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Section:- B.

Subject :- Eng → Mechanics.

Exam :- Mid-Term.

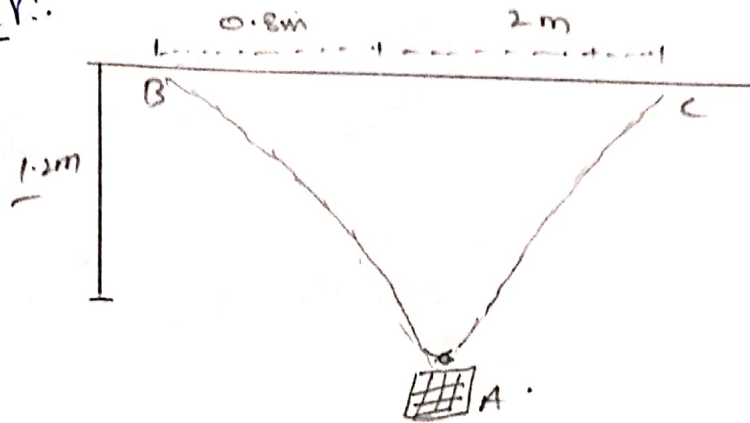
Department:- BS (Civil).

Teacher:- Eng- M. Majid Naeem:.

QNO1 (A) :- Part:

①

Answer:



Mass of tank = 400 lb.
water in tank = 3000 liter.

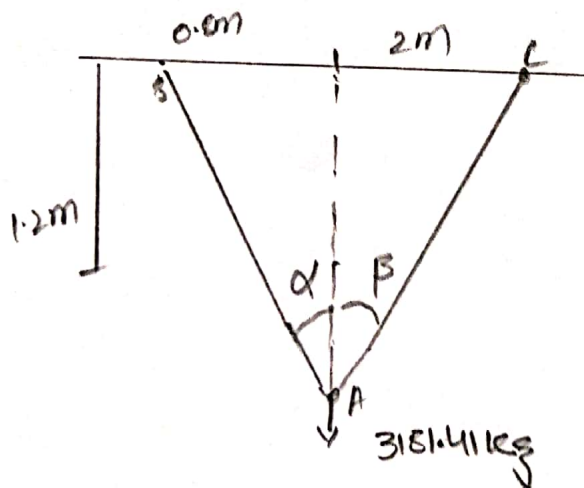
$$1 \text{ kg} = 2.205 \text{ lb.}$$

$$1 \text{ L} = 1 \text{ kg}$$

Mass of tank = 400 lb = 181.41 kg.

water in tank = 3000 liter = 3000 kg.

$$\begin{aligned} \text{Total load} &= 181.41 + 3000 \\ &= 3181.41 \text{ kg.} \end{aligned}$$



$$\tan \alpha = \frac{0.8}{1.2} \Rightarrow \alpha = \tan^{-1} \frac{0.8}{1.2} = \alpha \Rightarrow 33.69^\circ$$

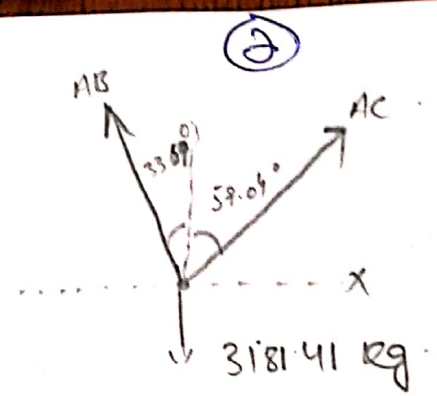
$$\tan \beta = \frac{2}{1.2} \Rightarrow \beta = \tan^{-1} \left(\frac{2}{1.2} \right) = \beta \Rightarrow 59.04^\circ$$

P.T.O.

QNO1. (A) part. Remaining part.

Ans

At joint A:



$$\sum F_x = 0 (-\rightarrow +)$$

$$-AB \cos(33.69) + AC \cos(59.04) = 0$$

$$AC (0.5144) = AB (0.8321)$$

$$AC = 1.62 AB \text{ --- (1)}$$

$$\sum F_y \uparrow = 0$$

$$AB \sin(33.69) + AC \sin(59.04) - 3181.41 \text{ kg}$$

$$AB (0.5547) + AC (0.858) = 3181.41 \text{ kg} \text{ --- (2)}$$

put eq(1) in eq(2) we get

$$AB (0.5547) + (0.858)(1.62AB) = 3181.41 \text{ kg}$$

$$AB (1.4045) = 3181.41 \text{ kg}$$

$$AB = 1635.97 \text{ kg}$$

The percentage of whole weight hold by cable AB alone

$$= \frac{1635.97}{3181.41} \times 100 = \underline{\underline{51.42}} \text{ Answer:}$$

$$\Rightarrow AB = 1635.97 \text{ kg}$$

$$\text{eq(1)} \quad AC = 1.62 \times 1635.97$$

$$\Rightarrow \text{AC} = 2650.27 \text{ kg}$$

$$W = mg$$

$$\text{Tension in AB} = 1635.97 \times 9.8 = 16048.87 \text{ N}$$

↪

$$\text{tension in AC} = 2650.27 \times 9.8$$

$$= 25999.1487 \text{ N}$$

Ans

QNO1 (B) part:

(3)

Ans:- weight of sand = $4200 \text{ lb} + 408 \times \frac{155}{100}$
 $\Rightarrow 4601.6 = 208.62 \text{ kg}$

water weight = $3000 + 3000 \times \frac{35}{100}$
 $\Rightarrow 4050 \text{ kg}$

Total weight = $208.62 + 4050 = 4258.62 \text{ kg}$

eq (3) $AB (1.945) = 4258.62$

$AB = 2189.52 \text{ kg}$

eq (1) $\Rightarrow AC = 1.62 \times 2189.52$

$AC = 3547.02 \text{ kg}$

Form AB,

percentage increase = $\frac{2189.52 - 1635.97}{1635.97} \times 100$
 $= 33.8\%$

For AC;

percentage increase = $\frac{3547.62 - 2650.27}{2650.27} \times 100$
 $= 33.8\%$

Hence the ~~Results~~ ^{Result} of part (a) will be increased 33.8%.

