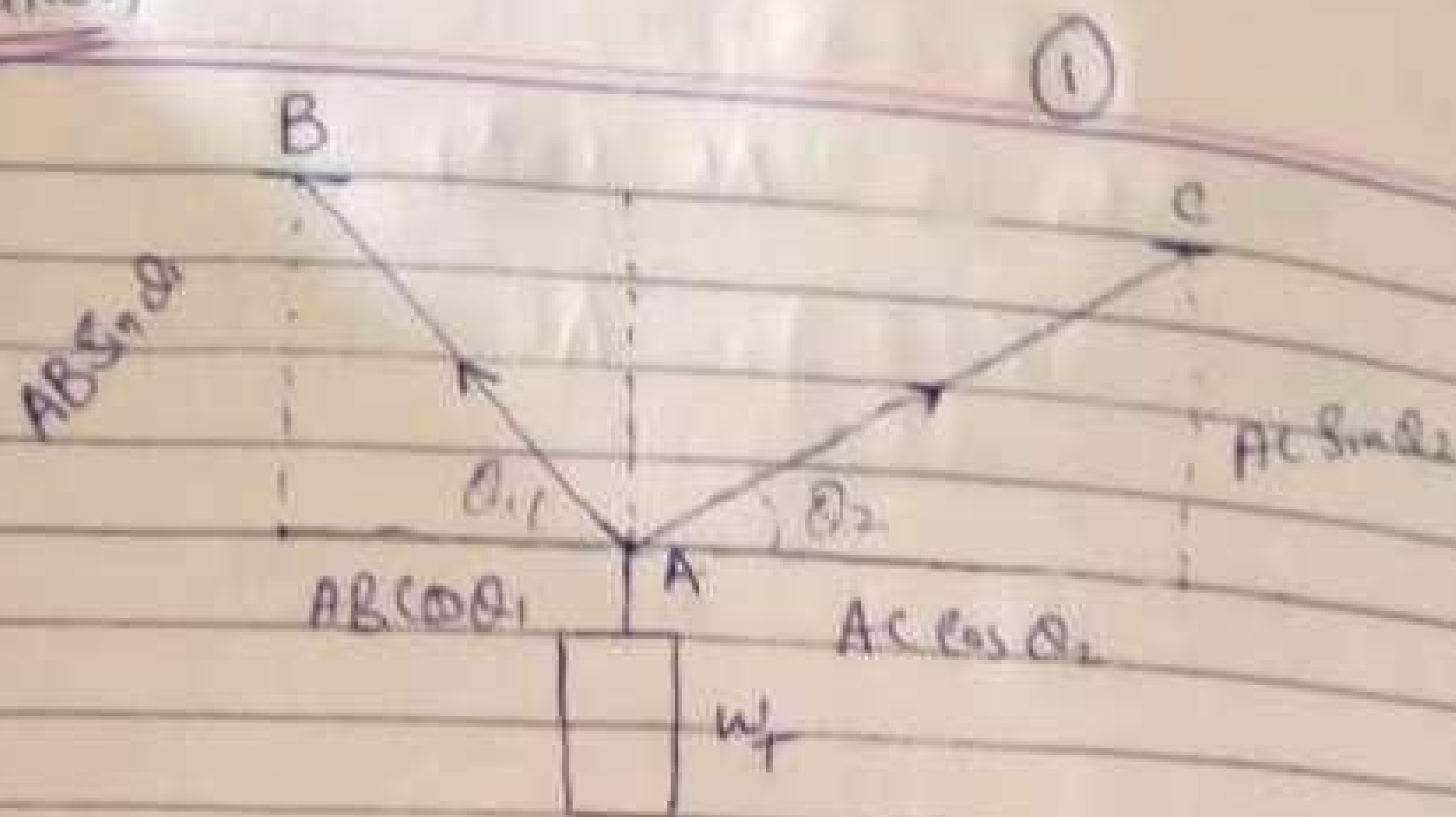


Solution



$$\begin{aligned} W_t &= W_{\text{tank}} + W_{\text{water}} \\ &= 400 + \frac{m_w}{g} \\ &= 400 + 98 \end{aligned}$$

