

①

NAME: FAHAD REHMAN

ID # 16582

SEMESTER 2<sup>nd</sup> SECTION-"B"

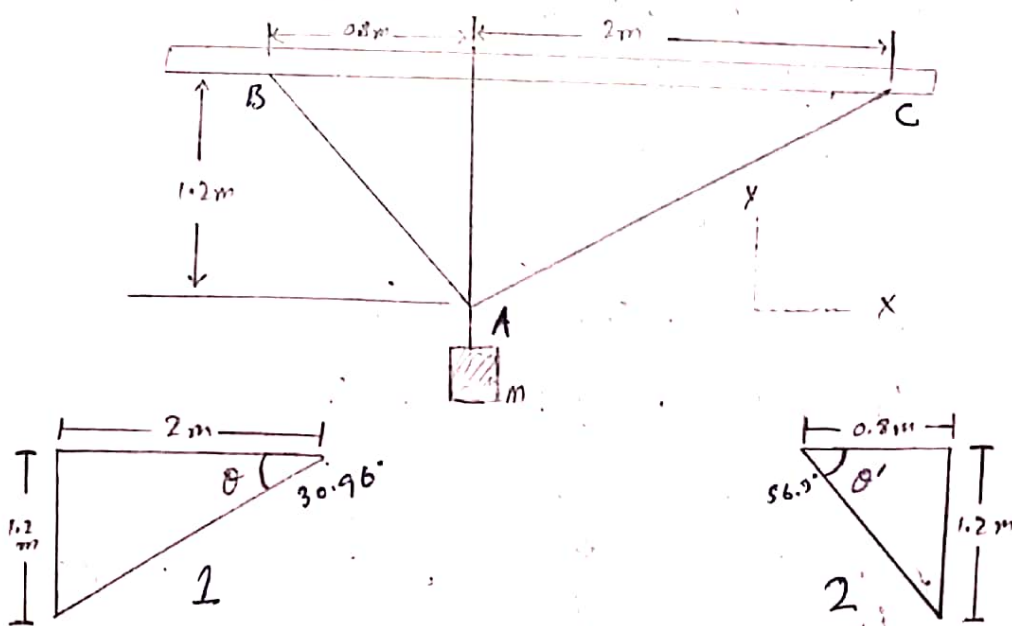
Question # 1

Answer (a)

REQUIRED DATA:-

1. Percentage of weight hold by cable AB.
2. Tensions in both the cables ie AB and AC.

DIAGRAMS :-



(p.t.o)

(2)

CALCULATIONS:

1.

$$\tan \theta = \frac{P}{B} = \frac{1.2}{2}$$

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

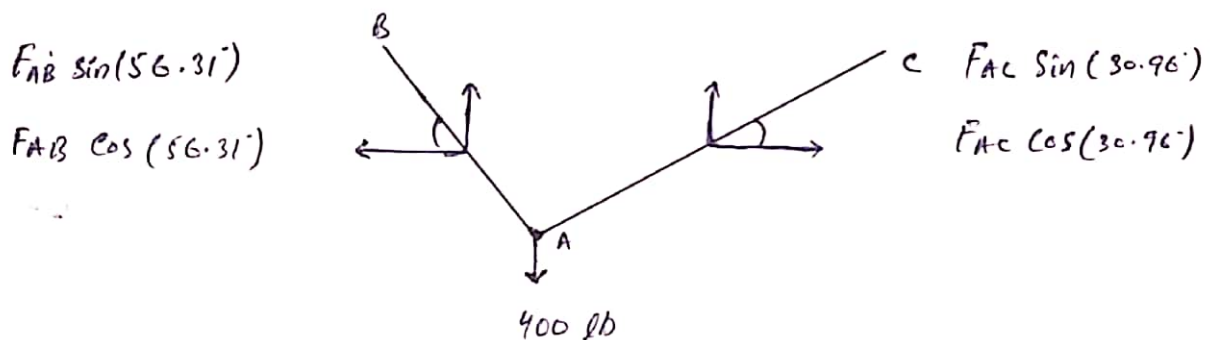
$$\theta = 30.96^\circ$$

2.

$$\tan \theta' = \frac{P}{B} = \frac{1.2}{0.8}$$

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

$$\theta' = 56.31^\circ$$



$$\sum F_x = 0$$

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

$$\sum F_y = 0$$

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

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

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

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

RESULTS:-

1.  $343.40 + 222.13 = 565.5 \text{ lb.}$  is Total F.

