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Subject: Engineering Mechanics

Department: Civil Engineering INU

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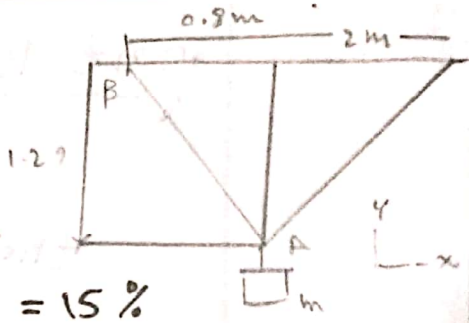
part -A



Given data

m = 400 lbs

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

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

Required:

AB = ?

BC = ?

Solution:

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

$\delta = 56.3^\circ$

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

$\beta = 31.0^\circ$

We know that

$m = 400$ lbs ⇒ $400/2.204 = 181.48$ kg

$T_{AB} = T_{AB}\,\Delta AB = 0.15 \times (181.48)(9.81)[-(\cos 56.3 i + \sin 56.3 j)$

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

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

$T_{AC} = T_{AC}\,\hat{n}_{AC} = 0.35\,(181.48)\,r\,(9.81)\{-\cos 33\hat{i} + \sin 33\hat{k}\}$

$T_{AC} = (623.11)\{-0.857\hat{i} + 0.515\hat{k}\}$

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

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

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

part B:

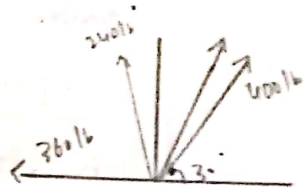
If the water tank increase their weight is their stability is not double.

Question 2

Ans:

Given Data:

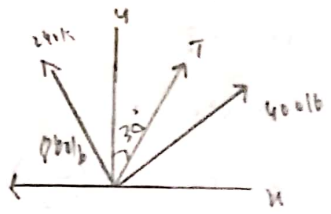
Effect of bold = 600 lb



Required

T = ?

Q = ?



Sol:-

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

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

Numerical solution of Equation (1) & (2)

$\theta = 21.7^\circ \quad T = 204\ lb$ Ans

Note: We could eliminate T between Equation 1 & 2 the resulting equation Transcendental.

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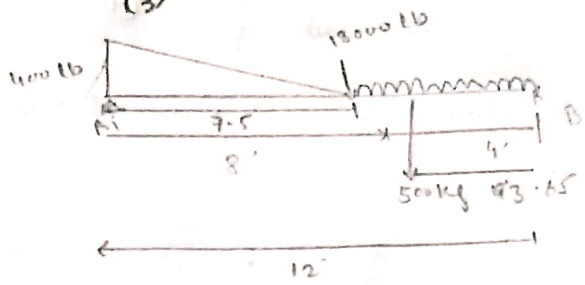
(3)

Q: 3

Ans:

Given data:



Required

Ay = ?

By = ?

Solution:

⇒ UDL = Convert to point Load

⇒ 300 x 4 = 1200 lb

at point = ½ x 4 = 2' from B

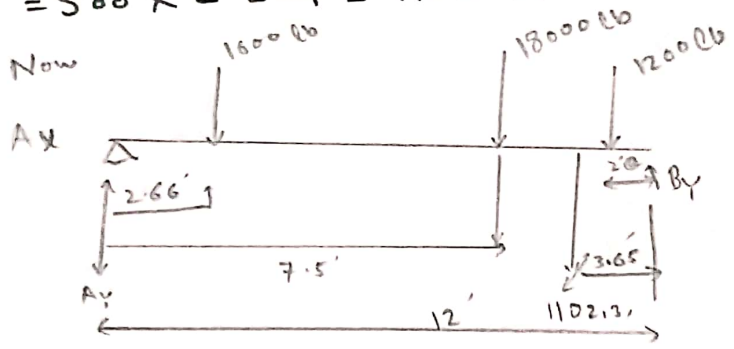
⇒ UVL = ½ x 400 x 8 = 1600 lb

at distance = ⅓ x 8 = 2.66' from A

⇒ one load in kg

Convert to lb

= 500 x 2.204 = 1102.31 lb



$\sum Ax = 0$

$Ax = 0$

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

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

$= -160460.12 + By \times 12$

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

$By = 13371.69$ lb

$A_y = \{$ Total Load $- B_y$

$A_y = 1200 + 1102.31 + 18000 + 1600 - 13371.69$

$A_y = 8530.31$ lb

$A_y = 8530.31$, $B_y = 13371.69$

Ans