find weight of water is

$$\begin{aligned} m_w &= \rho V_w \\ &= 1000 \times 3 \\ m_w &= 3000 \text{ kg} \end{aligned}$$

$$m_w = 3000 \text{ kg}$$

$$\begin{aligned} \text{Weight (water)} &= m_w g \\ &= 3000 \times 32.2 \\ W_{\text{water}} &= 96600 \text{ lb} \end{aligned}$$

$$\begin{aligned} W_{\text{total}} &= W_{\text{tank}} + W_{\text{water}} \\ &= 400 + 96600 \\ &= 97000 \text{ lb} \\ W_{\text{total}} &= 97000 \text{ lb} \end{aligned}$$

②

Putting Eq (2) in Eq (1)

$$-240 \sin \theta + \frac{D \cdot S}{0.023} [400 - 240 \cos \theta] = -464$$

$$-240 \sin \theta - 144.05 \cos \theta = -286.826$$

By comparing with

$$\sin \theta_1 = -144.05$$

$$\sin(\theta - \theta_1)$$

$$\cos \theta_1 = -240$$

$$= \cos \theta \sin \theta$$

$$\tan \theta_1 = \frac{144.05}{240}$$

$$+ \cos \theta \cdot \sin \theta$$

$$\theta_1 = 80.99^\circ$$

$$\Rightarrow R_n (R + 30.99) = -286.826$$

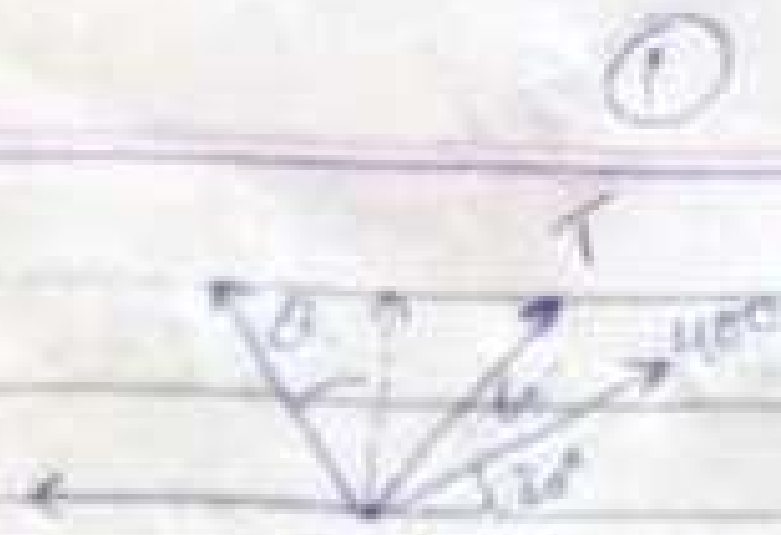
$$\Rightarrow \sin^{-1} \left(\frac{-286.826}{R + 30.99} \right) = 80.99^\circ$$

By arcs of (1) and (2)

