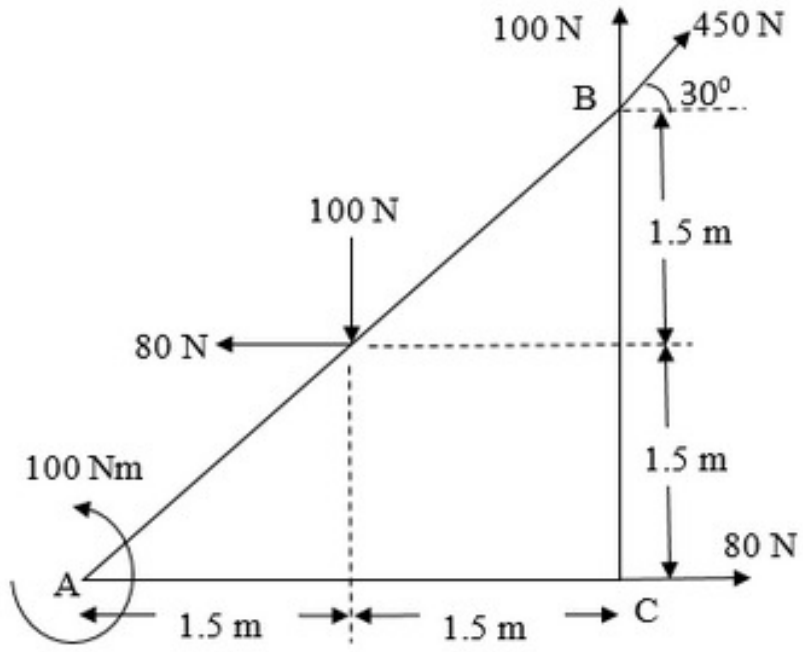
TUTORIAL (Additional)

1.

Locate the resultant of a force system shown in the figure with respect to C.



$\Sigma F_x = -80 + 450\cos 30 + 80 = 389.71\ N$

$\Sigma F_y = 100 + 450 \sin 30 - 100 = 225\ N$

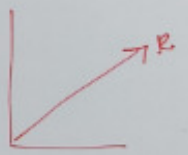
$R = 449.99\ N \Longrightarrow \qquad \theta = 30^\circ \Longrightarrow$

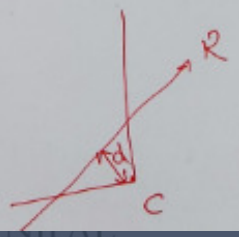
(↻ +ve)

