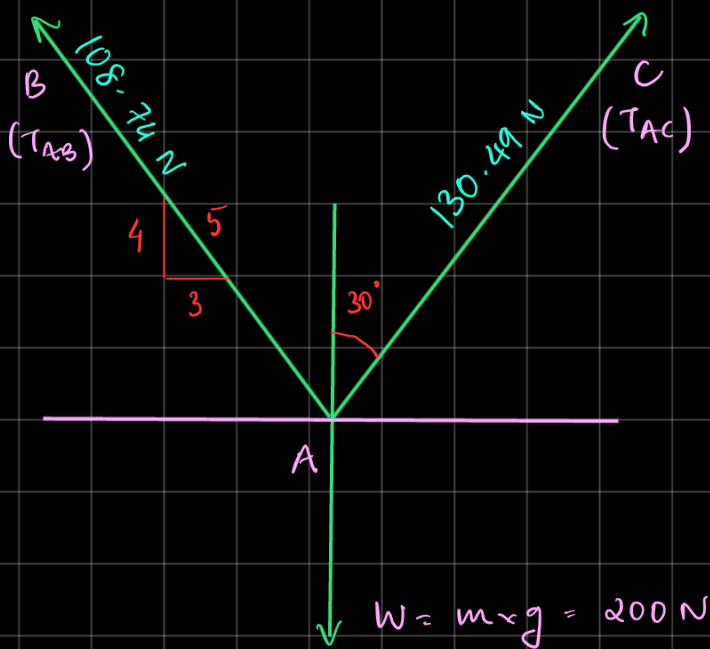


1.



- AB and AC are tension forces on the rope.
- W is the force due to weight.

$$\sum F_x = 0$$

$$-\frac{3}{5} T_{AB} + T_{AC} \sin \theta = 0$$

$$T_{AB} = T_{AC} \times \frac{1}{2} \times \frac{5}{3}$$

$$= \frac{5}{6} T_{AC}$$

$$\sum F_y = 0$$

$$\frac{4}{5} T_{AB} + T_{AC} \cos \theta - 200 = 0$$

$$\frac{2}{5} \times \frac{5}{3} T_{AC} + \frac{\sqrt{3}}{2} T_{AC} = 200$$

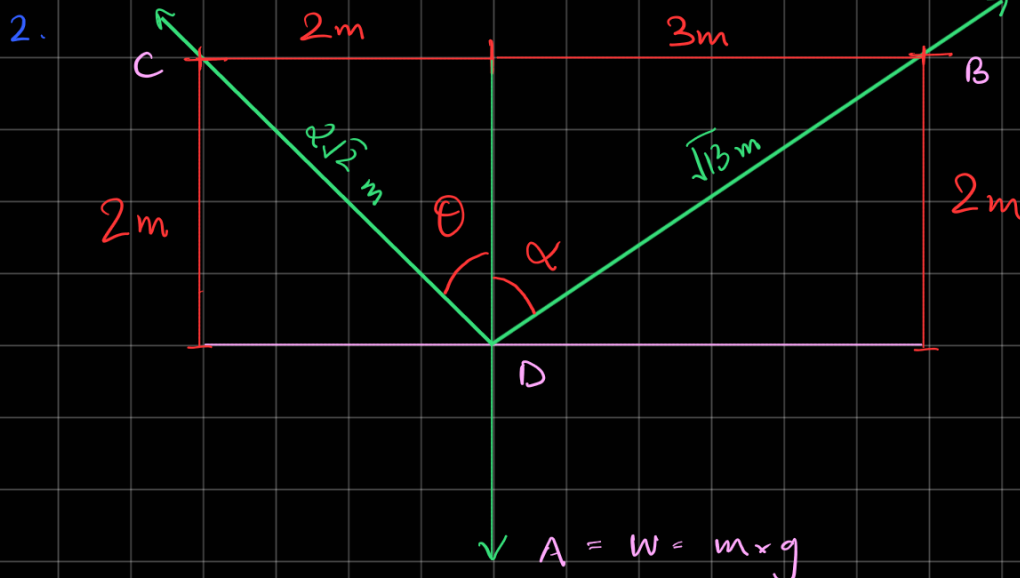
$$\frac{4 + 3\sqrt{3}}{6} T_{AC} = 200$$

$$T_{AC} = \frac{200 \times 6}{4 + 3\sqrt{3}}$$

$$= \underline{130.49 \text{ N}}$$

$$T_{AB} = \frac{5}{6} \times 130.49$$

$$= \underline{108.74 \text{ N}}$$



• CD and BD are tension forces on the rope and spring

• AD is the force due to weight of the crane.

