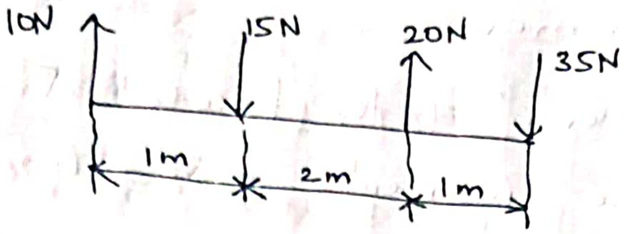
⑤ Four parallel forces of magnitudes 10N, 15N, 20N & 35N are shown in figure. Determine the magnitude & direction of the R. force from point A.



Magnitude of Resultant force.

$$R = 10 - 15 + 20 - 35$$

$$R = -20N$$

$$\boxed{R = 20N \text{ acting downwards}}$$

Moments of forces about point A.

$$\Sigma M_A = (10 \times 0) + (15 \times 1) - (20 \times 3) + (35 \times 4)$$

$$= 15 - 60 + 140$$

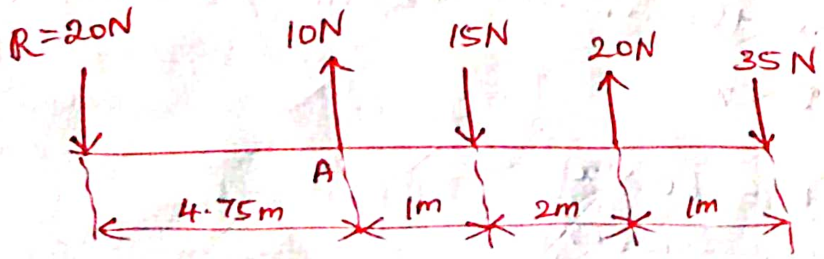
$$\boxed{\Sigma M_A = 95 \, Nm}$$

Location of R-force : $x = ?$

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

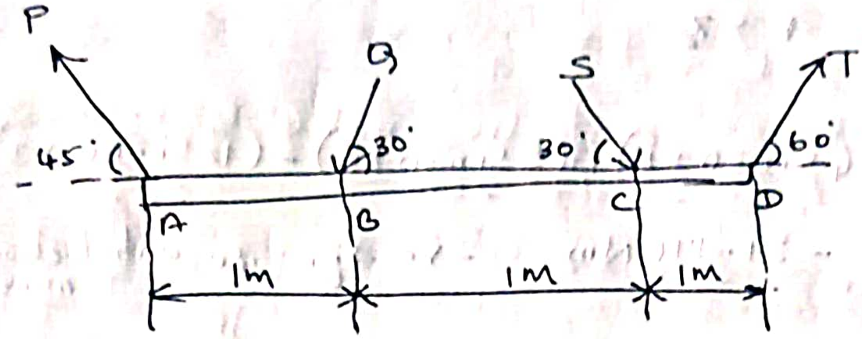
$$-20 \times x = 95$$

$$\boxed{x = -4.75 \, m}$$



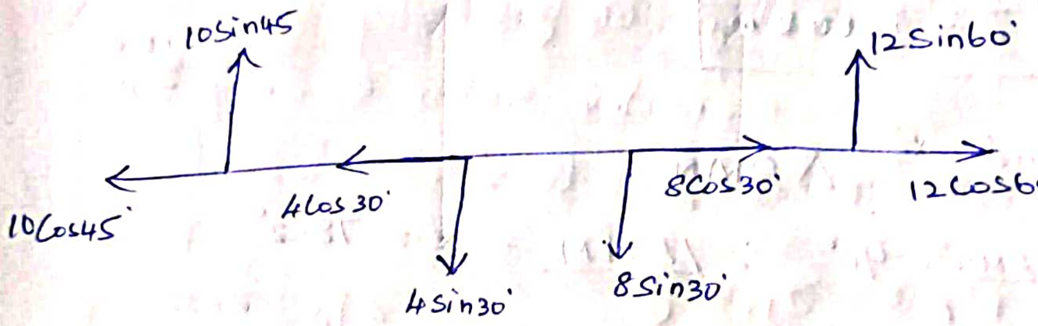
15N,
rmine

(6) ABCD is a weightless rod under the action of the four forces P, Q, S & T as shown in fig. P = 10N; Q = 4N; S = 8N; T = 12N. Calculate the resultant & mark the same in direction with respect to the end A of the rod.



