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ID No : 16317

Section : A

Submitted by : Sir Majid Naem

Subject : Engineering Mechanics.

Q1: Two high strength flexible steel cable AB and AC are fastened to the ceiling of a building through high Carbon Steel hooks at Point B and C. These cables are knotted together to a 3rd cable at Point A which is holding a thick wall water tank weighting 400 Pounds and is full of 3000 liter water volume. What Percentage of the whole weight is being held by cable AB alone? What amount of tension must be there in both the cable to maintain the static equilibrium of the system?

Part b: if the water tank weight and volume of water are increased 15% and 35% respectively what effect will occur on result of part a?

SMH



: Part A:

: Given data:

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

increase of volume $\Rightarrow \Delta V_{AB} = 15\%$

increase of volume $\Rightarrow \Delta V_{AC} = 35\%$

: Required:

$$AB = ?$$

$$BC = ?$$

Solution:

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

$$\gamma = 56.3^\circ$$

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

$$\beta = 31.0$$

we know that.

$$m = 400 \text{ lbs} \Rightarrow 400 / 2.204 = 181.48 \text{ Kg.}$$

SMidea

$$\vec{T}_{AB} = T_{AB} \Delta_{AB} = 0.15 \times (181.48)(9.81) [-\cos 56.3i + \sin 56.3j]$$

$$= 267.047 [-0.55i + 0.831j]$$

$$\vec{T}_{AB} = -146.87i + 221j \text{ N}$$

$$\vec{T}_{AC} = T_{AC} \Delta_{AC} = 0.35(181.48) \times (9.81) [-\cos 31i + \sin 31j]$$

$$\vec{T}_{AC} = (623.11) [-0.857i + 0.515j]$$

$$\vec{T}_{AC} = -534i + 320j \text{ N}$$

$$\vec{T}_{AB} = -146i + 221j \text{ N}$$

$$\vec{T}_{AC} = -534i + 320j \text{ N}$$

: Part B:

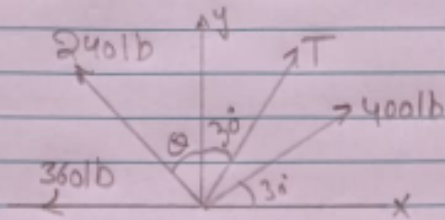
if the water tank increase their weight 10%, their stability is no durable.

Q2: Four forces are exerted on the eyebolt as shown below, if the net effect on the bolt is a direct pull of 600 pounds in the y-direction, determine the value T₃



Ans: Given data.

Sheet of bolt = 600lb



: Required :

$$T = ?$$

$$Q = ?$$

$$\text{Sol: } \Sigma F_x = 0 = -360 - 240 \sin \theta - T \sin 30^\circ + 400 \cos 30^\circ = 0$$

$$\Sigma F_y = 0 = 240 \cos \theta + T \cos 30^\circ + 400 \sin 30^\circ = 600.$$

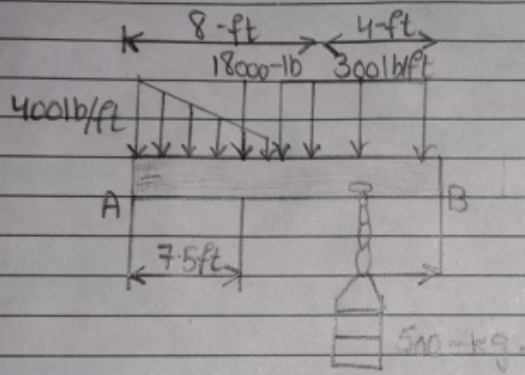
Numerical solution of equation (1) and (2).

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

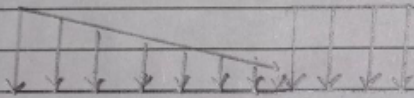
: Note:

We could eliminate T b/w eqn (1) and (2) the resulting equation Transcendental.

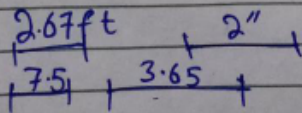
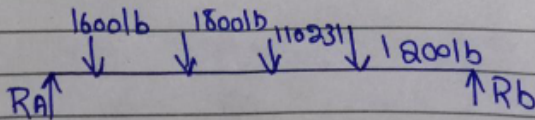
Q3: Calculate the reaction at supports,



Sol:



→ Free Body diagram.



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$$\sum F_y = 0 \quad (\uparrow + \downarrow -)$$

$$R_A + R_B - 1600 - 1800 - 110231 - 1200 = 0$$

$$R_A + R_B - 5702.31 = 0$$

$$R_A + R_B = 5702.31 \rightarrow (1)$$

$$R_A + R_B = 0 \quad (\curvearrowright + \curvearrowleft -)$$

$$R_A(0) + 1600(2.67) + 1800(7.5) + 110231(8.35) + 1200(10) - R_B \times 12 = 0$$

$$12R_B = 38976.2885$$

$$\frac{12R_B}{12} = \frac{38976.2885}{12}$$

$$R_B = 3248.024 \text{ lb}$$

using the value of R_B in equation (1).

$$R_A + 3248.024 = 5702.31 \Rightarrow R_A = 5702.31 - 3248.024$$

$$\boxed{R_A = 2454.286 \text{ lb}} \quad \boxed{R_B = 3248.024 \text{ lb}}$$

