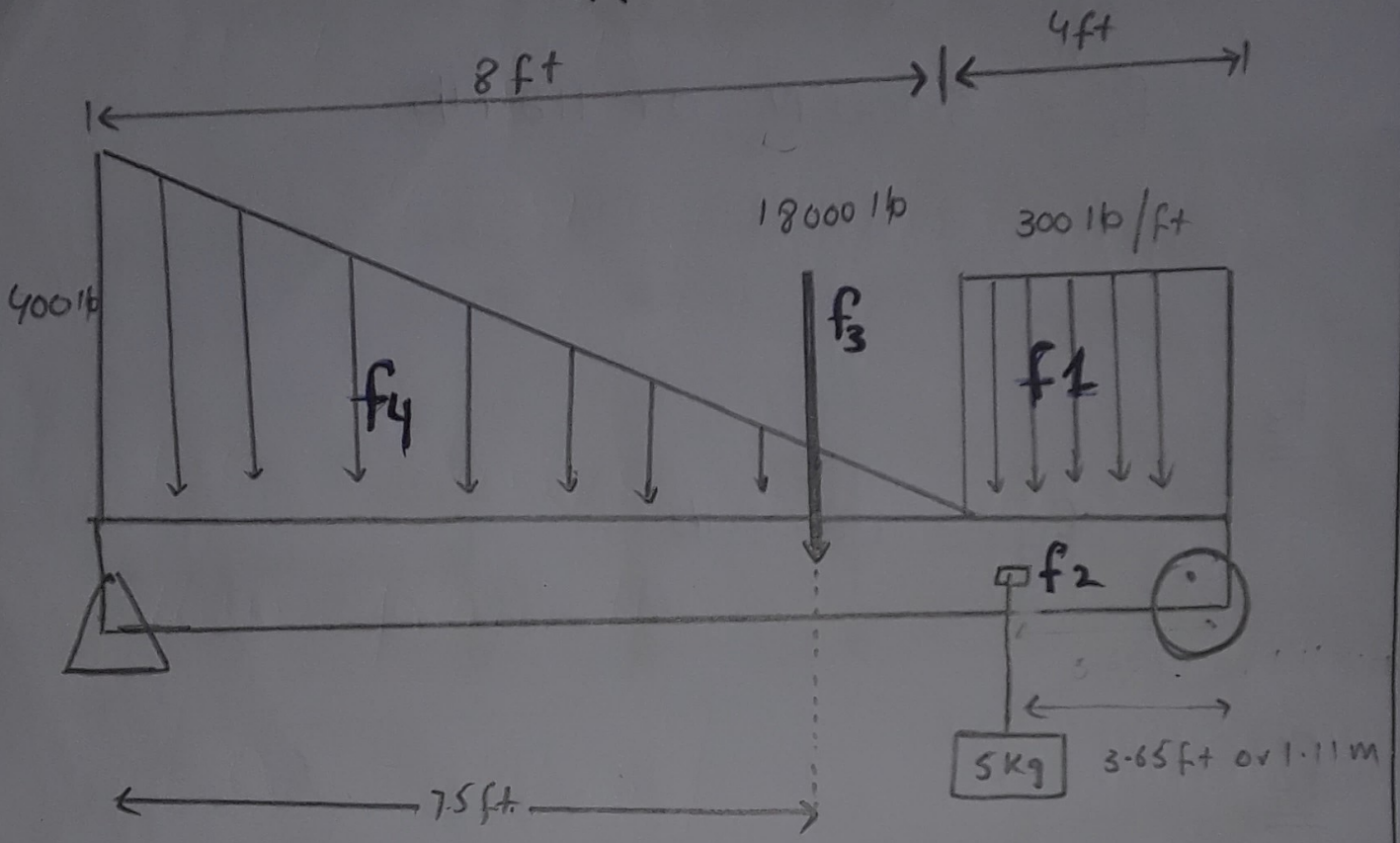
Q3 :- Calculate the reaction at support



△ = Hing support = Two reaction x, y

○ = Roller support = one reaction (y)

f1 = uniformly destributed load

f_1 = load intensity X length of load

$f_1 = 300\ lb/ft \times 4\ ft = 1200\ lb$

→ Resultant of f_1 is at middle

Question 3 Continue...

f_2

$f_2 = ma$

$f_2 = 500kg \times 10 m/s^2$

$f_2 = 5000 N$ or $1124 lb$

f_3

$f_3 = 18000 lb$

f_4

f_4 is uniformly variable load.

