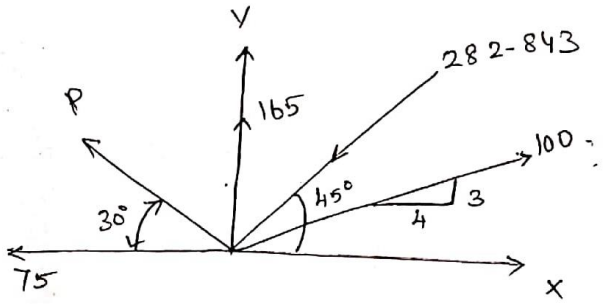
(2) If five forces act on a particle as shown in Fig. and the algebraic sum of horizontal components of all these forces is −324.904 kN, calculate the magnitude of "P" and the resultant of all the forces.

Soln:



The inclination of 100kN force with x-axis is

$$\tan\theta = 3/4 = 36.87^\circ$$

All the forces are represented in such a way that they act away from the particle as shown in fig.

$$\Sigma F_x = -75 - P\cos 30^\circ - 282.843\cos 45^\circ + 100\cos 36.87^\circ$$

$$-P\cos 30^\circ - 195 = -324.904$$

$$\boxed{P = 150\text{ kN}}$$

$$\Sigma F_y = P\sin 30^\circ + 165 + 100\sin(36.87^\circ) - 282.843(\sin 45^\circ)$$

$$= 100\text{ kN}.$$

Thus for particle

$$\Sigma F_x = -324.904\text{ kN}$$

$$\Sigma F_y = 100\text{ kN}$$

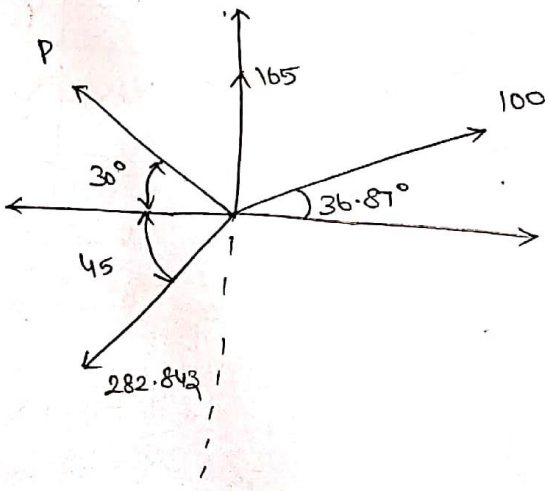
$$R = \sqrt{\Sigma F_x^2 + \Sigma F_y^2}$$

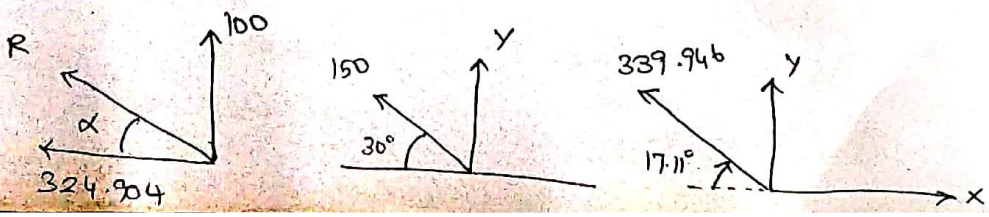
$$= \sqrt{(324.904)^2 + (100)^2}$$

$$R = 339.946\text{ kN}$$

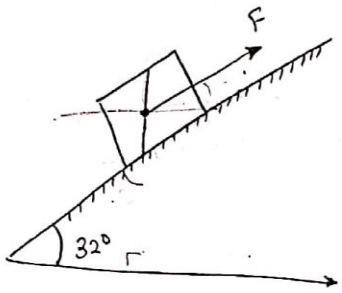
$$\tan\alpha = \frac{\Sigma F_y}{\Sigma F_x} = \frac{100}{324.904}$$

$$\boxed{\alpha = 17.11^\circ}$$



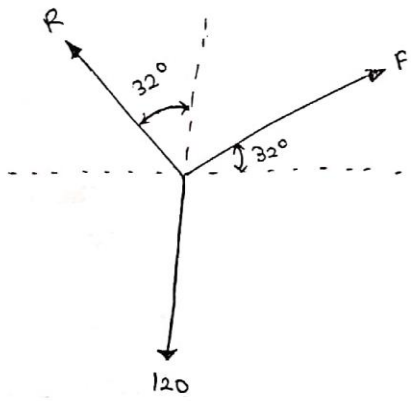


(1) Fig shows a block of weight 120N on a smooth inclined plane. The plane makes an angle of 32° with horizontal and the force "F" is applied parallel to the plane. Find the values of "F" and normal reaction.



(a)

F.B.D



Soln:

$\Sigma F_x = 0$: $F \cos 32° - R \sin 32° = 0$

$\Sigma F_y = 0$: $F \sin 32° - R \cos 32° = 0$

$$\begin{bmatrix} 0.848 & -0.53 \\ 0.530 & 0.848 \end{bmatrix} \begin{Bmatrix} F \\ R \end{Bmatrix} = \begin{Bmatrix} 0 \\ 120 \end{Bmatrix}$$

$$\begin{Bmatrix} F \\ R \end{Bmatrix} = \begin{bmatrix} 0.848 & 0.530 \\ -0.530 & 0.848 \end{bmatrix} \begin{Bmatrix} 0 \\ 120 \end{Bmatrix} = \begin{Bmatrix} 63.6 \\ 101.76 \end{Bmatrix}$$

This can also be solved by resolving along tangential & normal directions of plane.

$\Sigma F_T = 0$: $F - 120 \sin 32° = 0$

$\Sigma F_N = 0$: $R - 120 \cos 32° = 0$

$F = 63.6N$

$R = 101.76N$