$$[0 = 50] \text{ or } [0 = 100] \text{ or } 180 \text{ or } 270$$

$$T = 369.9985$$

Q 202



$$R = \sqrt{R_x^2 + R_y^2}$$

But here we have

$$R_x = 0$$

$$R = R_y$$

$$R_x = 0$$

$$\sum F_x = 0 \quad R_x$$

$$\rightarrow -300 - 240 \sin \theta + T \cos 60 + 400 \cos 30 = 0$$

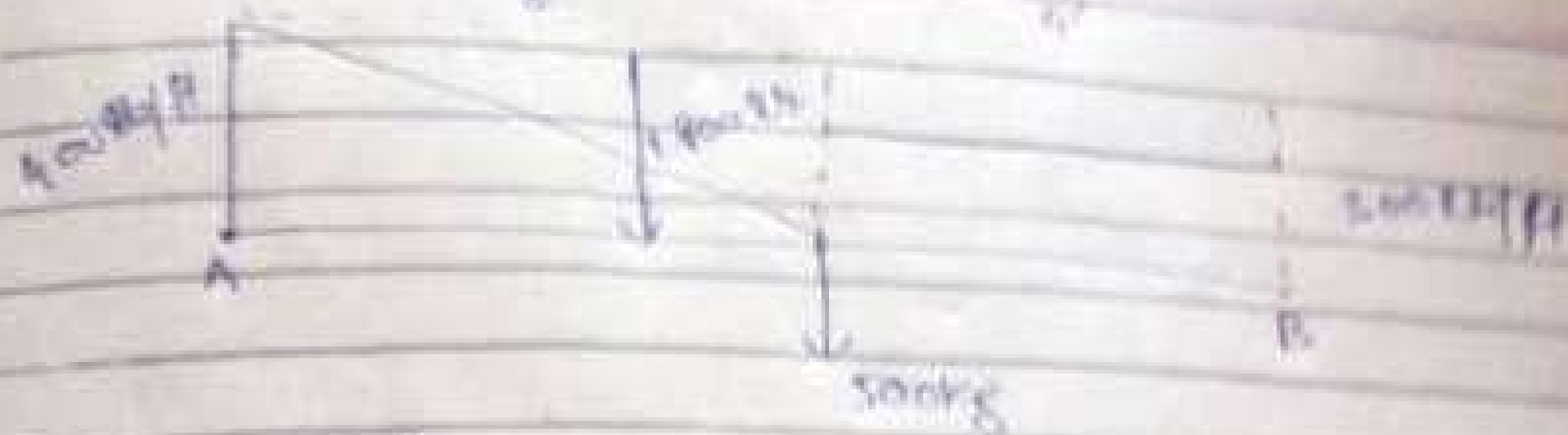
$$\rightarrow -240 \sin \theta + 0.5 T = -46.41$$

$$\rightarrow \sum F_y = R_y \quad \text{--- (1)}$$

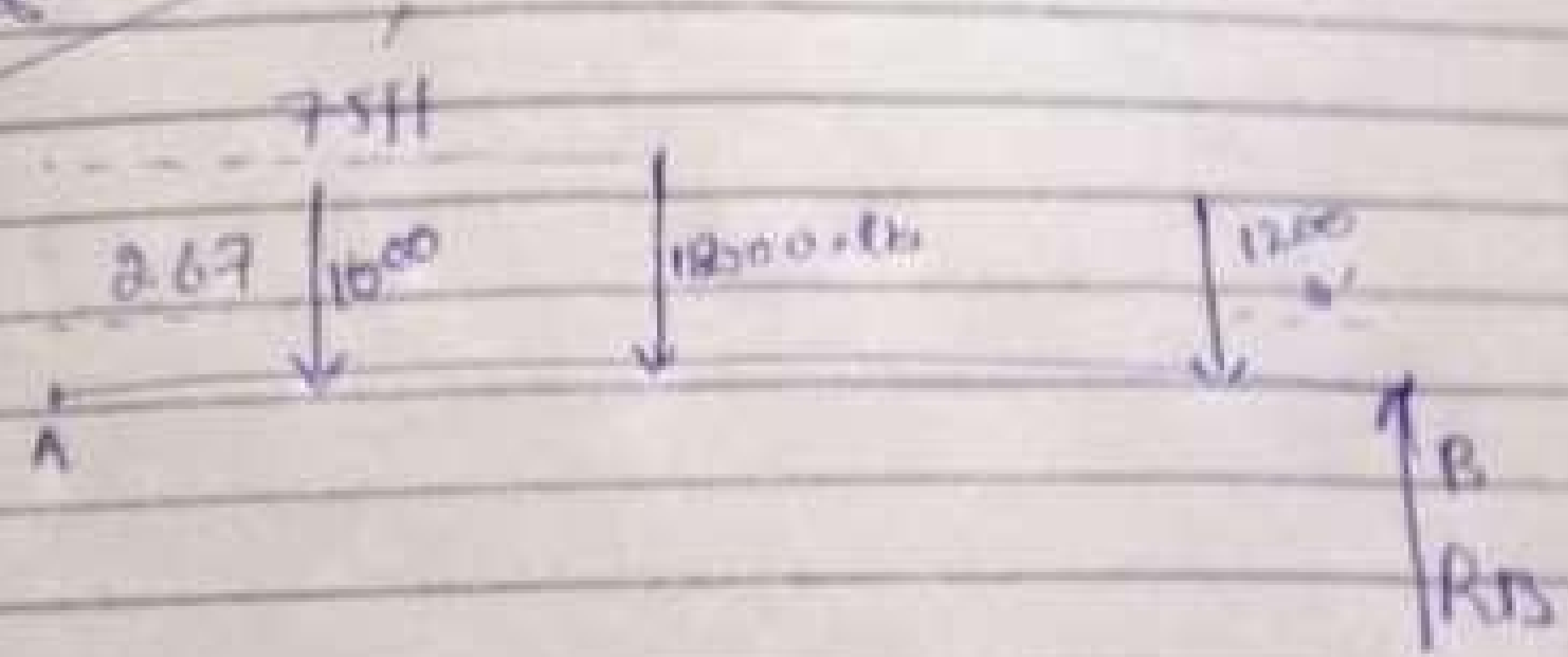
$$\rightarrow 240 \cos \theta + T \sin 60 + 400 \sin 30 = 600$$

