IQRA NATIONAL UNIVERSITY

DEPORTMENT: CIVIL ENGINEERING

PAPER: Engineering Mechanics

EXAM: MID TERM

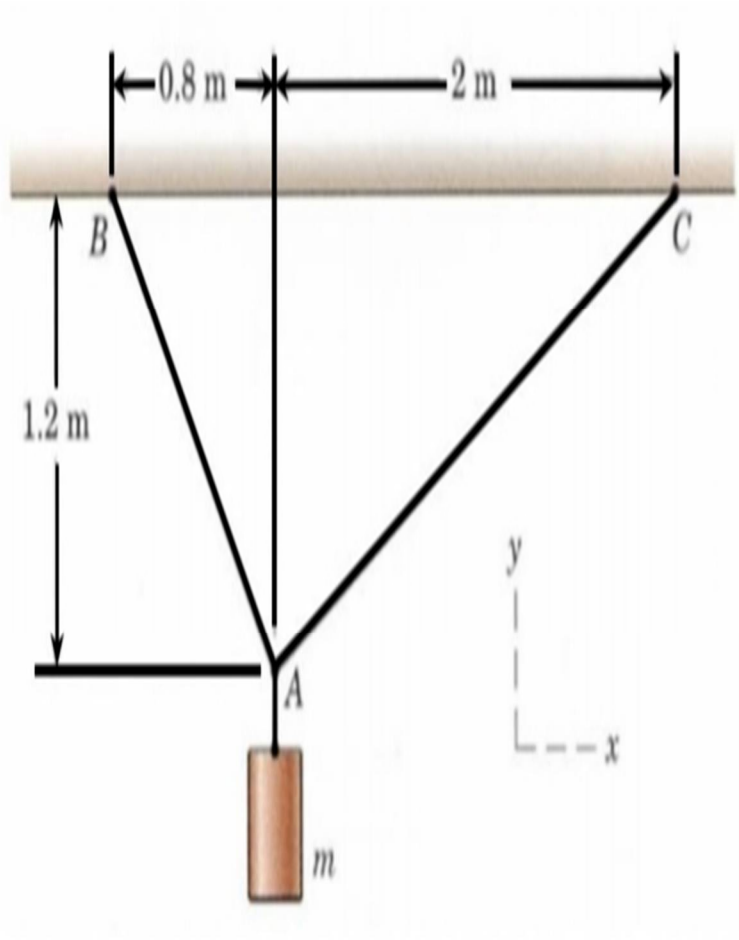
SEMESTER: 2ND

STUDENT:16595

NAME: NIAMAT ULLAH

QUASTION:-1 **PART-(A) TWO HIGH STRENGTH FLEXIBLE STEEL CABLES AB AND AC ARE FASTENED TO THE CEILING OF A BUILDING THROUGH HIGH CARBON STEEL HOOKS AT POINT B & 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 LITERS OF WATER VOLUME. WHAT PERCENTAGE OF THE WHOLE WEIGHT IS BEING HELD BY CABLE AB ALONE? WHAT AMOUNT OF TENSIONS MUST BE THERE IN BOTH THE CABLES TO MAINTAIN THE STATIC EQUILIBRIUM OF THE SYSTEM**

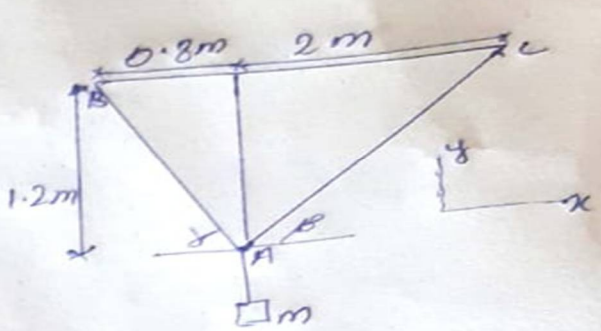
PART-(B) IF THE WATER TANK WEIGHT AND VOLUME OF WATER ARE INCREASED 15% AND 35% RESPECTIVELY WHAT EFFECTS WILL OCCUR ON RESULTS OF PART-A.