Soln:

Resolving the forces in to horizontal & vertical components and redrawing the space diagram.

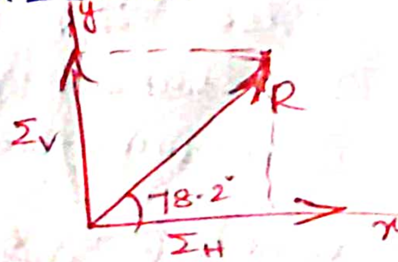


$\Sigma H = -10\cos 45 - 4\cos 30 + 8\cos 30 + 12\cos 60°$

$= 2.393N$

$\Sigma V = 10\sin 45° - 4\sin 30 - 8\sin 30° + 12\sin 60$

$= 11.463N$

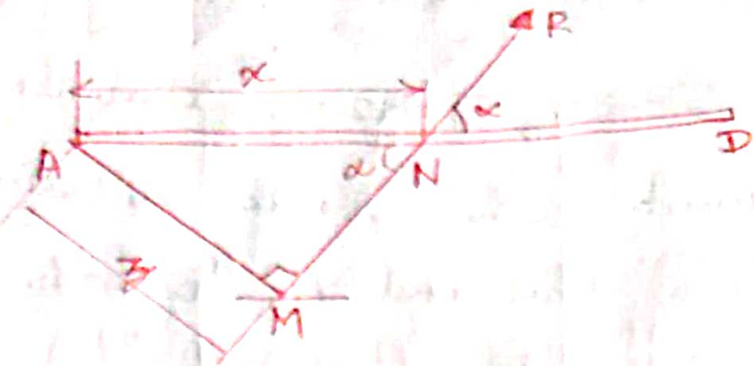


Resultant force $R = \sqrt{(\Sigma V)^2 + (\Sigma H)^2}$

$R = \sqrt{137.426} = 11.71N$

Direction; $\alpha = \tan^{-1}(V/H) = 78.2°$

Location of Resultant w.r.t. A



$\Sigma M_A = R \times z$

$\Sigma M_A = (6 \sin 30 \times 1) + (8 \sin 30 \times 2) - (12 \sin 60 \times 3)$

$= -21.176 \text{ Nm}$ (-ve sign so anticlockwise moment)

$\Sigma M_A = R \times z$

$21.176 = 11.71 \times z$

$\boxed{z = 1.808 \text{ m}}$

To find x ΔAMN

$\angle AMN = 90^\circ$; $\angle ANM = \alpha = 78.2^\circ$

$\therefore \sin \alpha = \dfrac{AM}{AN}$; $\sin 78.2 = \dfrac{z}{x} = \dfrac{1.808}{x}$

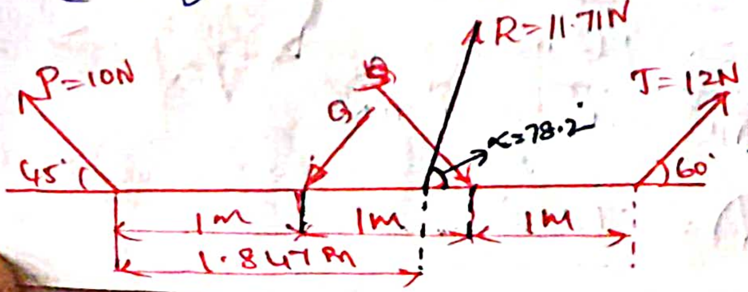
$\boxed{x = 1.847 \text{m}}$

(OR)

{Use Σv alone for resultant force in varignon theorem}

$\Sigma M_A = \Sigma v \times x$

$x = \dfrac{\Sigma M_A}{\Sigma v} = \dfrac{21.176}{11.463}$



$\boxed{x = 1.847 \text{m}}$