$f_4 =$ Load intensity $\times$ Length of load $/ 2$

$f_4 =$ ~~400ft x~~ $400 lb/ft \times 8 ft$

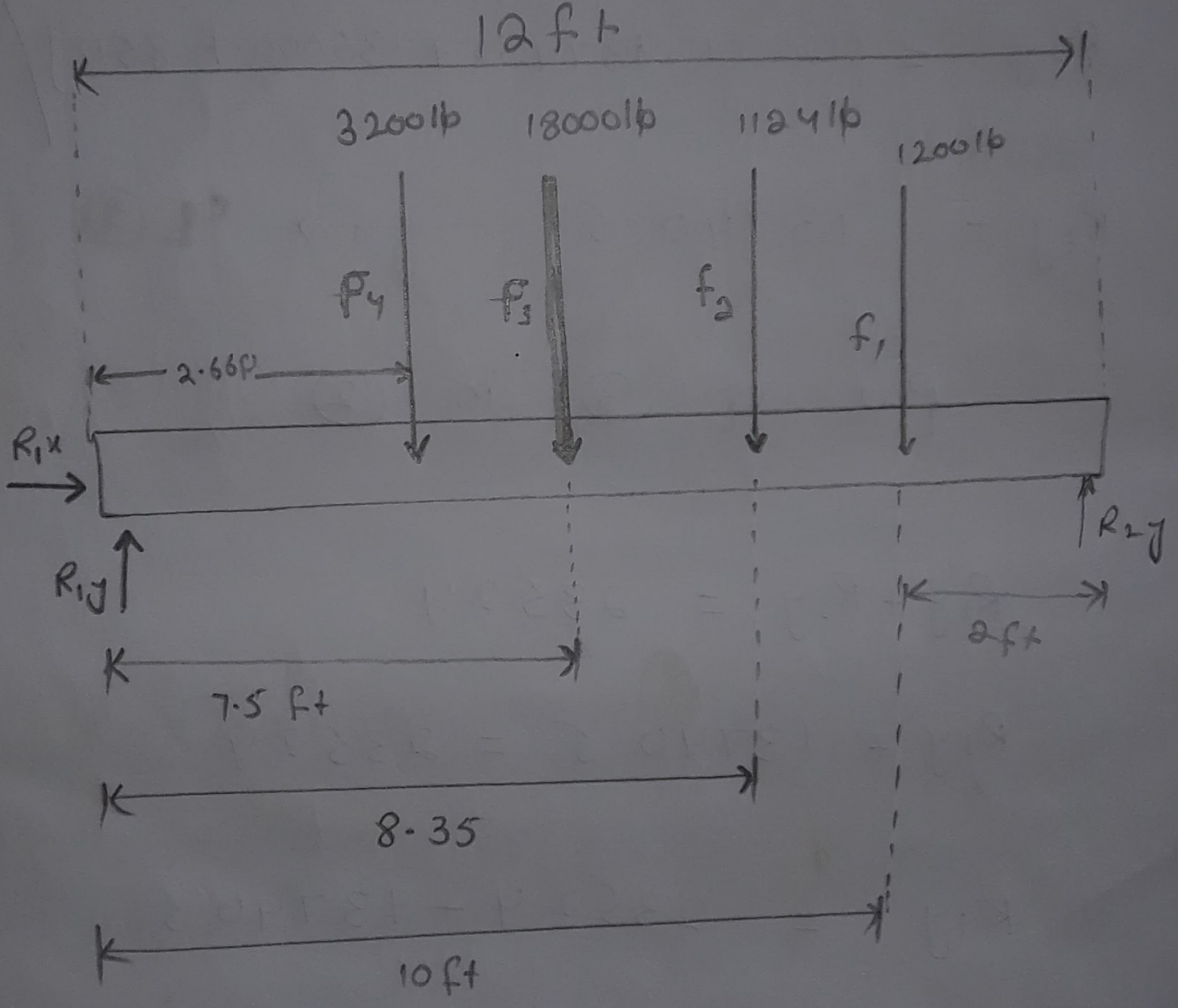
$f_4 = 3200 lb$

→ The Resultant of UVl will act 1/3 from the max load.

