

ID: [16069](#)

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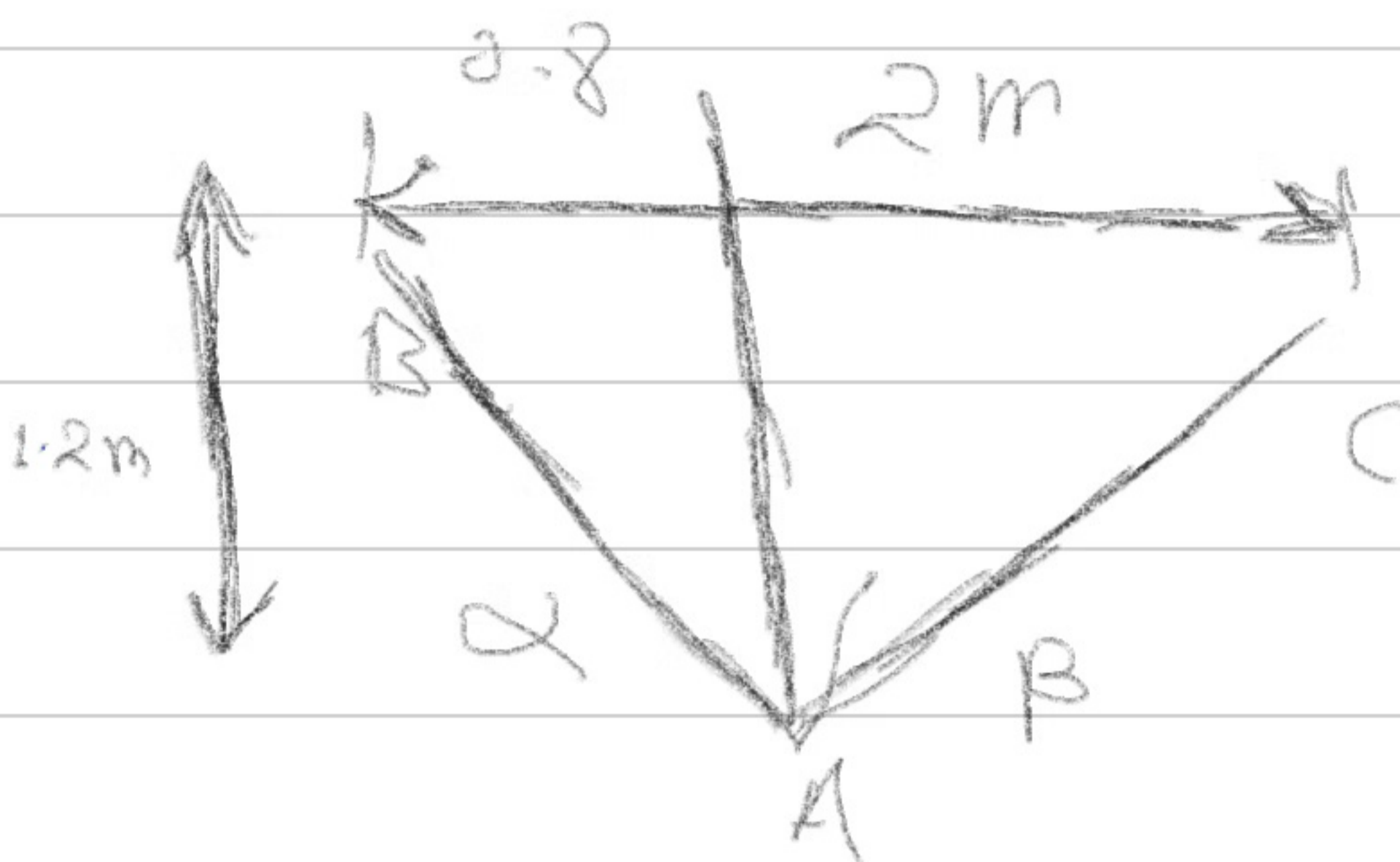
Semester : 2nd

Section: A

Subject: engineering mechanics

Question: 1

Solution:



$$\alpha = \tan^{-1}\left(\frac{1.2}{0.8}\right) \\ = 56.3^\circ$$

$$\beta = \tan^{-1}\left(\frac{1.2}{2}\right) \\ \beta = 31.0^\circ$$

$$\bar{T}_{\text{total mass}} = 400 + 6613.9 = 713.9 \text{ lb}$$

$$\text{or } 3181.45 \text{ kg}$$

- The total weight is being held by cable AB is 85.8%

Part a

Tension in AB

$$\begin{aligned}\bar{T}_{AB} &= T_{AB} \underline{n}_{AB} = 0.858 (3181.45) (9.81) \\ &\quad [-\cos 56.3^\circ \hat{i} + \sin 56.3^\circ \hat{j}] \\ &= -14857 \hat{i} + 22278 \hat{j} \text{ N}\end{aligned}$$

Tension in AC

$$\begin{aligned}\bar{T}_{AC} &= T_{AC} \underline{n}_{AC} = 0.553 (3181.45) (9.81) [\cos 31^\circ \hat{i} + \sin 31^\circ \hat{j}] \\ &= 14857 \hat{i} + 8921 \hat{j} \text{ N}\end{aligned}$$