$$\rightarrow 0.86 T = (400 - 240 \cos \theta) \quad \text{--- (2)}$$

Prob #103



Free body diagram



$$\sum M_A = 0$$

$$\Rightarrow 7.5 R_B = 2.67 \times 1000 + 7.5 \times 18000 + 10 \times 1200$$

$$\Rightarrow 12 R_B = 151272$$

$$R_B = 12606 \text{ lb}$$

$$\sum M_B = 0$$

~~OR~~ OR

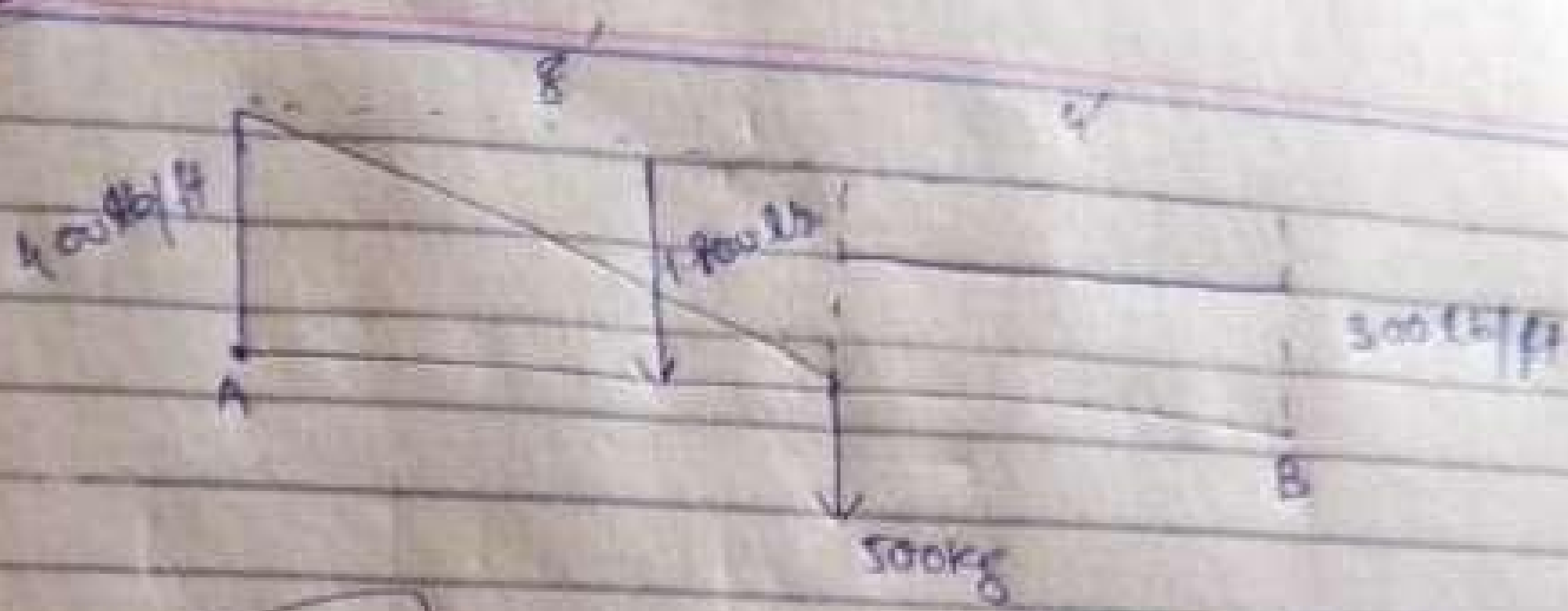
$$\sum F_y = 0$$

$$\Rightarrow R_A + R_B = 1000 + 18000 + 1200$$

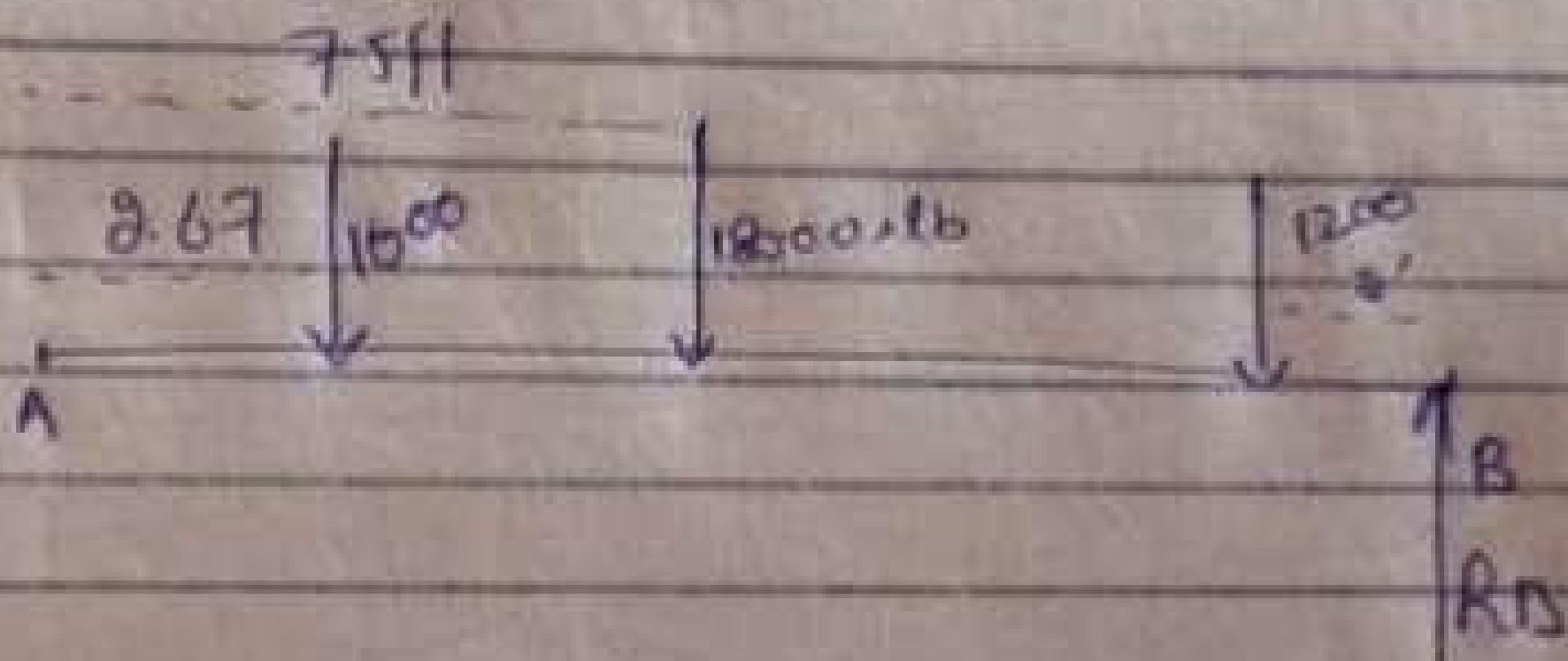
$$\Rightarrow R_A = 1000 + 18000 + 1200 - 12606$$

