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Semester : 2nd

Section : A

Assignment : Engineering Mechanics

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Q1: Part (a)

Given data:

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

increase of volume $\Rightarrow \Delta AB = 15\%$

increase of volume $\Rightarrow \Delta AC = 35\%$

Required:

$$AB = ?$$

$$BC = ?$$

Solution:

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

$$\delta = 56.3^\circ$$

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

$$\beta = 31.6^\circ$$

We know that

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

$$T_{AB} = T_{AB} \Delta_{AB} = 0.15 \times (181.48) (9.81) [-0.356 - 3i + \sin 56.3i]$$

$$= 267.047 \{-0.55i + 0.831i\}$$

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

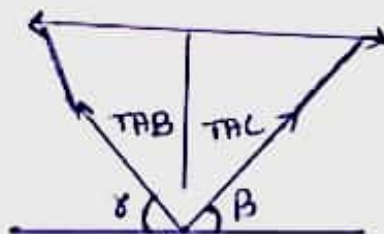
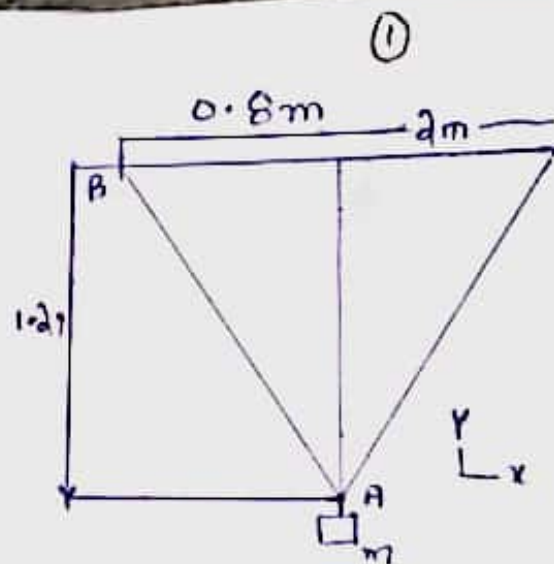
$$T_{AC} = T_{AC} \Delta_{AC} = 0.35 (181.48) (9.81) \{-0.331i + \sin 31.6i\}$$

$$T_{AC} = (623.11) \{0.0857i + 0.515i\}$$

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

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

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



Q1:-
Part - (B)

(2)

If the tank of water weight and volume of water are increased by 15% and 35% the total will be ;

$$\begin{aligned}w &= (400 + 400 \times 15/100) + 6569 + 6569 \times 35/100 \\&= 400 + 60 + 65 + 2299 \\&= 9328.15 \text{ lb}\end{aligned}$$

$$\sum F_x = 0$$

$$T_{AB} = 1.54 T_{AC}$$

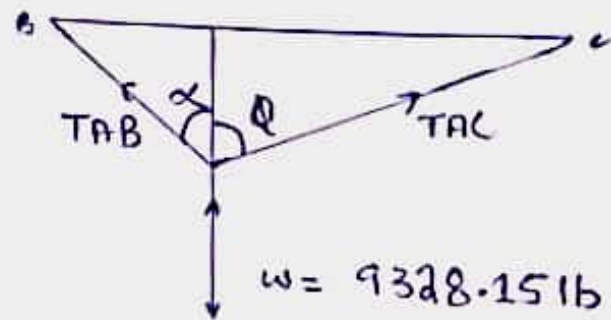
$$\sum F_y = 0$$

$$(1.8) T_{AC} = 9328$$

$$T_{AC} = 5182 \text{ lb}$$

$$T_{AB} = 1.54 \times 5182$$

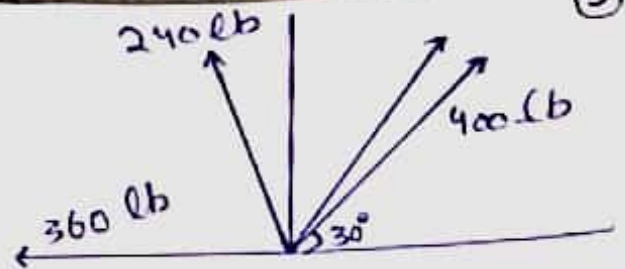
$$T_{AB} = 7980.6 \text{ lb}$$



Answer NO : 02.

