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Subject: Engineering Mechanics.

Q1) Part(a)

Two high streaght flexiable steel cables AB and AC are fastened to the ceiling of a building through high carbon hooks at point B & C. These cables are knitted togethere to a 3rd. cable at point A. which is holding a thick wall water tank weighning 400 pounds & is full of 300liters of water volume. What percentage of the whole weight is beign held by cable AB alone? what amount of tension must be there in both the cables to maintain the static equilibrium of the system?

Sol:

Given :

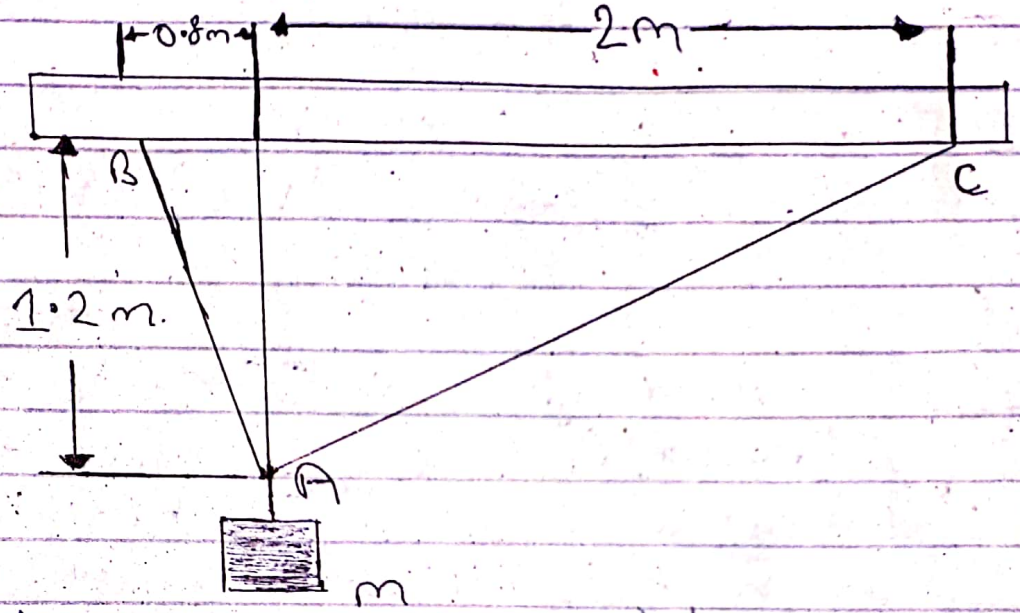
Mass of tank = 400lb.m.
= 181.4 kg

Volume of water = 300L

Mass of water = 3000 kg

Total Mass = 181.4 + 3000
= 3181.4

Now force = weight = 31209 N



① Now Applying

$\Sigma F_y = 0$

$AB \cos\theta_1 + BC \cos\theta_2 = 31209$

$\theta_1 = \tan^{-1}\left(\frac{0.8}{1.2}\right)$

$= 33.6°$

$\theta_2 = \tan^{-1}\left(\frac{2}{1.2}\right) = 59°$

~~AB~~ $= \frac{\text{Weight}}{\cos\theta_1} = \frac{31209}{\cos(33.6)}$

$0.83AB + 0.5BC = 31209 \rightarrow$ eq (i)

$\Sigma F_x = 0$

$AB \sin(33) \; BC \sin(59) = 0$

$AB = 1.57\ BC$

or

$BC = 0.635\ AB \longrightarrow$ eq(ii)

putting eq (ii) in (i)