$\Sigma M_C = -100 - 80 \times 1.5 - 100 \times 1.5 + 450 \sin 30 \times 3$

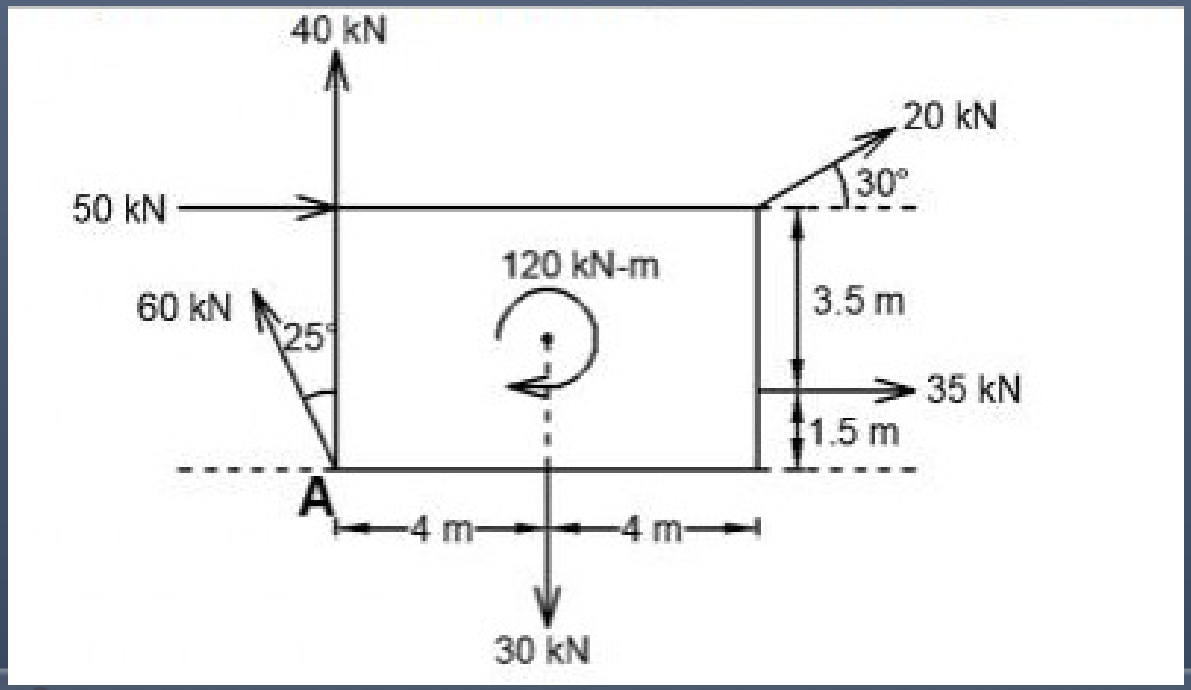
$= 305\ N-m \Longrightarrow$

$d = \frac{\Sigma M_C}{R} = 0.67\ m.$





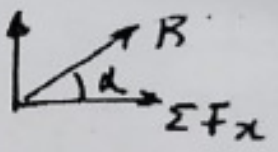
2. Locate the resultant of coplanar non-concurrent force system shown in figure with respect to 'A'.



$+\rightarrow \quad \Sigma F_x = 50 + 20\cos 20^\circ + 35 - 60\sin 25 = 76.96\,kN\ (\rightarrow)$

$+\uparrow \quad \Sigma F_y = 40 + 20\sin 30^\circ + 60\cos 25 - 30 = 74.378\,kN\ (\uparrow)$

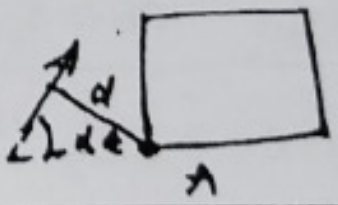
$R = 107.028\,kN \qquad \alpha = 44.02^\circ$



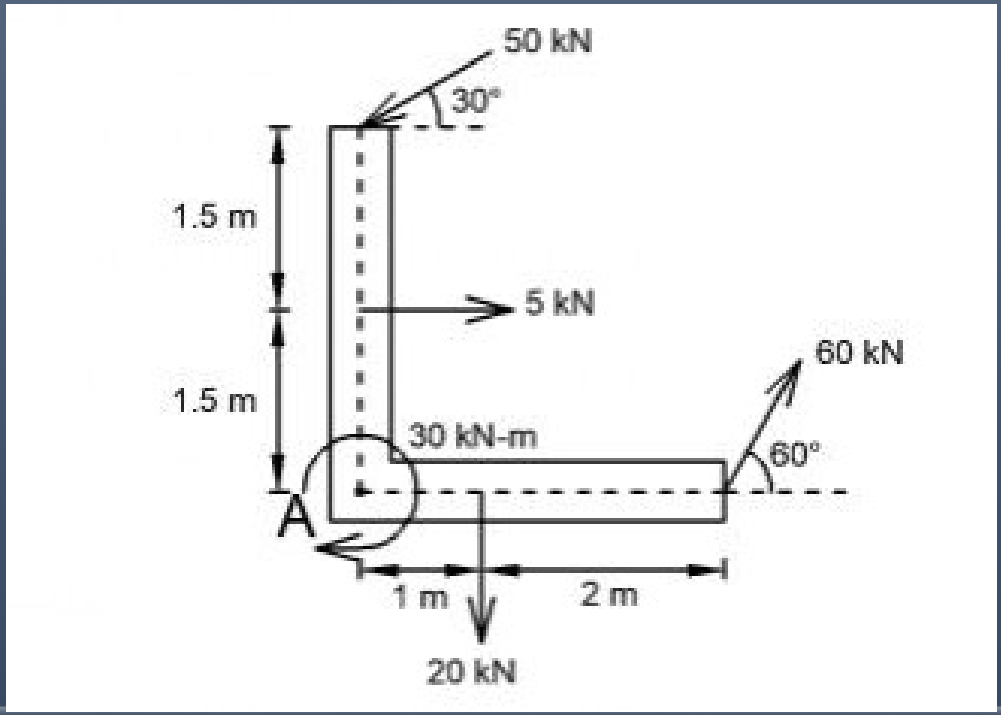
$\circlearrowright \Sigma M_A = 50\times 5 + 30\times 4 + 35\times 1.5 + (20\cos 30^\circ)\times 5 - (20\sin 30^\circ)$

$+120 = 549.102\,kN\text{-}m\ [2]$

$d = \left|\frac{\Sigma M_A}{R}\right| = 5.13\,m$



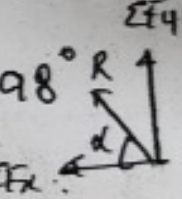
3. Locate the resultant of coplanar non-concurrent force system shown in figure with respect to ‘A’.