Given Data:

Effect on hold = 600 lb

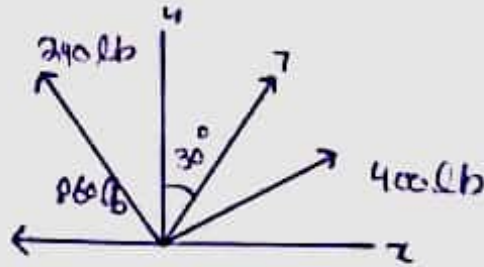


Required:

$T = ?$

$\theta = ?$

Solution:-



$$\{ F_x = 0 = -360 - 240 \sin \theta + T \sin 30 + 400 \cos 30 = 0$$

$$\{ F_y = 0 = 240 \cos \theta + T \cos 30 + 400 \sin 30 = 600$$

Numerical solution of Eq-(1) & (2)

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

NOTE: We could eliminate T b/w eq-(1) & (2)
the resulting eq- Transcendental.

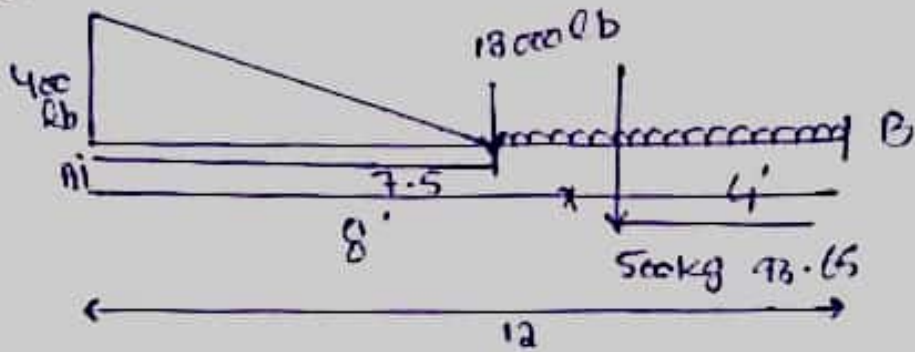
Answer NO :- 03

(4)

Required:-

$A_y = ?$

$B_y = ?$



Sol:-

\Rightarrow UDL = Convert to point load

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

at point = $1/2 \times 4 = 2'$ from B

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

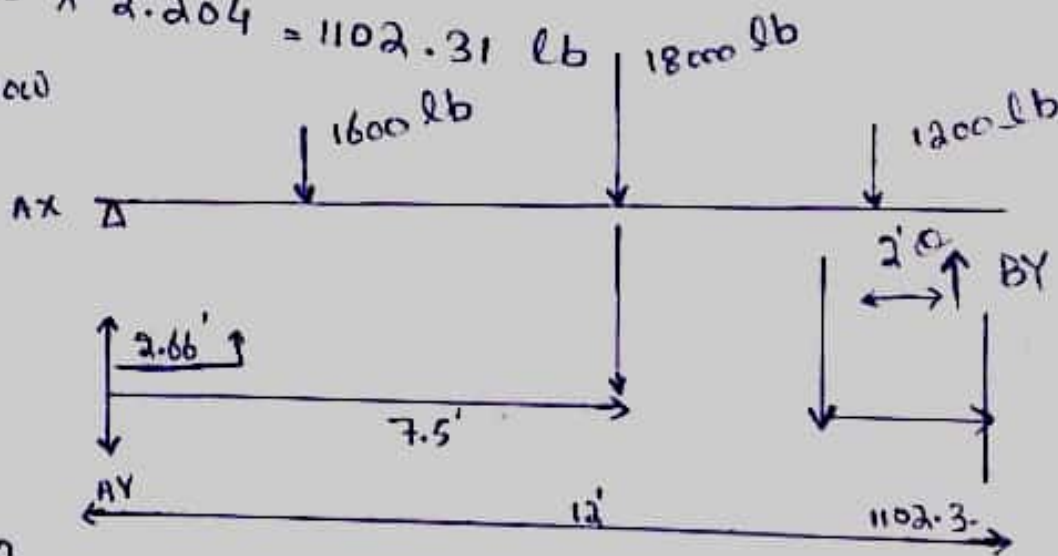
at distance = $1/3 \times 8 = 2.66'$ from A

\Rightarrow one load in kg

Convert to lb

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

Now



$\sum A_x = 0$

$A_x = 0$

$\sum M_A = -1600 \times 2.66 - 18000 \times 7.5 - 1200 \times 10 - 1102.31 \times 8.35 + 12 + B_y \times 12$

$= -4256 - 135000 - 1200 - 9204.28 + B_y \times 12$

$= -160460.12 + B_y \times 12$

$B_y = \frac{160460.12}{12}$

$B_y = 13371.69 \text{ lb}$

$A_y = \{ \text{Total load} - B_y$

$A_y = 1200 + 1102.31 + 1800 + 1600 - 13371.69$

$A_y = 8530.31 \text{ lb}$

$\Rightarrow A_y = 8530.31, B_y = 13371.69$

Answer.