Part b

increasing weight by 15%

$$400 + 60 = 460 \text{ lb}$$

increasing volume by 35%

$$3000 + 1050 = 4050 \text{ L or } 8928.7 \text{ lb}$$

$$\begin{aligned} \text{Total weight} &= 8928.7 + 460 \Rightarrow 9388.7 \text{ lb} \\ &\text{or } 4258.7 \text{ kg} \end{aligned}$$

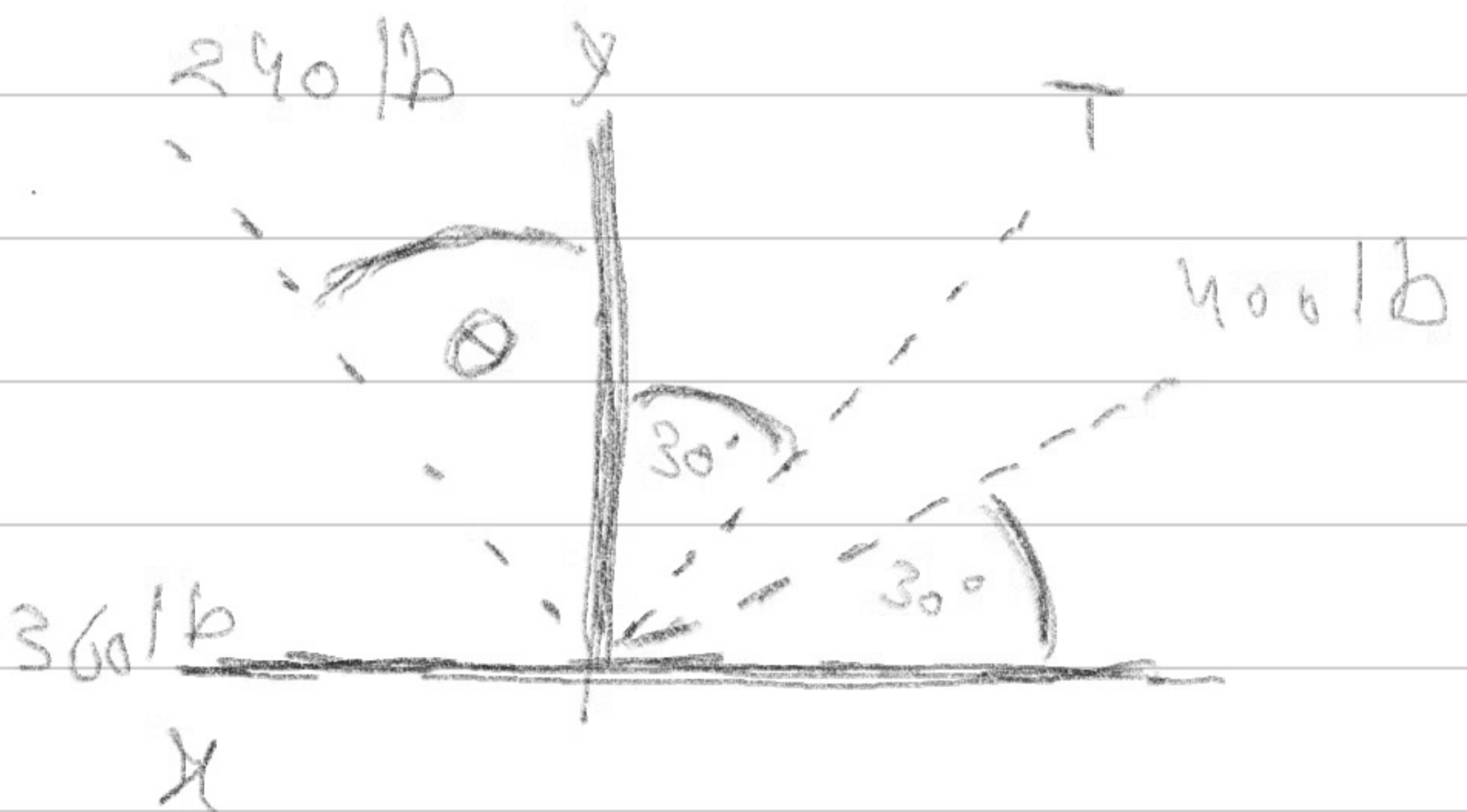
Now find tension in AB

$$\begin{aligned} \vec{T}_{AB} &= T_{AB} \hat{n}_{AB} = 0.858(4258.7)(9.81)(-\cos 56.3^\circ \hat{i} + \sin 56.3^\circ \hat{j}) \\ &= -19888 \hat{i} + 29822 \hat{j} \text{ N} \end{aligned}$$

$$\begin{aligned} \vec{T}_{AC} &= T_{AC} \hat{n}_{AC} = 0.353(4258.7)(9.81)(\cos 31.0^\circ \hat{i} + \sin 31^\circ \hat{j}) \\ &= 19874 \hat{i} + 11942 \hat{j} \text{ N} \end{aligned}$$

Question: 2

Solution:



