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Department \* BE (civil)

Semestr \* 2nd

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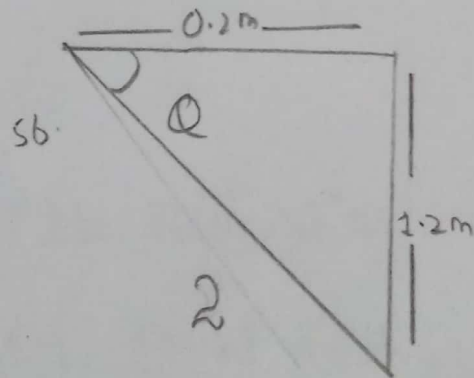
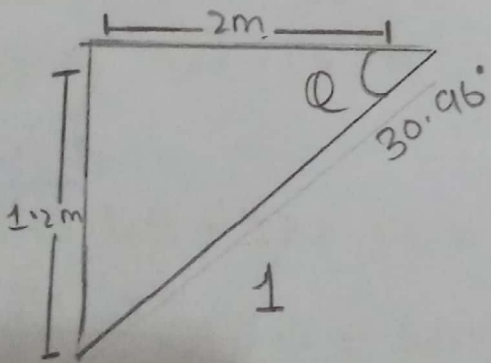
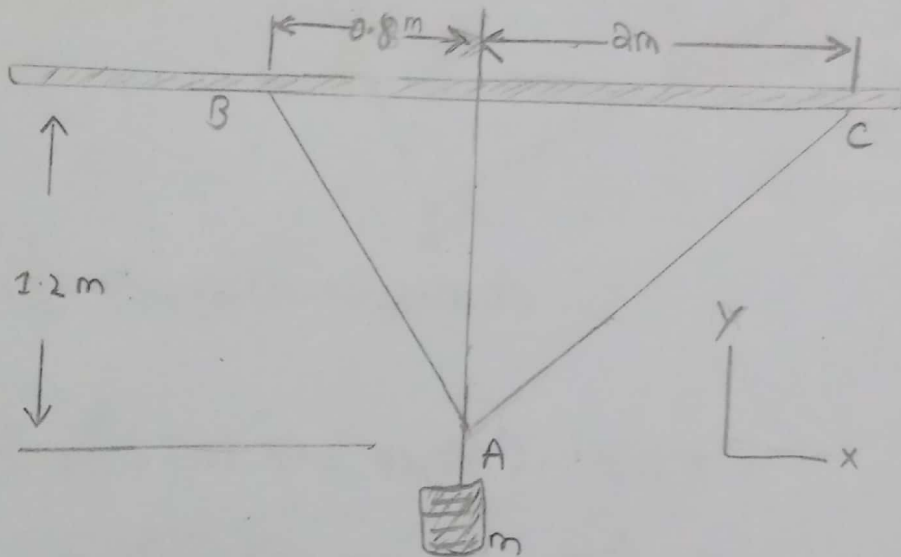
Q1 #

(Answer a)

Required Data :-

- 1 Percentage of weight hold by cable AB.
- 2 Tension in both the cables ie AB & AC.

DIAGRAMS :-



P.T.O

### CALCULATIONS:-

$$1:- \tan \alpha = \frac{P}{B} = \frac{1.2}{2}$$

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

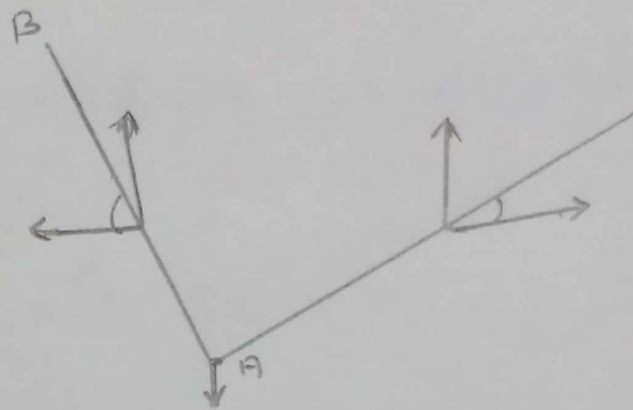
$$\alpha = 30.96^\circ$$

$$2:- \tan \alpha' = \frac{P}{B} = \frac{1.2}{0.8}$$

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

$$\alpha' = 56.31^\circ$$

$$F_{AB} \sin(56.31^\circ)$$
  
$$F_{AB} \cos(56.31^\circ)$$



$$F_{AC} \sin(30.96^\circ)$$
  
$$F_{AC} \cos(30.96^\circ)$$

$$\sum F_x = 0$$

$$F_{AC} \cos(30.96^\circ) - F_{AB} \cos(56.31^\circ) = 400 \text{ lb}$$

$$\sum F_y = 0$$

$$F_{AB} \sin(56.31^\circ) + F_{AC} \sin(30.96^\circ) - 400 = 0$$

$$F_{AB} \sin(56.31^\circ) + F_{AC} \sin(30.96^\circ) = 400$$

$$\Rightarrow F_{AB} = 343.40 \text{ lb}$$

$$\Rightarrow F_{AC} = 222.13 \text{ lb}$$

### RESULTS :-

1:-  $343.40 + 222.13 = 565.5 \text{ lb}$  is Total T.

