sin 45°$

$= 141.42N$





step 2: Redraw the space diagram.



Step 3:

Compute the moments:

Moment about point A:

$M_A = (F_H \times 4) - (F_V \times 10)$

$= (141.42 \times 4) - (141.42 \times 10) = -848.52$

$\boxed{M_A = 848.52 \text{ Nm anticlockwise}}$

Moment about point B:

$M_B = (F_H \times 4) - (F_V \times 0)$ {Line of action of F_V passes through point B

$= 141.42 \times 4 = 565.68$

$\boxed{M_B = 565.68 \text{ clockwise}}$

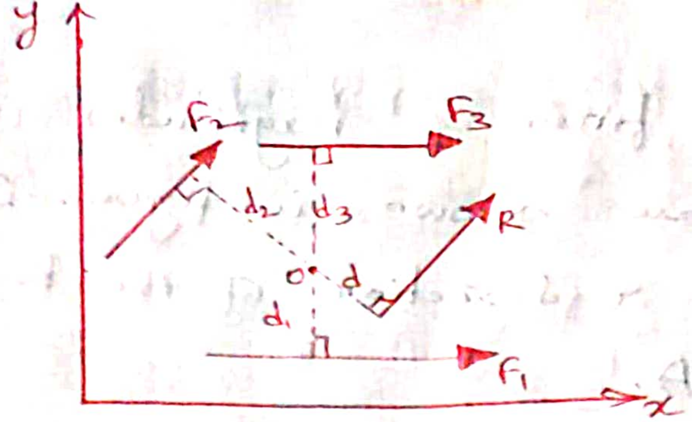
VARIGNON THEOREM:

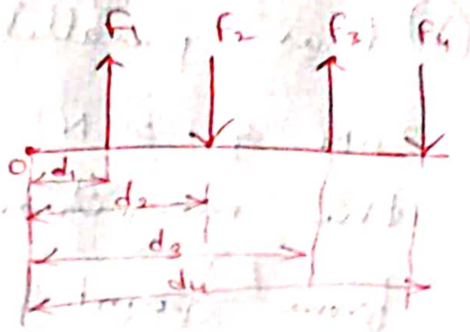
The algebric sum of the moments of any number of forces about any point in their plane is equal to the moment of their resultant about the same point.

Varignon theorem is also known as the theorem of moments.

Consider a rigid body subjected to three coplanar forces F_1, F_2 & F_3 as shown in fig at $\perp^r$ distances d_1, d_2 & d_3 from a point 'O'.

Let the Resultant force 'R' is at a distance 'd' from 'O'.



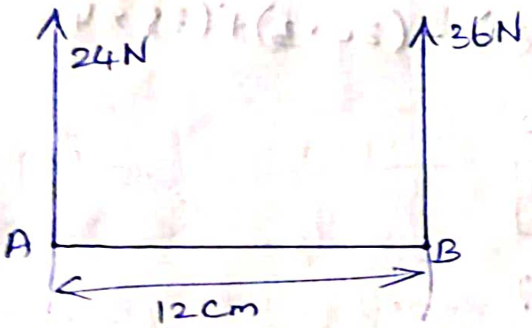


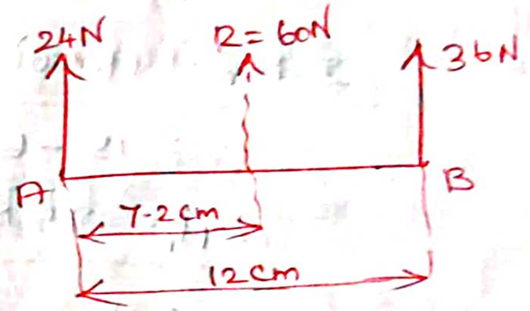
From Varignon theorem:

Sum of moments of the forces F_1, F_2, F_3 about 'O' is equal to the moment of Resultant force 'R' about same point 'O'.

ie, $$\boxed{F_1 d_1 + F_2 d_2 + F_3 d_3 = R d}$$

④ Find the resultant force for the parallel force system.





Solution: Magnitude of resultant force

$$R = 24 + 36$$
$$\boxed{R = 60N}$$

Location of R force:

Applying varignon theorem at point A

$$\Sigma M_A = R \times x$$

$$(24 \times 0) - (36 \times 12) = 60 \times x$$
$$-432\ Ncm = 60 \times x$$
$$\boxed{x = 7.2\ cm}$$