As we know that forces

on x-axis is

$$\sum F_x = 0$$

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

$$\sum F_y = 600$$

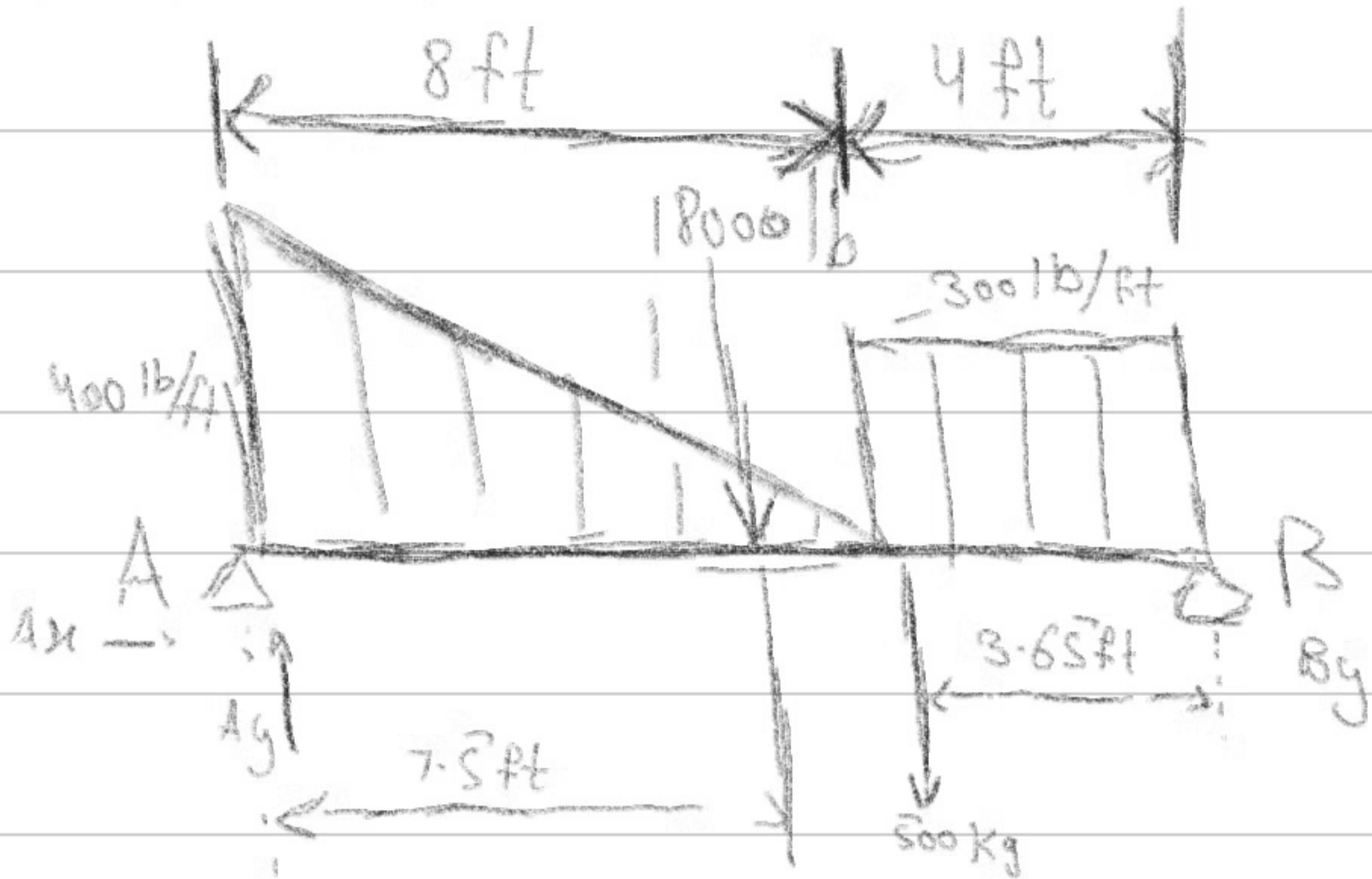
$$T \cos 30^\circ + 400 \sin 30^\circ + 240 \cos \theta = 600 \rightarrow (2)$$

Numerical solution of eqs (1) and (2)

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

Question 3:

Solution:



$$400 \text{ lb/ft} \times 8 \text{ ft} = 3200 \text{ lb}, \quad 300 \text{ lb/ft} \times 4 \text{ ft} = 1200 \text{ lb}$$

$$500 \text{ kg} = 1102.31 \text{ lb}$$

$$\text{From } \sum F_x = 0 \quad A_x = 0$$

$$\sum M_A = 0$$

$$-3200 - 18000(7.5) - 1200 \text{ lb} - 1102.31(3.65)$$

$$+ B_y(12) = 0$$

$$B_y = \frac{143423.43}{12}$$

$$B_y = 11952$$

$$\sum F_y = 0$$

$$Ay - 3200 - 18000 - 1200 - 1102 \cdot 31 + 11952 = 0$$

$$Ay = 11550 \cdot 31$$

$$By = 11952, Ay = 11550 \cdot 31$$