$0.83\ AB + 0.5\ (0.635\ AB)$

$= (AB)\ 1.1475 = 3120\ g$

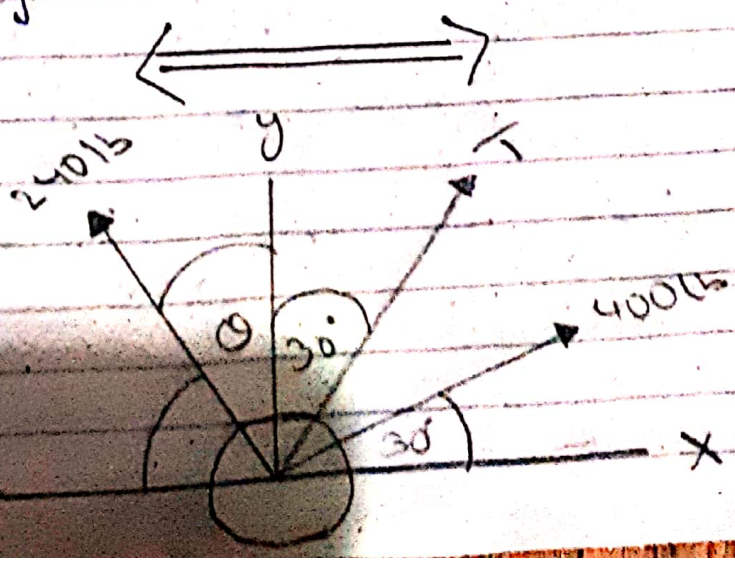
$AB = 27197.39$

percentage of $AB = \frac{27197.39}{3120\ g}$

$= 87\ \%$

(b) Ans) If the water tank increase their weight so their stability is not double.

Q2)



To find:

Magnitude of $\bar{T}$ = ?

* Hint:

