

Given:  $F_1 = P$   
 $F_3 = 800\text{ N}$   
 $F_2 = 775\text{ N}$

Resultant,  $R = 500\text{ N}$   
 Resultant is a vertical force acting along positive y-axis

Soln: It is the resultant force  $500\text{ N}$  in (+ve) y  
 As resultant force is vertical force, it is equal  
 to the net vertical force, & also the net horizontal  
 force is zero.

i)  $\Sigma V = R = 500\text{ N}$   
 $\Sigma H = 0$

$$\left[ \begin{array}{l} \Sigma n 0 = 0 \\ \cos 0 = 1 \\ \therefore 775 \sin 0 = 0 \\ 775 \cos 0 = 775 \end{array} \right]$$

$\Rightarrow \Sigma H = P \cos \theta - 775 \cos 0 + 800 \cos 20$

$0 = P \cos \theta - 775 + 751.75$

$P \cos \theta = 23.25\text{ N}$  ——— ①

$\Rightarrow \Sigma V = P \sin \theta - 800 \sin 20$

$500 = P \sin \theta - 273.616$

$P \sin \theta = 773.616\text{ N}$  ——— ②

Solving  
 ②/①

$\Rightarrow \frac{P \sin \theta}{P \cos \theta} = \frac{773.616}{23.25} = 33.27$

$\tan \theta = 33.27$

$\theta = \tan^{-1}(33.27)$

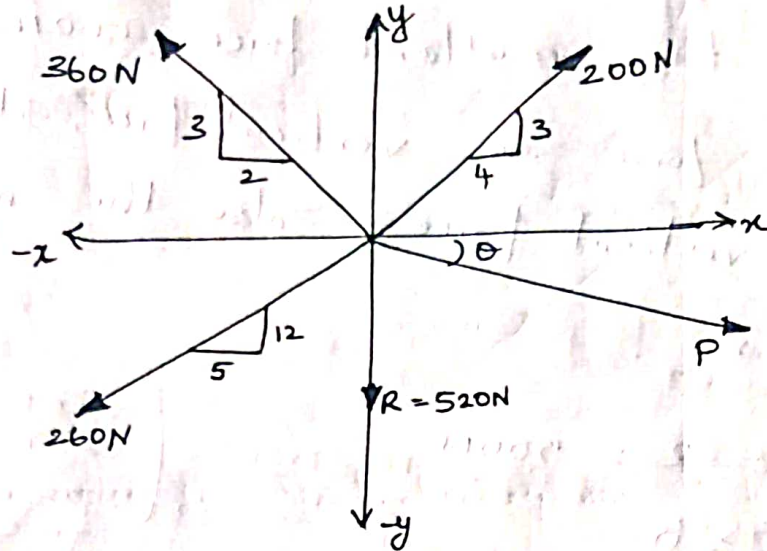
$\theta = 88.27^\circ$

Substituting  
 $\theta$  in ①

$\Rightarrow P \cos \theta = 23.25$   
 $P \cos 88.27 = 23.25$

$P = 770.13\text{ N}$

8) The resultant of the force system shown in figure is 520N along the negative direction of y-axis. Determine  $P$  &  $\theta$



Given data

$$F_1 = 200\text{N}$$

$$F_2 = P$$

$$F_3 = 260\text{N}$$

$$F_4 = 360\text{N}$$

Soln.

$$\theta_1 = \tan^{-1}\left(\frac{3}{4}\right) = 36.87^\circ$$

$$\theta_2 = \theta$$

$$\theta_3 = \tan^{-1}\left(\frac{12}{5}\right) = 67.38^\circ$$

$$\theta_4 = \tan^{-1}\left(\frac{3}{2}\right) = 56.31^\circ$$

Since resultant is vertical force.

$$\Sigma H = 0 ; \quad \Sigma V = R \quad \left. \begin{array}{l} \text{Resultant in negative y} \\ \therefore R = -500\text{N} \end{array} \right\}$$

Algebraic sum of horizontal forces:

$$\Sigma H = 200 \cos 36.87 + P \cos \theta - 260 \cos 67.38 - 360 \cos 56.31$$

$$0 = 160 + P \cos \theta - 100 - 199.69$$

$$P \cos \theta = 139.7 \quad \text{--- (1)}$$

Algebraic sum of vertical forces:

$$\Sigma V = 200 \sin 36.87 - P \sin \theta - 260 \sin 67.38 - 360 \sin 56.31$$

$$-520 = 120 - P \sin \theta - 240 + 299.53$$



$$-520 = 179.53 - P \sin \theta$$

$$P \sin \theta = 699.53 \quad \text{--- (2)}$$

Solving:  $\frac{(2)}{(1)} \Rightarrow \frac{P \sin \theta}{P \cos \theta} = \frac{699.53}{139.69} = 5.007$

$$\tan \theta = 5.007$$

$$\theta = \tan^{-1}(5.007)$$

$$\boxed{\theta = 78.70^\circ}$$

Sub.  $\theta$  in (1)  $P \cos \theta = 139.69$

$$P = \frac{139.69}{\cos 78.70^\circ} = 713.2$$

$$\boxed{P = 713.2 \text{ N}}$$