

ENGINEERING MECHANICS

SUBMITTED TO \rightarrow Engr. Majid Naeem

SUBMITTED BY \rightarrow Syed Mazhar Ali
Shah

SECTION \rightarrow "A"

ID # \rightarrow 16066

DEPARTMENT \rightarrow Civil Engineering

SEMESTER \rightarrow "2nd"

Iqra National University
Peshawar.

QUESTION # 1 ; →

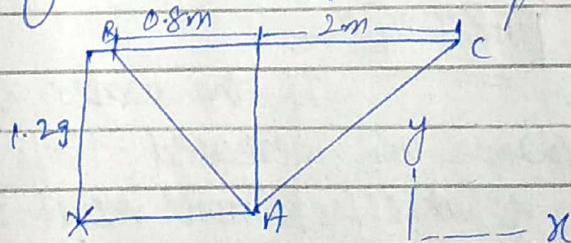
(a) Two high strength flexible steel cables A, B & C are fastened to the ceiling of a building through high carbon steel at point B & C. These cables are knotted together to a 3rd cable at point A which is holding a thick wall water tank weighing 400 pounds & is full of 3000 litres of water volume ----- tensions must be there at both cables to maintain the static equilibrium of the system?

Ans ; → GIVEN DATA →

$$\text{mass} = 400 \text{ lbs}$$

$$\text{increase of volume} \Rightarrow n_{AB} = 15\%$$

$$\text{increase of volume} \Rightarrow n_{AC} = 35\%$$



REQUIRED ; →

$$AB = ?$$

$$BC = ?$$

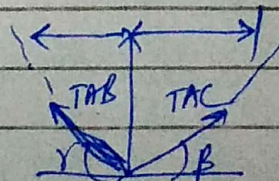
SOLUTION ; →

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

$$\gamma = 56.3^\circ$$

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

$$\beta = 31.0^\circ$$



we know that \rightarrow

$$m = 400 \text{ lbs} \Rightarrow \frac{400}{2.204} = 181.48 \text{ kg}$$

$$T_{AB} = T_{AB} \Delta AB = 0.15 \times (181.48) (9.81) [\cos 56.3^\circ i + \sin 56.3^\circ j]$$
$$= 267.047 [-0.55j + 0.831i]$$

$$(T_{AB} = -146.87i + 221i \text{ N})$$

$$T_{AC} = T_{AC} \Delta AC = 0.35 (181.48) (9.81) \{-\cos 31^\circ i + \sin 31^\circ j\}$$
$$T_{AC} = (623.11) \{-0.857i + 0.515j\}$$

$$T_{AC} = -534j + 320i \text{ N}$$

$$T_{AB} = -146i + 221i \text{ N}$$

$$T_{AC} = -534j + 320i \text{ N}$$

(b) PART "B" \rightarrow

If the water tank weight & volume are increased 15% & 35% respectively what effects will result in results of part a.

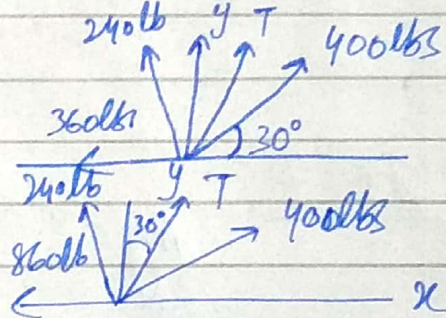
If the water tank increases their weight in o/p their stability is not durable.