$\underset{+ve}{\rightarrow} \Sigma F_x = -50\cos 30^\circ + 5 + 60\cos 60^\circ = -8.301\,kN$ (or) $8.301\,kN\ (\leftarrow)$

$\underset{+ve}{\uparrow} \Sigma F_y = -50\sin 30^\circ + 60\sin 60^\circ - 20 = 6.961\,kN\ (\uparrow)$

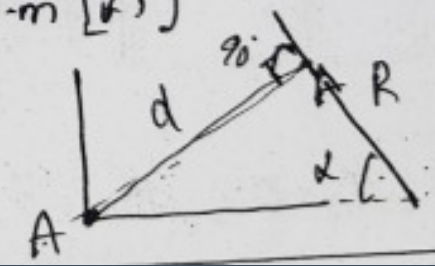
$R = \sqrt{8.301^2 + 6.961^2} = 10.834\,kN \quad \alpha = \tan^{-1}\left(\frac{\Sigma F_y}{\Sigma F_x}\right) = 39.98^\circ$



$\underset{+ve}{\circlearrowleft} \Sigma M_A = 5\times 1.5 + 30 - (50\cos 30^\circ)\times 3 + 20\times 1 - (60\times \sin 60^\circ)\times 3$

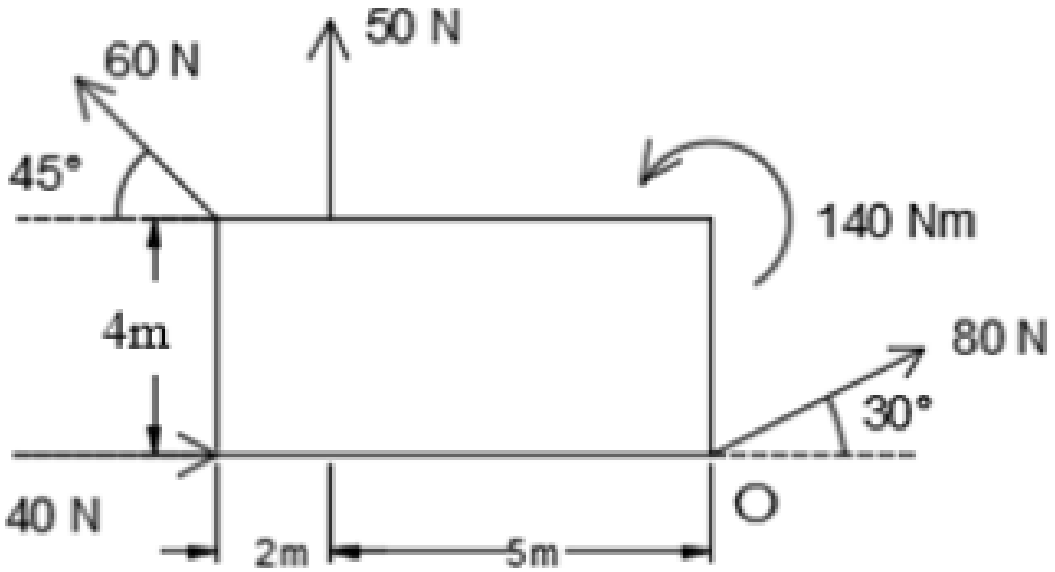
$= -228.29\,kN\text{-}m$ (or) $228.29\,kN\text{-}m\ [\curvearrowleft]$

$d = \left|\frac{\Sigma M_A}{R}\right| = 21.07m$ (or) $x = 32.795m$, $y = 27.501m$



4.

Find magnitude, direction and position of a resultant force for a system of forces shown in the figure with respect to 'O'.



$\xrightarrow{+}\ \Sigma F_x = 40 + 80\cos 30^\circ - 60\cos 45^\circ = 66.86\ N$

$+\uparrow \Sigma F_y = 50 + 80\sin 30^\circ + 60\sin 45^\circ = 132.43\ N$

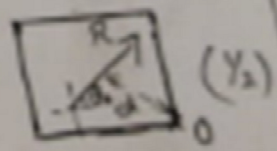
Resultant $R = \sqrt{(66.86^2 + 132.43^2)} = 148.351\ N$

$\theta_c = \tan^{-1}\left\{\frac{\Sigma F_y}{\Sigma F_x}\right\} = 63.2^\circ$

$\circlearrowleft +\Sigma M_O ;\ R \times d = -140 + (50)(5) - (60\cos 45^\circ)(4) + (60\sin 45^\circ)(7)$

$(148.351)\, d = 237.279$

$d = 1.6\ m \quad (\frac{1}{2})$



$(\frac{1}{2})$