

$$\textcircled{1} T_1 + T_2 + T_3 = \frac{4}{3}W + W$$

$$\Rightarrow T_1 + T_2 + T_3 = \frac{7}{3}W$$

$\textcircled{2}$ Taking moments about the y-axis:

$$T_2(4) + T_1(0) + T_3(0) = \frac{4}{3}W(2) + W\left(\frac{4}{3}\right)$$

$$\Rightarrow 4T_2 = 4W$$

$$\Rightarrow T_2 = W$$

$\textcircled{3}$ Taking moments about the x-axis:

$$T_1(3) + T_2(0) + T_3(0) = \frac{4}{3}W(1) + W(1)$$

$$\Rightarrow T_1 = \frac{7}{9}W$$

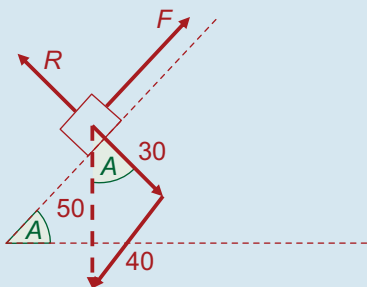
$$\text{But } T_1 + T_2 + T_3 = \frac{7}{3}W$$

$$\Rightarrow T_3 = \frac{5}{9}W$$

$$\text{Answer: } \frac{7}{9}W, W, \frac{5}{9}W$$

Exercise 8H

Q. 1.



$$\tan A = \frac{4}{3}$$

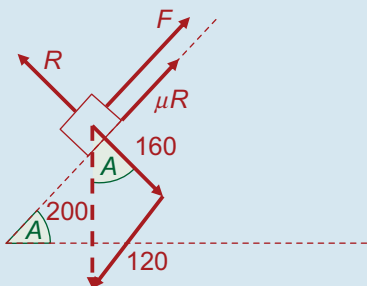
$$\Rightarrow \cos A = \frac{3}{5} \text{ and } \sin A = \frac{4}{5}$$

Component of weight acting down the

$$\text{plane} = 50 \sin A = 50\left(\frac{4}{5}\right) = 40 \text{ N}$$

$$\Rightarrow F = 40 \text{ N}$$

Q. 2.



$$\tan A = \frac{3}{4}$$

$$\Rightarrow \cos A = \frac{4}{5} \text{ and } \sin A = \frac{3}{5}$$

Component of weight acting down the

$$\text{plane} = 200 \sin A = 200\left(\frac{3}{5}\right) = 120 \text{ N}$$

Component of weight acting perpendicular

$$\text{to the plane} = 200 \cos A = 200\left(\frac{4}{5}\right) = 160 \text{ N}$$

$$\Rightarrow R = 160 \text{ N}$$

$$\Rightarrow \text{Friction} = \mu R$$

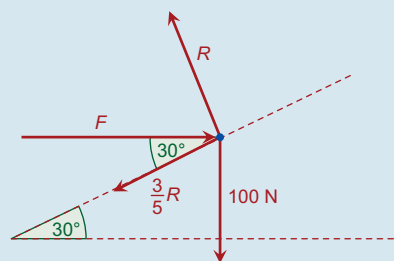
$$= \frac{1}{2}(160)$$

$$= 80 \text{ N}$$

$$\Rightarrow F + 80 = 120$$

$$\Rightarrow F = 40 \text{ N}$$

Q. 3. Here is a diagram of all the forces acting on the particle



Component of weight acting down the

$$\text{plane} = 100 \sin 30^\circ = 100\left(\frac{1}{2}\right) = 50 \text{ N}$$

Component of weight acting perpendicular

$$\text{to the plane} = 100 \cos 30^\circ = 100\left(\frac{\sqrt{3}}{2}\right) = 50\sqrt{3} \text{ N}$$

Component of F acting along

$$\text{the plane} = F \cos 30^\circ = \frac{\sqrt{3}}{2}F$$

Component of F acting perpendicular to

$$\text{the plane} = F \sin 30^\circ = \frac{1}{2}F$$

$$\Rightarrow R = 50\sqrt{3} + \frac{1}{2}F$$

$$\text{But, } \frac{3}{5}R + 50 = \frac{\sqrt{3}}{2}F$$

$$\Rightarrow \frac{3}{5}\left[50\sqrt{3} + \frac{1}{2}F\right] + 50 = \frac{\sqrt{3}}{2}F$$

$$\Rightarrow 30\sqrt{3} + \frac{3}{10}F + 50 = \frac{\sqrt{3}}{2}F$$

$$\Rightarrow 300\sqrt{3} + 3F + 500 = 5\sqrt{3}F$$

$$\Rightarrow F(5\sqrt{3} - 3) = 300\sqrt{3} + 500$$

$$\Rightarrow F = \frac{100(3\sqrt{3} + 5)}{5\sqrt{3} - 3} \approx 180 \text{ N}$$