Q No 2

(4)

Ans: $\sum F_x = 0$

$$-360 - 240 \sin \theta + T \sin 30^\circ + 400 \cos 30^\circ = 0 \quad (1)$$

$$\sum F_y = 600 : 240 \cos \theta + T \cos 30^\circ + 400 \sin 30^\circ = 600 \rightarrow (2)$$

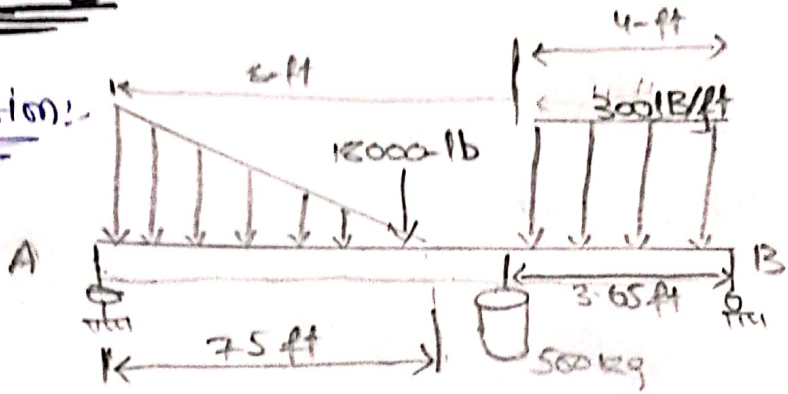
Numerical solution: Eq (1) and (2)

$$\theta = 21.7 \quad T = 204.15$$

(we could eliminate T between Eq (1) and (2).
But the resulting eq is still transcendental)

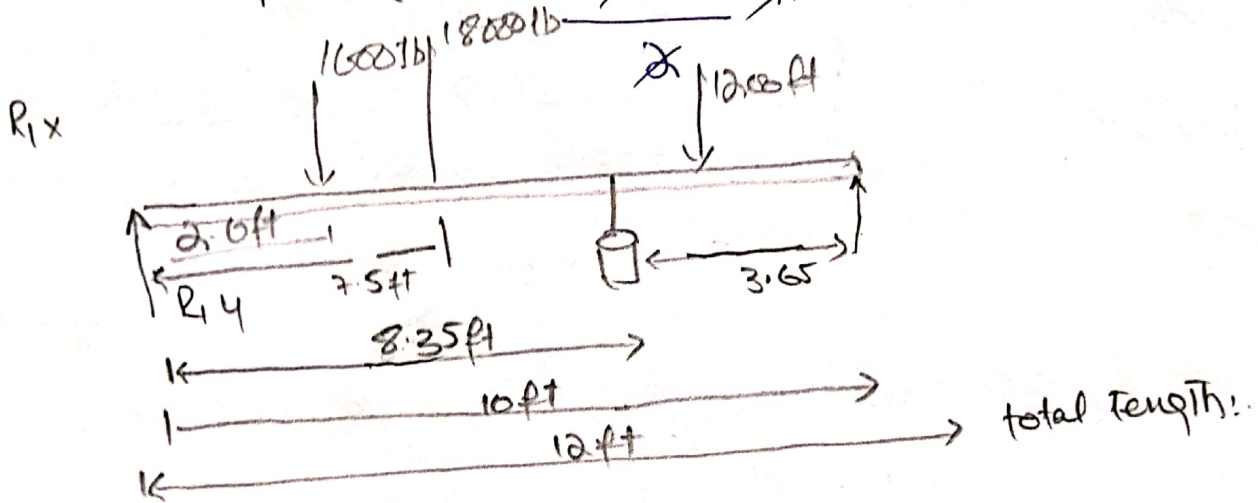
Q No 3:

Solution:



Resultant of UDL $\rightarrow 3000 \text{ lb/ft} \times 4 \text{ ft} = 12000 \text{ lb}$

Resultant of UDL $= 18000 \text{ lb/ft} \times \frac{24}{8} \text{ ft} = 16000 \text{ lb}$



$$\sum F_x = 0 \quad \text{--- (1)}$$

$$\sum F_y = 0$$

$$R_{1y} + R_{2y} - 16000 - 18000 - 500 - 12000 = 0$$

$$\sum M = 0$$

$$(R_2 \times 12 \text{ ft}) - (16000 \times 2.6) - (18000 \times 7.5) - (500 \times 8.35) - (12000 \times 10) = 0$$

$$12 R_2 - 41600 - 135000 - 4156 - 120000 = 0$$

$$12 R_2 - 155316 = 0$$

$$R_2 = \frac{155316}{12} = 12942.5 \text{ lb}$$

$$R_2 = 12942.5 \text{ lb}$$

P.T.O.

Q103:

⑤ ⑥

Ans put the value of R_1 in eq (i) we get .

$$R_1 + (12942.5) - 1600 - 18000 - 500 - 1200 = 0$$

$$R_1 + 12942.5 - 21300 = 0$$

$$R_1 - 8357.5 = 0$$

$$R_1 = 8357.5 \text{ IB}$$

$$R_1 = 0$$

$$R_1 = 8357.5 \text{ IB}$$

$$R_2 = 12942.5 \text{ IB}$$

The end.