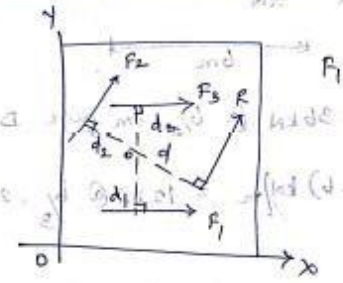
VARIGNON'S THEOREM:

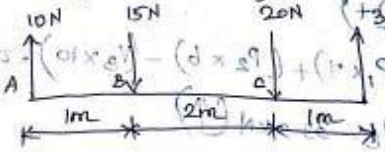
The algebraic sum of the moments of any number of forces about any point in their plane is equal to the moment of their resultant force about the same point. It is also known as theorem of moments.



$F_1 d_1 + F_2 d_2 + F_3 d_3 = Rd$

Used for locating the resultant force.

1) Four Parallel forces of magnitudes 10N, 15N, 20N and 35N are shown in figure. Determine the magnitude & direction of the resultant. Find the distance of resultant from point A.



Magnitude of Resultant force $R = 10 - 15 - 20 + 35$

$= 10N$

Location;

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

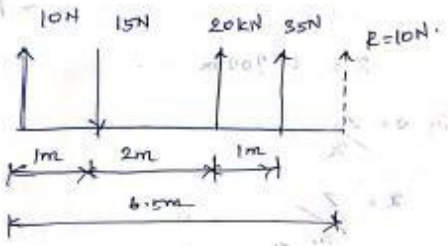
$= 15 + 60 - 140 = -65\ Nm.$

Moment of Resultant force $= R \times x$

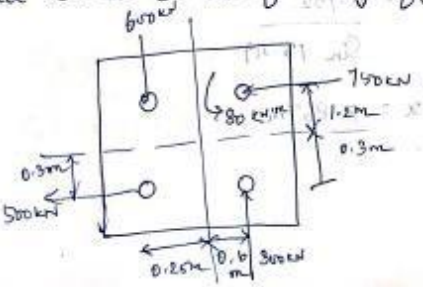
$R \times x = \Sigma M_A$

$10 \times x = 65$

$x = 65/10 = 6.5m$



2) Find R & x @ the following figure.



* $\Sigma H = -500 - 700$

$= -1250\ kN$

* $\Sigma V = -600 + 300$

$= -300\ kN$

* $R = \sqrt{\Sigma H^2 + \Sigma V^2}$

$= 1285.49\ kN$

* $\alpha = \tan^{-1}\left(\frac{\Sigma V}{\Sigma H}\right)$

$= 13.495°$

* Apply Varignon's Theorem

$(500 \times 0.3) - (600 \times 0.25) - (300 \times 0.6) - (750 \times 1.2) - 80 = R.Z$

$Z = 0.902\ m$

$\sin\alpha = Z/x$

$x = \frac{Z}{\sin\alpha}$

$= \frac{0.902}{\sin 13.49}$

* $x = 3.867\ m$