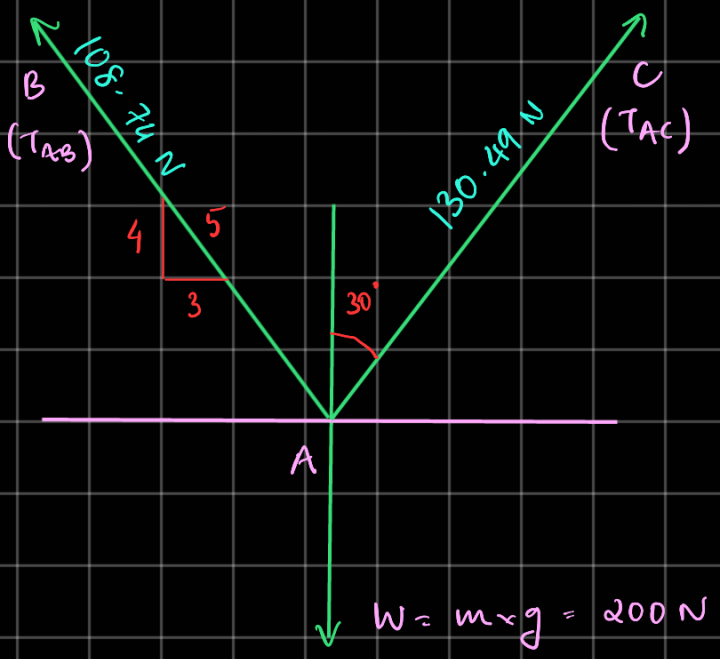
1.




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

$\Sigma F_x = 0$

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

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

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

$\Sigma F_y = 0$

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

$$\frac{\cancel{2}}{\cancel{4}_{5}} \times \frac{\cancel{8}}{\cancel{6}_{3}} T_{AC} + \frac{\sqrt{3}}{2} T_{AC} = 200$$

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

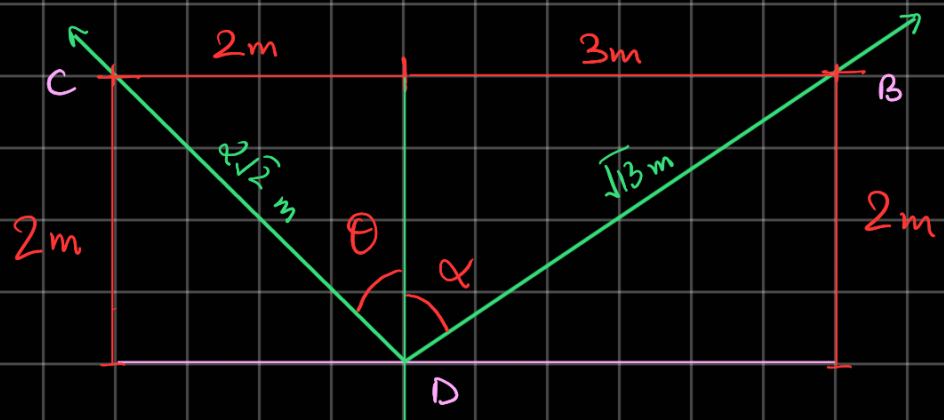
$$T_{AC} = \frac{200 \times 6}{4+3\sqrt{3}}$$

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

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

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

2.




- CD and BD are tension forces on the rope and spring
- AD is the force due to weight of the crate.

$$A = W = m \times g$$
$$= 40 \times 9.81$$
$$= 392.4 \text{ N}$$

$$\sum F_x = 0$$
$$F_{DB} \sin\alpha - F_{DC} \sin\theta = 0$$
$$\frac{3}{\sqrt{13}} F_{DB} - \frac{1}{\sqrt{2}} F_{DC} = 0$$
$$\frac{3}{\sqrt{13}} F_{DB} = \frac{1}{\sqrt{2}} F_{DC} \Rightarrow F_{DB} = \frac{1}{\sqrt{2}} \times \frac{13}{3} F_{DC} \quad \text{(I)}$$

$$\sum F_y = 0$$
$$F_{DB} \cos\alpha + F_{DC} \cos\theta - W = 0$$
$$\frac{2}{\sqrt{13}} F_{DB} + \frac{1}{\sqrt{2}} F_{DC} = 392.4 \quad \text{(II)}$$

Substituting (I) in (II)

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

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

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

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

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

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

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

$$F = k\Delta x$$

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

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

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

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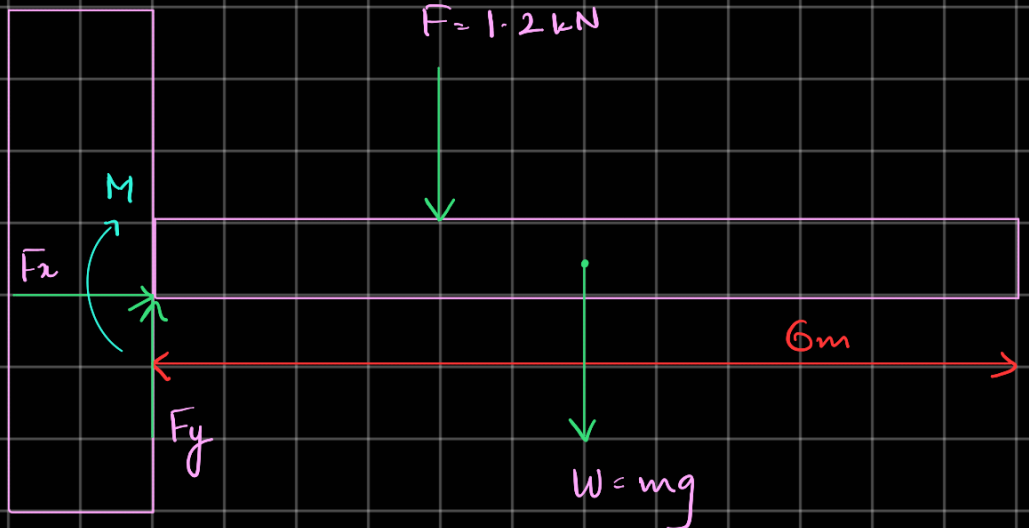
3.




$$= 100 \times 9.81$$

$$= 981 \text{ N}$$

$$\Sigma F_x = 0$$

$$\underline{F_x = 0}$$

$\Sigma F_y = 0$

$F_y - 1200 - 981 = 0$

$F_y = 2181\ N$

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

$= 2400 + 2943$

$= 5343\ Nm$

- $F_x$ 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