$$\begin{aligned}
 A &= W = m \times g \\
 &= 40 \times 9.81 \\
 &= 392.4 \text{ N}
 \end{aligned}$$

$$\sum F_x = 0$$

$$F_{DB} \sin \alpha - F_{DC} \sin \theta = 0$$

$$\frac{3}{\sqrt{13}} F_{DB} - \frac{1}{\sqrt{2}} F_{DC} = 0$$

$$\frac{3}{\sqrt{13}} F_{DB} = \frac{1}{\sqrt{2}} F_{DC} \Rightarrow F_{DB} = \frac{1}{\sqrt{2}} \times \frac{13}{3} F_{DC} \quad \text{--- (i)}$$

$$\sum F_y = 0$$

$$F_{DB} \cos \alpha + F_{DC} \cos \theta - W = 0$$

$$\frac{2}{\sqrt{13}} F_{DB} + \frac{1}{\sqrt{2}} F_{DC} = 392.4 \quad \text{--- (ii)}$$

Substituting (i) in (ii)

$$\frac{2}{\cancel{\sqrt{13}}} \times \frac{\cancel{\sqrt{13}}}{3} \times \frac{1}{\sqrt{2}} F_{DC} + \frac{1}{\sqrt{2}} F_{DC} = 392.4$$

$$\frac{2}{3\sqrt{2}} F_{DC} + \frac{1}{\sqrt{2}} F_{DC} = 392.4$$

$$\frac{5\sqrt{2}}{6} F_{DC} = 392.4$$

$$F_{DC} = \underline{332.96 \text{ N}}$$

$$\frac{2}{\sqrt{13}} F_{DB} + \frac{332.96}{\sqrt{2}} = 392.4$$

$$F_{DB} = \left(392.4 - \frac{332.96}{\sqrt{2}} \right) \frac{\sqrt{13}}{2}$$

$$= \underline{282.97 \text{ N}}$$

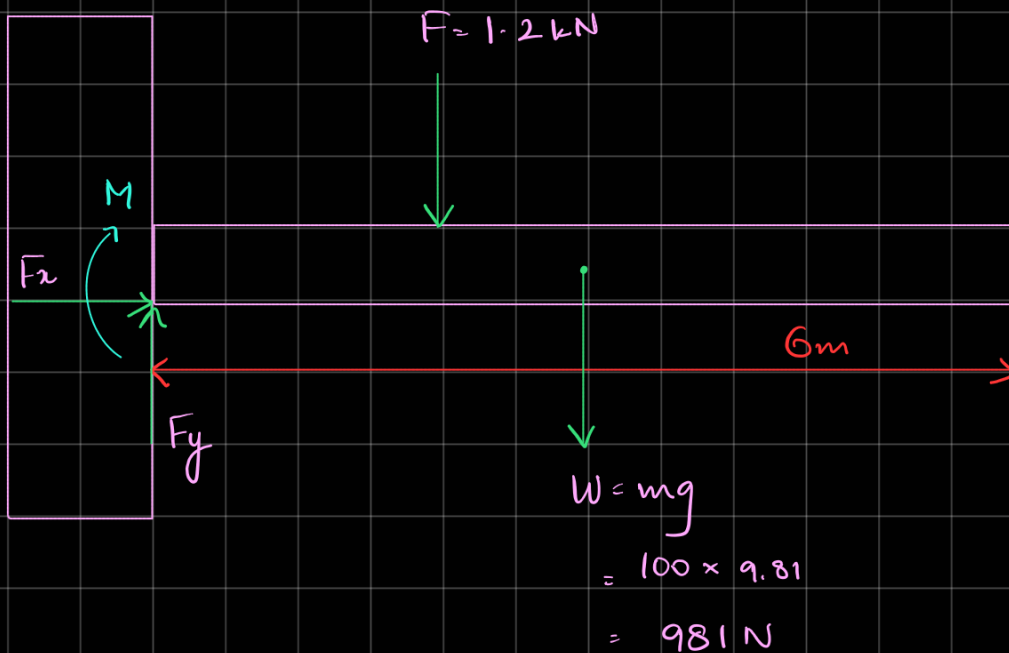
$$F = k \Delta x$$

$$k = \frac{F}{\Delta x}$$

$$= \frac{282.97}{\sqrt{13} - 2}$$

$$= \underline{176.245 \text{ N/m}}$$

3.



$$\sum F_x = 0$$

$$\underline{F_x = 0}$$

$$\sum F_y = 0$$

$$F_y - 1200 - 981 = 0$$

$$F_y = \underline{2181 \text{ N}}$$

$$M = (1200 \times 2) + (981 \times 3)$$

$$= 2400 + 2943$$

$$= \underline{5343 \text{ Nm}}$$

- F_x and F_y is the force of the support on the wall.
- F is the load on the beam
- W is the effect of gravity
- M is the moment caused due to forces