2:-  $\frac{343.40}{565.5} \times 100 = 60.72\%$  of total weight is

held by (AB) alone

P.T.O

## (Answer b)

$$1:- \text{ weight increased by } 15\%$$

$$= 400 \text{ lb} \times \frac{15}{100} = 60$$

$$\text{weight} = 460 \text{ lb.}$$

$$2:- \text{ volume of water increased by } 35\%$$

$$= 3000 \times \frac{35}{100} = 1050 \text{ ltrs}$$

Calculating effects on Results of (a).

$$\sum F_x = 0$$

$$- F_{AB} \cos 56.31^\circ + F_{AC} \cos 30.96^\circ = 0 \text{ and}$$

$$\sum F_y = 0$$

$$F_{AB} \sin 56.31^\circ + F_{AC} \sin 30.96^\circ = 460$$

RESULTS:-

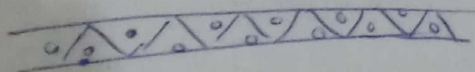
$$F_{AB} = 394.71 \text{ lb}$$

$$F_{AC} = 255.45 \text{ lb}$$

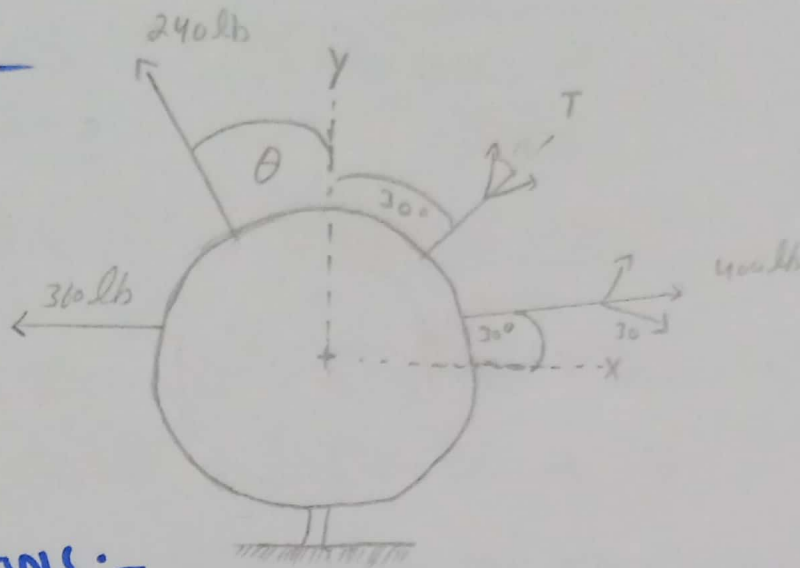
$$\text{total} = 649 \text{ lb.}$$

$$\Rightarrow \frac{394}{649} \times 100 = 60\% \text{ of total weight is}$$

held by (AB) cable alone which is same as the first one.



Q #2

AnswerDIAGRAM:-CALCULATIONS:-

Component of 1  
 $400 \cos 30^\circ$  and  
 $400 \sin 30^\circ$

Component of 2  
 $240 \cos \theta$  and  
 $240 \sin \theta$

Component of T

 $T \cos 30^\circ$  and  $T \sin 30^\circ$ 

$$\sum F_x = 0$$

$$\Rightarrow -240 \sin \theta - 360 + T \sin 30^\circ + 400 \cos 30^\circ = 0$$

$$\sum F_y = 600$$

$$\Rightarrow 240 \cos \theta + T \cos 30^\circ + 400 \sin 30^\circ = 600$$

$$\text{As } -240 \sin \theta + T \sin 30^\circ = 13.599 \rightarrow \textcircled{1}$$

$$240 \cos \theta + T \cos 30^\circ = 400 \rightarrow \textcircled{2}$$

P.T.O

(5)

for  $\theta$  Put eq (i) in eq (ii) we get

$$-240 \sin \theta = \frac{13599 - T \sin 30}{240}$$

$$\sin \theta = \frac{T \sin 30 - 13.599}{240}$$

$$\theta = \sin^{-1} \left( \frac{T \sin 30 - 13.599}{240} \right)$$

$$\Rightarrow -360 - 240 \sin \theta + T \sin 30 + 400 \cos 30 = 0 \rightarrow (1)$$

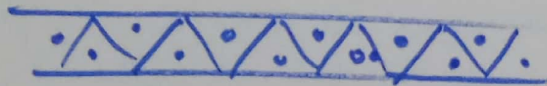
$$240 \cos \theta + T \cos 30 + 400 \sin 30 = 600 \rightarrow (2)$$

