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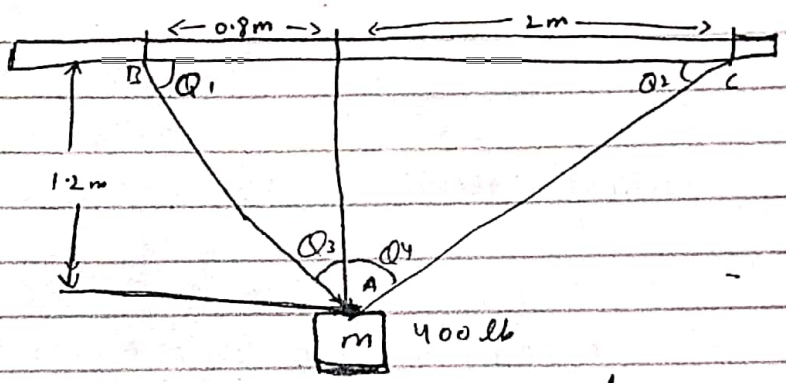
Department = "Civil"
Subject : "Engineering mathematics"
Section : "B"

Q1:-



Volume = 3000 liters.

Solution:-

$\overline{AB} = \sqrt{(0.8)^2 + (1.2)^2} = 1.44\ m$

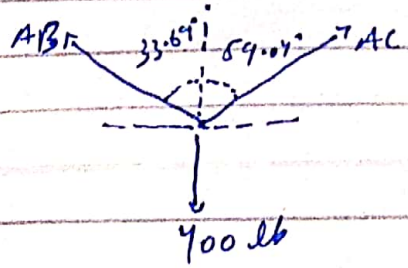
$\overline{AC} = \sqrt{(2)^2 + (1.2)^2} = 2.33\ m$

$\theta_1 = \tan^{-1}\left(1.2/0.8\right) = 56.31°$

$\theta_2 = \tan^{-1}\left(1.2/2\right) = 30.96°$

$\theta_3 = 90° - 56.31°$
$= 33.69°$

$\theta_4 = 90° - 30.96°$
$= 59.04°$



$\Rightarrow \quad \Sigma F_y = 0 \quad +\uparrow$

$$-400 + AB\cos(33.69) + AC\cos(59.04) = 0$$

$$0.832\,AB + 0.514\,AC = 400 \rightarrow (A)$$

$\Rightarrow \quad \Sigma F_x = 0 \quad \overset{+}{\rightarrow}$

$$\Rightarrow \quad -AB\sin(33.69) + AC\sin(59.04) = 0.$$

$$-0.555\,AB + 0.858\,AC = 0$$

$$AB - 1.55\,AC = 0 \longrightarrow (B)$$

Putting value of AB on eq (A)