Answer:-

Question #2

Answer:



Given data:

$m = 400$ lbs

Increase of volume =>

$\Rightarrow \eta_{AB} = 15\%$

Increase of volume =>

$\Rightarrow \eta_{AC} = 35\%$

Required

$AB = ?$

$AC = ?$

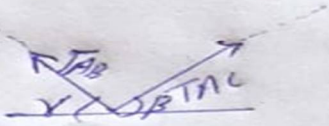
Solution

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

$\Rightarrow \gamma = 56.3^\circ$

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

$\Rightarrow \beta = 31.0^\circ$



Convert ~~lbs~~ m from lbs to kg

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

$T_{AB} \Rightarrow T_{AB}\hat{n}_{AB} = 0.15(181.48)(9.81)\{-\cos 56.3i + \sin 56.3j\}$

(P.T.O)

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

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

$T_{AC} \Rightarrow T_{AC}n_{AC} = 0.35(181.48)(9.81)\{-\cos 31 i + \sin 31 j\}$

$T_{AC} = 623.11\{-0.857i + 0.515j\}$

$T_{AC} = 534i + 320j$

#End

part B

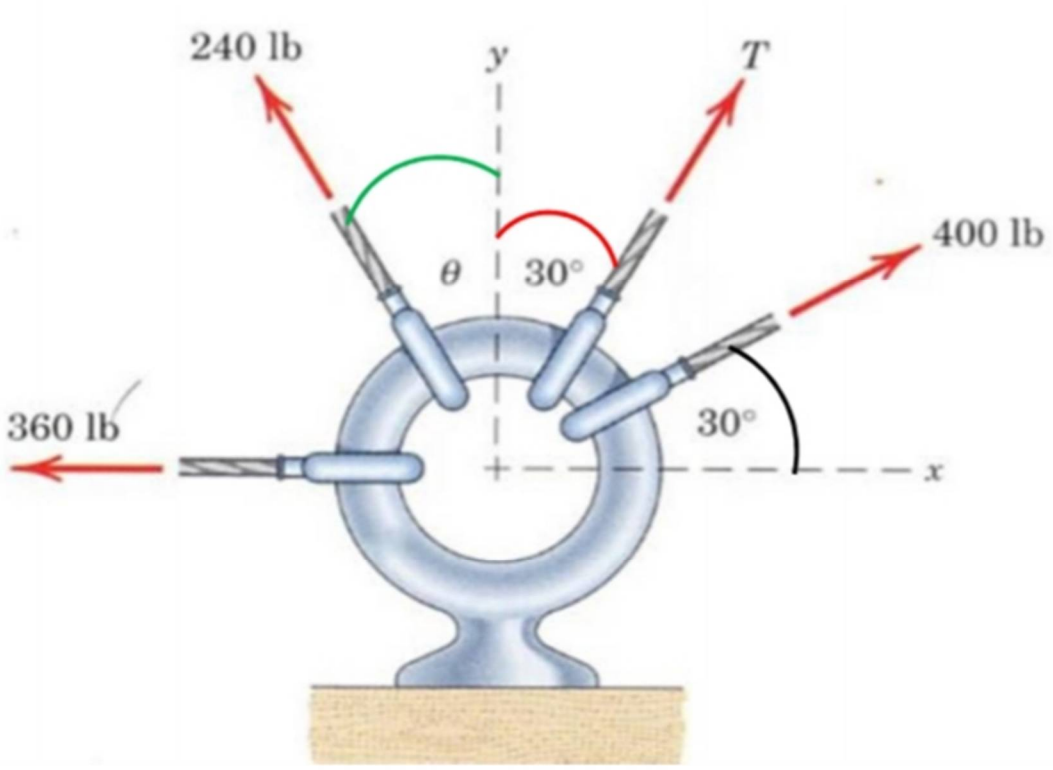
If the water tank increase the percentage of weight then the AC & AB weight will be increase.