Numerical solution of eq (1) and (2) are as under:-

$$\theta = 21.7 \text{ and } 204 \text{ lb}$$

RESULT:-

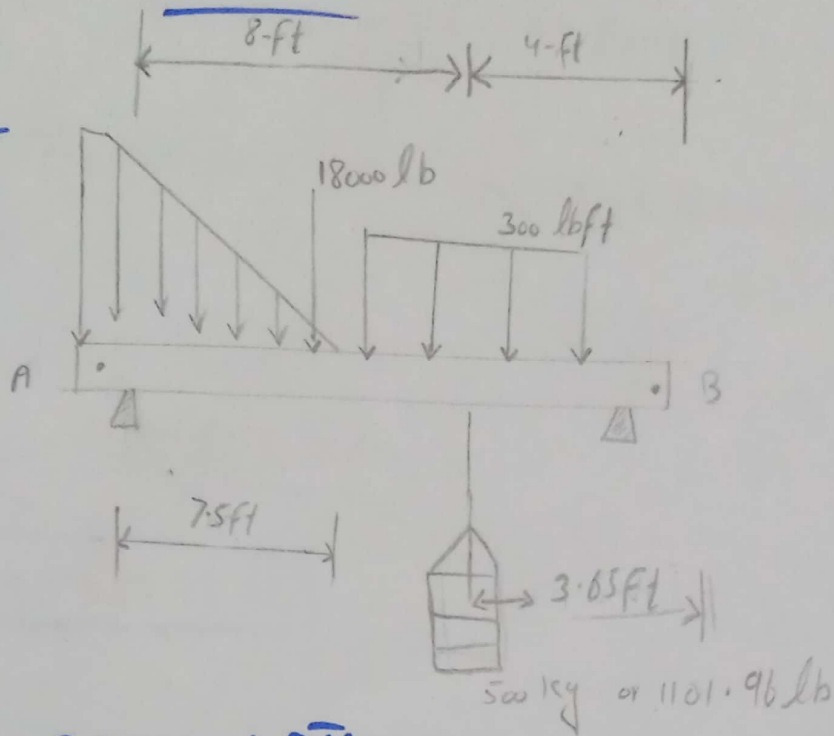
$$\boxed{T = 204 \text{ lb}}$$



Q.3

Answer

DIAGRAM :-



REACTIONS CALCULATIONS :-

Statically determinate

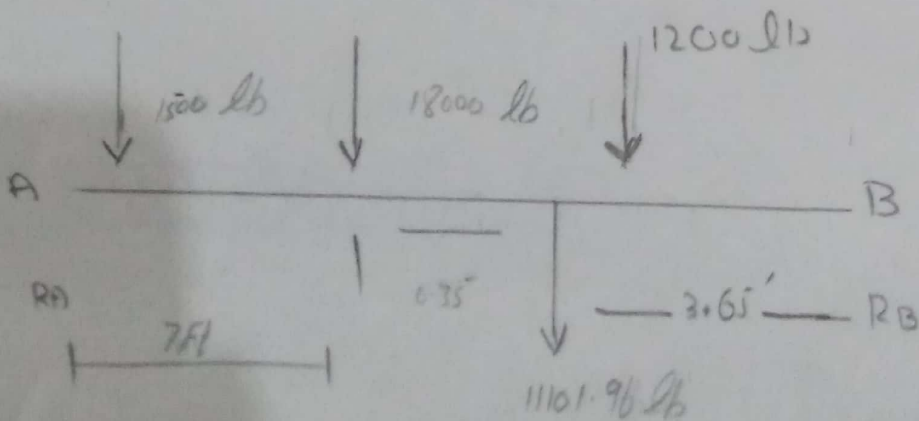
$$\sum F_x = 0$$

$$\sum F_y = 0$$

$$\sum M = 0$$

Statically determinate :-

free body diagram.



(7)

Sum of clockwise & anticlockwise torques and forces are equal to zero As,

$$\sum MA = 0$$

$$1600 \times 2.67 + 18000 \times 7.5 + 1101.96 + 1200 \times 10 - RB \times 12 = 0$$

$$\Rightarrow 12 RB = 160473.37$$

$$\Rightarrow \frac{12 RB}{12} = \frac{160473.37}{12}$$

$$\Rightarrow \boxed{RB = 13372.78 \text{ lb}}$$

$$\sum MA = 0$$

$$RA \times 12 - 1600 \times 9.33 - 18000 \times 4.5 - 1101.96 \times 3.65 - 1200 \times 2 = 0$$

$$\Rightarrow 12 RA = 102350.154$$

$$\Rightarrow \frac{12 RA}{12} = \frac{102350.154}{12}$$

$$\Rightarrow \boxed{RA = 8529.18 \text{ lb}}$$