2.  $\frac{343.40}{565.5} \times 100 = 60.72\%$  of total weight is holded by (AB) alone. (p.t.o)

3

## Answer (b)

1. weight increased by 15%

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

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

2. Volume of water increased by 35%.

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

Calculating effects on Results of (a).

$$\rightarrow \sum F_x = 0$$

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

$$\sum F_y = 0$$

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

Results:

$$\begin{array}{l|l} F_{AB} = 394.91 \text{ lb} & F_{AB} = 463.59 \text{ lb} \\ F_{AC} = 255.452 \text{ lb.} & F_{AC} = 299.83 \text{ lb.} \\ \text{Total} = 649 \text{ lb.} & \text{for balancing.} \end{array}$$

$\Rightarrow \frac{394}{649} \times 100 = 60\%$  of total weight is held by (AB) cable alone, which is same as the first one.

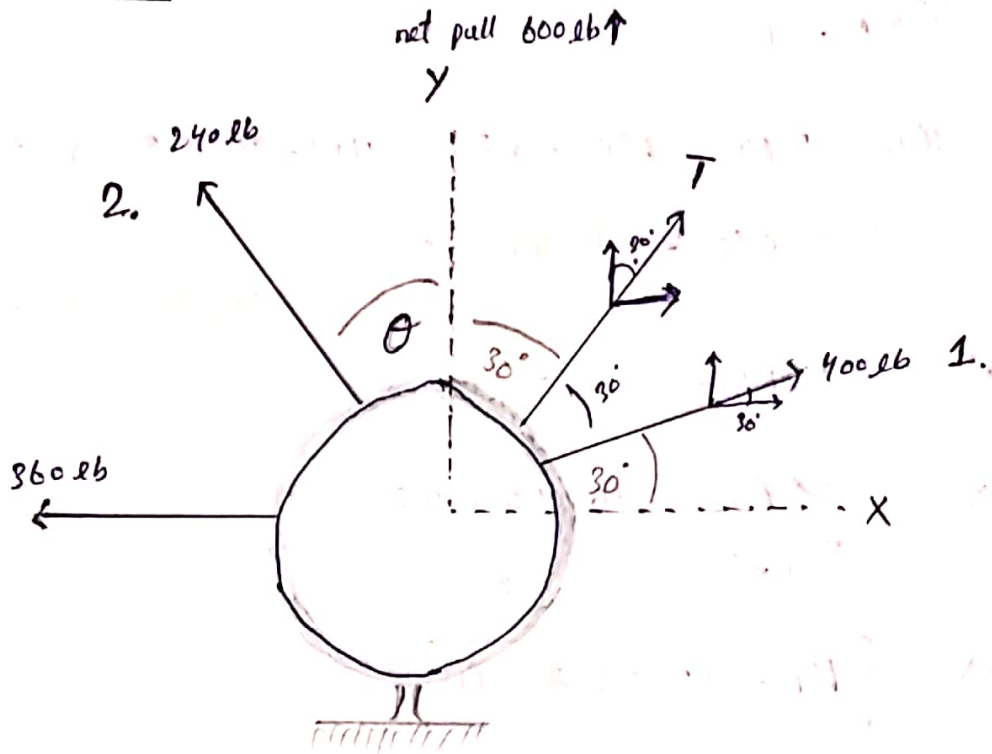
\*—————\*

(4)

## Question # 2

### Answer

#### DIAGRAM:-



#### CALCULATIONS:-

Components of 1.

$400 \cos 30^\circ$ , and  
 $400 \sin 30^\circ$ .

Components of 2.

$240 \cos \theta$ , and  
 $240 \sin \theta$ .

Components of T.