If net effect on the bolt is a direction pull of 600 pand in y direction

$$\Sigma F_x = 400 \times \cos 30 + T \cos 60 + 360 + 240 \times \sin 30$$

$$= 346.41 + T/2 + 368 + 120$$

$$\Sigma F_x = 346.41 + T/2 - 360 - 120.$$

$$\Sigma F_x = T/2 - 133.60 \longrightarrow (1)$$

$$\Sigma F_x = 400 \sin 30 + T \sin 60 + 240 \sin 60$$

$$= 200 + 0.366 (\bar{T}) + 207$$

$$= 0.866 T + 407 \longrightarrow (2)$$

$$\Sigma F_x + \Sigma F_y = 600$$

$$T/2 - 133.6 + 0.3666 T + 407 = 600$$

$$T_{or} + 0.8666 T + 273.4 = 600$$

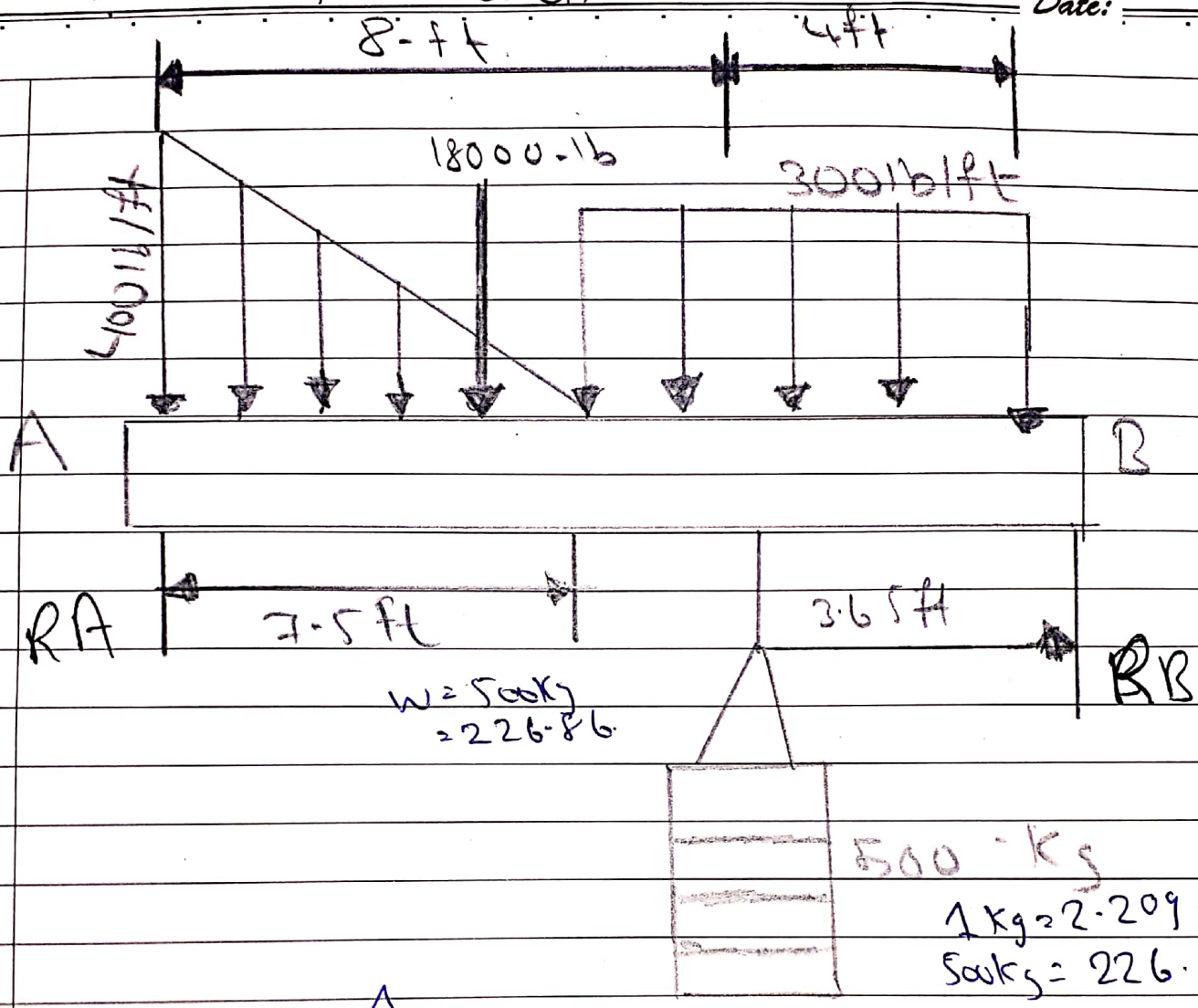
$$1.30 T = 326.6$$

$$T = \frac{326.6}{1.30}$$

$$\boxed{T = 251.230} \text{ A}$$

Q3) Calculate the reaction at support?

Date:



1 kg = 2.2046 lb

500 kgs = 226.86 lb

$\therefore \Sigma R_y = 0 \cdot \uparrow +$

$R_A + R_B = 1800 + 226.86 + 300 A4 + \frac{400 \times 8}{2}$

$= 1800 + 226.86 + 1200 + 1600$

$R_A + R_B = 4826.86 \text{ Lb} \longrightarrow (1)$

$\Sigma M_A = 0 \; (+\circlearrowleft)$

$R_B \times 12 = 1800 \times 7.5 + 226.86 \times 8.35 + 300 \times 10 + \frac{400 \times 8}{2} \times \frac{8}{3}$

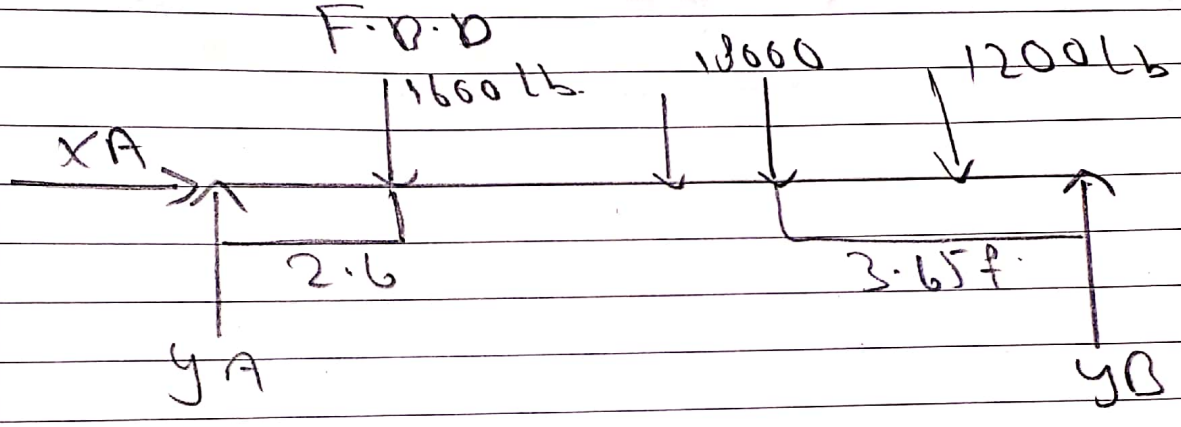
$R_B = \frac{31660.95}{12}$

Date:

$$R_B = 2638.41\ lb$$

eqn (i)

$$R_A = 4826.86 - R_B = 2188.45\ lb$$



Moment At B=0

$$y_A \times 12 = 1600 \times 5.4 + 18000 \times 4.5 + 1102.31 \times 3.65 + 1200 \times 2$$

$$8640 + 81000 + 4023.4315 + 2400$$

$$y_A \times 12 = 88287.4315$$

$$y_A = 7357.28$$

$$y_A + y_B = 0$$

$$y_B = -7357.28 + 1600 + 18000 + 1102.31 + 1200$$

$$y_B = 13555.0$$

$$y_B = 21902.31 - 7357.28$$

$$y_B = 14545.02\ lb$$

$\Longleftrightarrow$