$$R_A = 8194 \text{ lb}$$

Prob 110



Free Body diagram



$$\sum M_A = 0$$

$$\Rightarrow 7B R_B = 2.67 \times 1600 + 7.5 \times 18000 + 10 \times 1200$$

$$\Rightarrow 12 R_B = 151278$$

$$R_B = 12606 \text{ lb}$$

$$\sum M_B = 0$$

~~OR~~

$$\sum F_y = 0$$

$$\Rightarrow R_A + R_B = 1600 + 18000 + 1200$$

$$\Rightarrow R_A = 1600 + 18000 + 1200 - 12606$$

$$R_A = 8194 \text{ lb}$$

$$\Rightarrow \sum F_x = 0$$

$$\Rightarrow AB \cos \theta_1 = AC \cos \theta_2$$

$$\Rightarrow AB \cos \left(\tan^{-1} \frac{1.2}{0.8} \right) = AC \cos \left(\tan^{-1} \frac{1.2}{2} \right)$$

$$\Rightarrow 0.55 AB = AC \cdot 0.867$$

$$\Rightarrow \boxed{AB = 1.56 AC}$$

$$\Rightarrow \sum F_y = 0$$

$$\Rightarrow AB \sin \theta_1 + AC \sin \theta_2 = W$$

$$\Rightarrow AB \sin \left(\tan^{-1} \frac{1.2}{0.8} \right) + AC \sin \left(\tan^{-1} \frac{1.2}{2} \right) = 97000$$

$$\Rightarrow 0.83 AB + 0.514 AC = 97000$$

$$\Rightarrow 0.83 \cdot 1.56 AC + 0.514 AC = 97000$$

$$\Rightarrow \boxed{AC = 53626.71 \text{ lb}}$$

$$\boxed{AB = 83657.62 \text{ lb}}$$

④

$$\sum F_y = 0$$

$$\Rightarrow AB \sin \theta_1 + AC \sin \theta_2 = W_{\text{total}}$$

$$\Rightarrow 0.83 AB + 0.514 AC = 130.870$$

$$\Rightarrow 0.83 \times 1.56 AC + 0.514 AC = 130.870$$

$$\Rightarrow AC = 72351.83 \text{ lb}$$

$$\Rightarrow \sum F_x = 0$$

$$AB = 1.56 AC$$

$$= 1.56 \times 72351$$

$$AB = 112868.86 \text{ lb}$$

(3)

$$AB = 83657.67 \text{ lb}$$

Find its percentage.

$$AB\% = \frac{83657.67}{97000} \times 100$$

$$AB\% = 86.24\%$$

Part - 2 :

When tank weight is increased by 15% and when volume of water is increased by 35% then first we have to find total weight.

$$W_{\text{tank}} = 1.15 \times 400$$

$$(W_{\text{tank}}) = 460 \text{ lb}$$

$$W_{\text{water}} = 1.35 \times 96600$$
$$= 130410 \text{ lb}$$

$$W_{\text{total}} = 130870 \text{ lb}$$