P-2

END

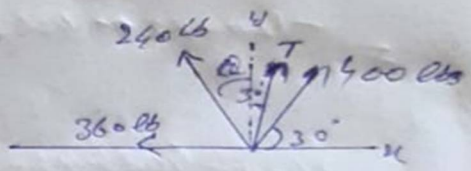
QUASTION:-2 **FOUR FORCES ARE EXERTED ON THE EYEBOLT AS SHOWN BELOW. IF THE NET EFFECT ON THE BOLT IS A DIRECT PULL OF 600 POUNDS IN THE Y-DIRECTION, DETERMINE THE VALUES OF T AND ϴ**

Answer:-



Q2

Answer.



Given data

$F_1 = 400\ lb$

$F_2 = T$

$F_3 = 240\ lb$

$F_4 = 360\ lb$

y direction full = 600 lb

Required

$T = ?$

$\theta = ?$

Solution

$\Sigma F_x = 0$

$\Rightarrow -360 - 240\sin\theta + T\sin 30 + 400\cos 30 = 0$ — Equation (1)

$\Sigma F_y = 0$

$= 240\cos\theta + T\cos 30 + 400\sin 30 = 600$ Equation (2)

Numerical Solution of Equation 1 & 2

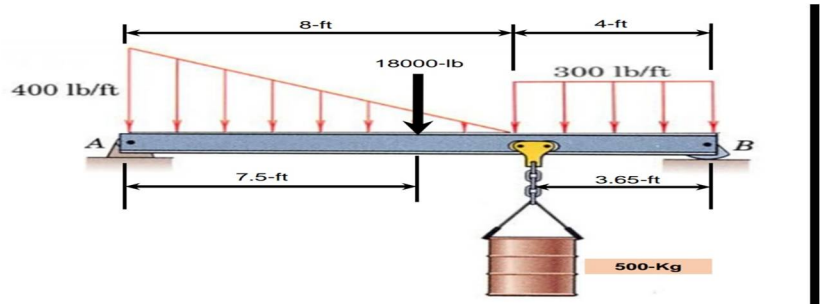
Then

$\theta = 21.7°,\ T = 204\ lb$

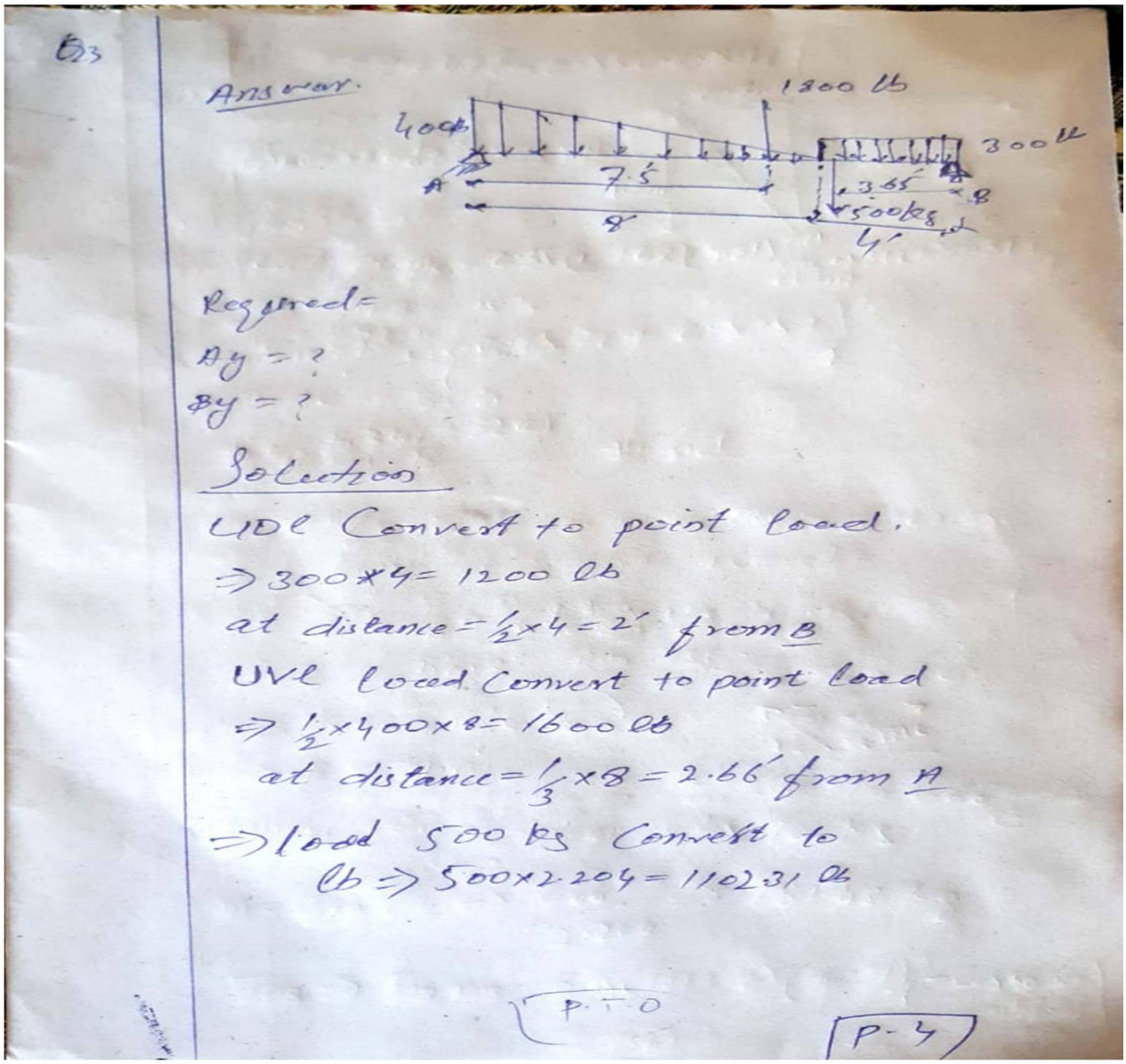