$$\Rightarrow 0.832\,[1.55\,AC] + 0.514\,AC = 400$$

$$\Rightarrow \quad 1.2896\,AC + 0.514\,AC = 400$$

$$1.8036\,AC = 400$$

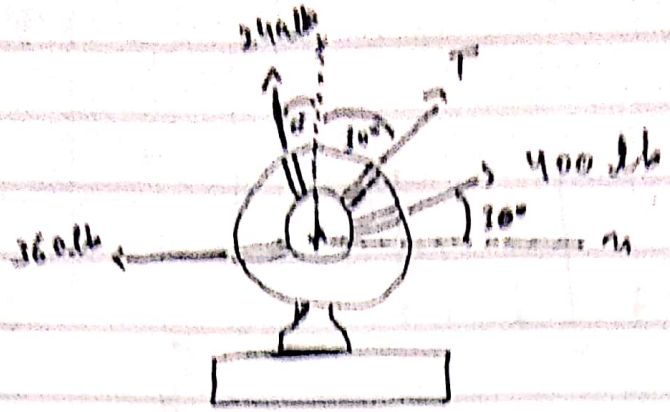
$$\Rightarrow \quad AC = 221.78\ lb$$

So eq (B) becomes

$$\Rightarrow AB - 1.55(221.78) = 0$$

$$\Rightarrow \quad AB = 343.76\ lb.$$

Q2:-



Solution:-

$$\Sigma F_x = 0$$

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

$$\Sigma F_y = 600$$

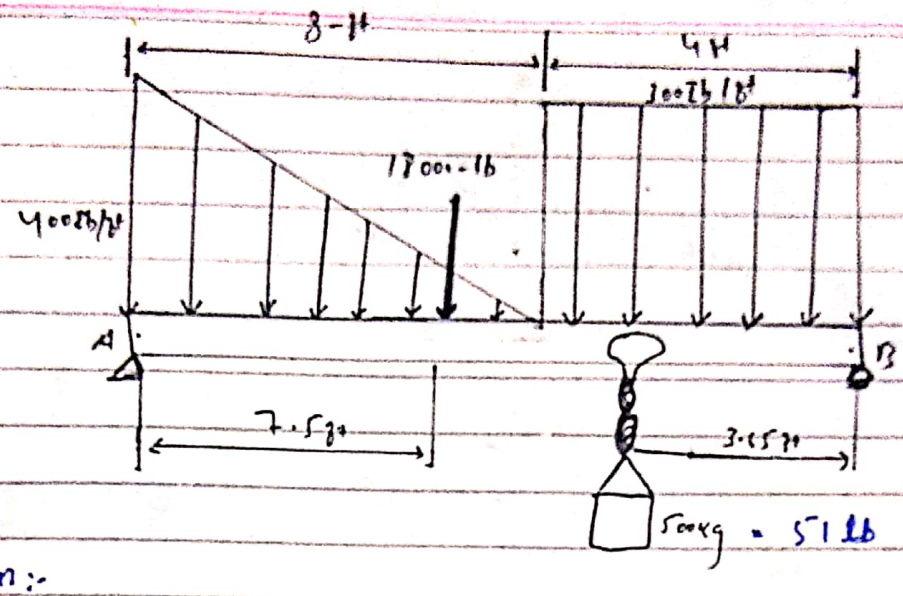
$$\Rightarrow 240\cos\theta + T\cos 30^\circ + 400\sin 30^\circ = 600 \rightarrow (2)$$

Numerical solution of eq (1) & (2) is

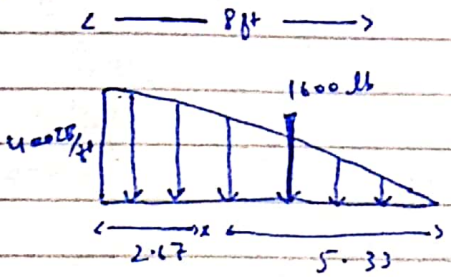
$$\theta = 21.7 \quad , \quad T = 204 \text{ lb}$$

(we could eliminate T between eq (1) & (2) but the resulting is still trasendented.)

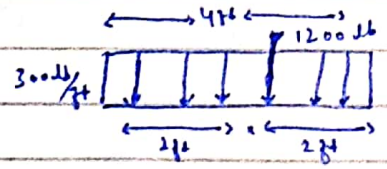
Q3:-



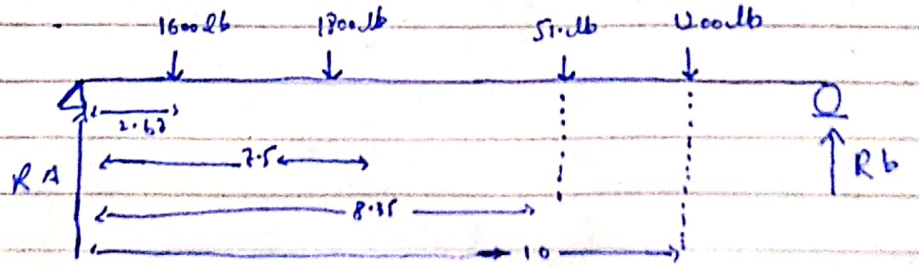
Solution:-



$\frac{400 \times 8}{2} = 1600$ lb



$300 \times 4 = 1200$ lb



$\Rightarrow \Sigma M_A = 0$ ↻

$\Rightarrow (1600 \times 2.67) + (1800 \times 7.5) + (51 \times 8.35) + (1200 \times 10) - R(12) = 0$

$27528.5 = 12\,Rb$

$\boxed{Rb = 2294\ lb}$

$\Rightarrow \Sigma F_y = 0$ ↑+

$\Rightarrow RA - 1600 - 1800 - 51 - 1200 + 2294 = 0$

$\Rightarrow \boxed{RA = 2357\ lb}$