QUESTION # 2; →

Four forces are exerted on an eyebolt shown. If the net effect of the bolt is a direct pull of 600 pounds in the y-direction, determine the values of T and

Ans; → GIVEN DATA; →

Effect of bolt = 600 lb



REQUIRED; →

$$T = ?$$

$$\theta = ?$$

Solution; →

$$\sum F_x = 0 = -360 - 240 \sin \theta + T \sin 30 + 400 \cos 30 = 0$$
$$\sum F_y = 0 = 240 \cos \theta + T \cos 30 + 400 \sin 30 = 600$$

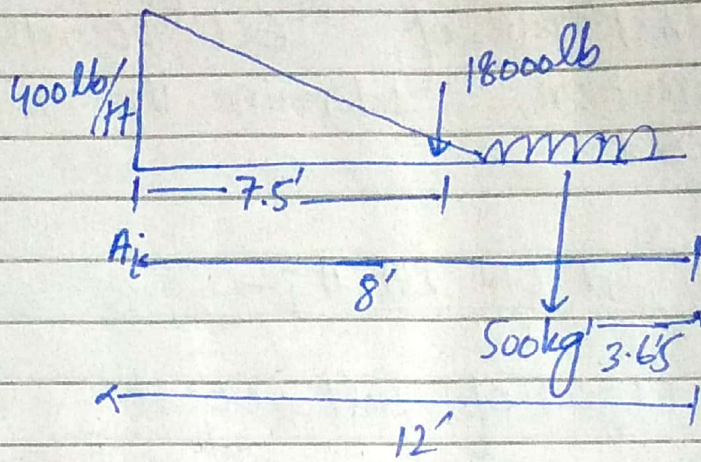
Numerical solution of equation (2)

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

Note; → we could eliminate T between equation 1 & 2 the resulting equation transcendental.

QUESTION # 3 →

calculate the reactions at supports; →



REQUIRED ; →

$$A_y = ?$$
$$B_y = ?$$

SOLUTION ; →

⇒ UDL = Convert to point load

$$\Rightarrow 300 \times 4 = 1200 \text{ lb.}$$

at point = $\frac{1}{2} \times 4 = 2'$ from B

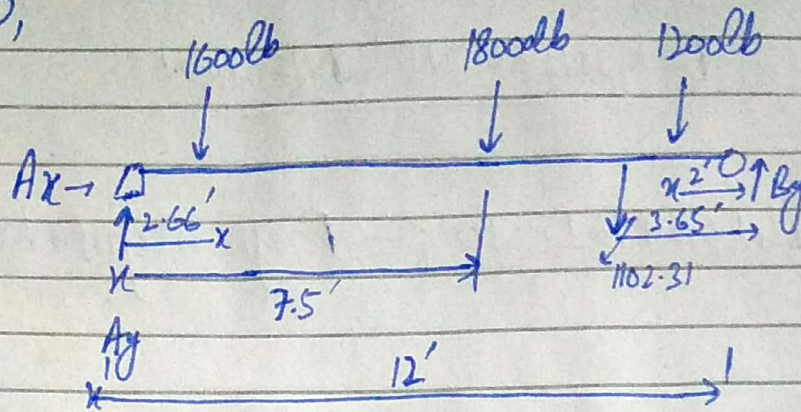
$$\Rightarrow \text{UVL} = \frac{1}{2} \times 400 \times 8 = 1600 \text{ lb}$$

at distance = $\frac{1}{3} \times 8 = 2.66'$ from A

⇒ On load is in lb, we'll convert it into lb.

$$= 500 \times 2.204 = 1102.31 \text{ lb.}$$

Now,
A



$$\sum Ax = 0$$
$$Ax = 0$$

$$\sum MA = -16000 \times 2.66 - 18000 \times 7.5 - 1200 \times 10 - 1102.31 \times 8.35 + By \times 12$$

$$= -4256 - 135000 - 12000 - 9204.28 + By \times 12$$
$$= -160460.12 + By \times 12$$

$$\Rightarrow By = \frac{160460.12}{12}$$

$$\Rightarrow By = 13371.69 \text{ lbs.}$$

$$Ay = \{ \text{total load} - By$$

$$\Rightarrow Ay = 1200 + 1102.31 + 18000 + 1600 - 13371.69$$
$$\Rightarrow Ay = 8530.31 \text{ lb}$$

$$\Rightarrow Ay = 8530.31, By = 13371.69 \text{ Ans.}$$