note = we could eliminate T between eq (1) & 2 the resulting equation transcendental

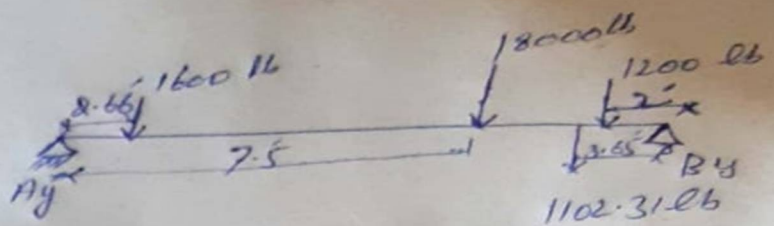
END

QUASTION:-3 CALCULATE THE REACTIONS AT SUPPORTS



Answer:-





Now

$\Sigma A_x = 0$

$A_x = 0$

$\Sigma M_A = 0$

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

$= -4256 - 135000 - 12000 - 9204.23 + By \times 12$

$= -160460.12 + By \times 12$

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

$By = 13371.69$ lb

$Ay =$

$\Sigma M_B = 0$

$= -1200 \times 2 - 1602.31 \times 3.65 - 18000 \times 4.5 - 1600 \times 9.34 + Ay \times 12$

$= -2400 - 4023.43 - 31000 - 14944 + Ay \times 12$

$= -102367.43 + Ay \times 12$

$Ay = \frac{102367.43}{12}$

$Ay = 8530.36$ lb

$Ay = 8530.36$ lb

$By = 13371.69$ lb

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END