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

$$\sum F_x = 0$$

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

(P.T.O)

→

(5)

$$\sum F_y = 600$$

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

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

$$240 \cos \theta + T \cos 30^\circ = 600 \rightarrow \textcircled{ii}$$

for  $\theta$ , put eq  $\textcircled{i}$  in eq  $\textcircled{ii}$  we get.

$$-240 \sin \theta = \underline{13.599 - T \sin 30^\circ}$$

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

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

$$\Rightarrow -360 - 240 \sin \theta + T \sin 30^\circ + 400 \cos 30^\circ = 0 \rightarrow \textcircled{1}$$

$$240 \cos \theta + T \cos 30^\circ + 400 \sin 30^\circ = 600 \rightarrow \textcircled{2}$$

Numerical solutions of eq  $\textcircled{1}$  and  $\textcircled{2}$ , are as under.

$$\theta = 21.7^\circ \text{ and } T = 204 \text{ lb.}$$

RESULT:-

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

✱

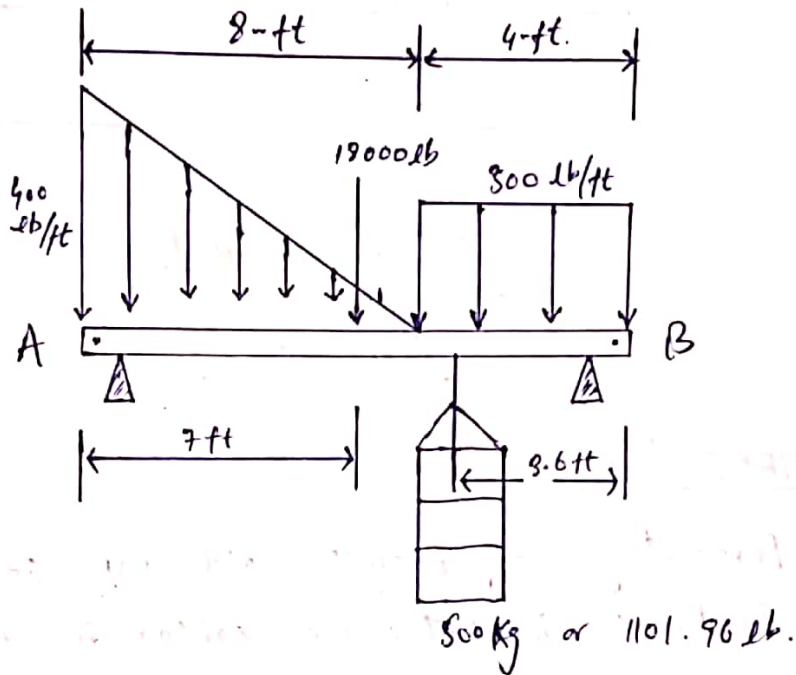
✱

(6)

### Question #3

Answer

DIAGRAMS:



REACTIONS CALCULATIONS:-

Statically determinacy;

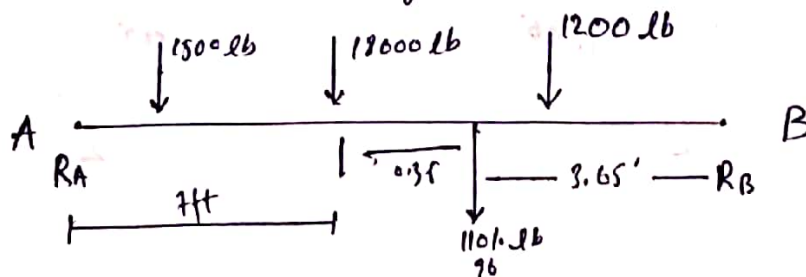
$$r - 3n = 0$$

$$3 - 3(1) = 0$$

$$0 = 0$$

Statically determinate.

Free Body Diagram.



(P.T.O)

7

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

$$\sum M_A = 0$$

$$1600 \times 2.67 + 18000 \times 7.5 + 1101.96 \times 8.35 + 1200 \times 10 - R_B \times 12 = 0$$

$$\Rightarrow 12 R_B = 160473.37$$

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

$$\Rightarrow \boxed{R_B = 13372.78 \text{ lb.}}$$

$$\sum M_A = 0$$

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

$$\Rightarrow 12 R_A = 102350.154$$

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

$$\Rightarrow \boxed{R_A = 8529.19 \text{ lb.}}$$

\* \_\_\_\_\_ \*

Completed