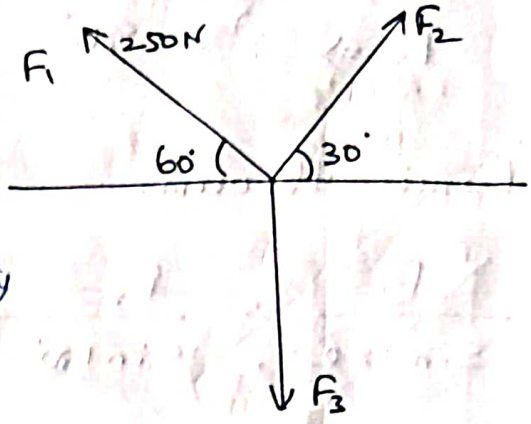
(11) The forces shown in figure are acting on a particle and keep the particle in equilibrium. The magnitude of force F_1 is 250N. Find the magnitude of forces F_2 & F_3.



Method 1:

The given system of forces are in equilibrium and they are coplanar, concurrent

$$R = 0; \Rightarrow R = \sqrt{\Sigma_V^2 + \Sigma_H^2}$$

i.e., $\Sigma_H = 0$ & $\Sigma_V = 0$.

$\Sigma_H = 0$ ($\longrightarrow$ +)

$\Rightarrow F_2 \cos 30^\circ - F_1 \cos 60^\circ = 0$ { Force F_3 has no horizontal component }

$$F_2 = \frac{F_1 \cos 60}{\cos 30^\circ} = \frac{250 \cos 60}{\cos 30^\circ}$$

$$\boxed{F_2 = 144.33\,N}$$

$\Sigma_V = 0$; $F_1 \sin 60^\circ + F_2 \sin 30^\circ - F_3 = 0$

($\uparrow$ +)

$250 \sin 60^\circ + 144.33 \sin 30^\circ = F_3$

$$\boxed{F_3 = 288.67\,N}$$

Method 2: (Lamis Theorem)

Here there are only three forces and are acting concurrent and outwards a point, Hence Lamis theorem may be used.

The angles opposite to the forces.

$F_1 \Rightarrow \alpha = 90 + 30^\circ = 120^\circ$

$F_2 \Rightarrow \beta = 90 + 60^\circ = 150^\circ$

$F_3 \Rightarrow \gamma = 90^\circ$

By Lamis theorem.

$$\frac{F_1}{\sin 120^\circ} = \frac{F_2}{\sin 150^\circ} = \frac{F_3}{\sin 90^\circ}$$

$$\frac{250}{\sin 120^\circ} = \frac{F_2}{\sin 150^\circ} = \frac{F_3}{\sin 90^\circ}$$

Solving weget:

$$\frac{250}{\sin 120^\circ} = \frac{F_2}{\sin 150^\circ}$$

$$F_2 = \frac{250 \times \sin 150}{\sin 120}$$

$$\boxed{F_2 = 144.33\,N}$$

$$\frac{250}{\sin 120^\circ} = \frac{F_3}{\sin 90^\circ}$$

$$F_3 = \frac{250 \times \sin 90}{\sin 120}$$

$$\boxed{F_3 = 288.675\,N}$$