8/3 = 2.66 ft from the max load

question 3 continuous.

according to f_1, f_2, f_3, f_4 ~~find~~ draw the free body diagram



so, $R_1x = 0 \longrightarrow$ eq① $\Sigma fx = 0$

$R_1y + R_2y - 1200 - 11241b - 18000lb - 3200lb = 0 \rightarrow$ eq②

$R_1y + R_2y = 23524 \longrightarrow$ eq (2)

Question 3 continue

$$12 \times R_2y = [1200 \times 10 + 1124ft \times 8.34ft + 18000 \times 7.5 + 320 \times 2.66] = 0 \longrightarrow \text{eq 3}$$

$$R_2y = [12000 + 9374.16 + 135000 + 8512] / 12$$

$$R_2y = 13740.5 \longrightarrow \text{eq 3}$$

Put eq (3) in (2)

$$R_1y + R_2y = 23524$$

$$R_1y + 13740.5 = 23524$$

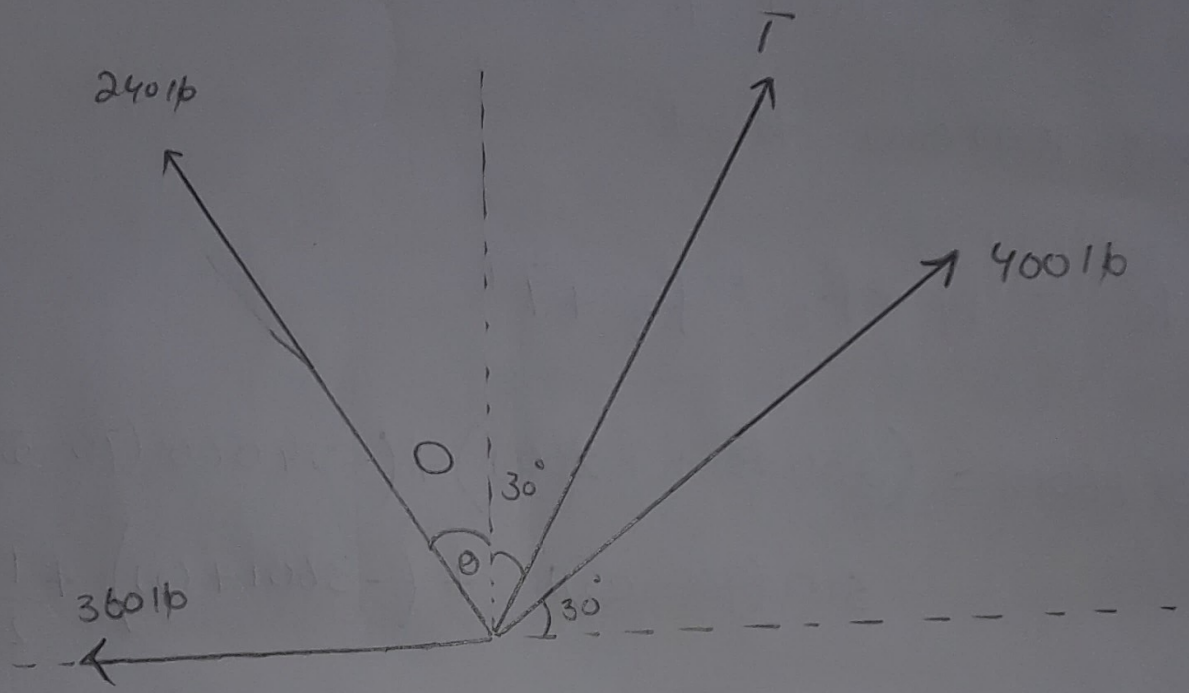
$$R_1y = 23524 - 13740.5$$

$$R_1y = 9738.5$$

$$\boxed{R_1y = 9738.5, \quad R_2y = 13740.5}$$

Ans

Q2 determine the T and Q



Sol:

$\vec{R} = 600\ lb\, j$

$F_1 = 400\cos 30\, i + 400\sin 30\, j$

$= 400\left(\frac{\sqrt{3}}{2}\right) j + 400\left(\frac{1}{2}\right) j$

$F_1 = 200\sqrt{3}\, i + 200\, j$

$\vec{T} = T\cos 60\, i + T\sin 60\, j$

$\vec{T} = \frac{T}{2} i + \frac{\sqrt{3}}{2} T\, j$

$$\vec{f_2} = -240\cos(90-\theta)\,i + 240\sin(90-\theta)\,j$$

$$f_3 = -360i + 0j$$

we know that

$$\vec{R} = f_1 + f_2 + f_3 + T$$

$$0i + 600j = (200\sqrt{3}\,i + 200j) + (-240\cos(90-\theta)i + 240\sin(90-\theta)j + (-360i + 0j) + \frac{T}{2}i + \sqrt{\frac{3}{2}}Tj$$

so,

$$0 = 200\sqrt{3}\,1 - 240\cos(90-\theta)\,1 - 360 + \frac{T}{2} \longrightarrow (A)$$

$$0 = -27.2 - 480\cos(90-\theta + T \longrightarrow (A)$$

$$T = 480\cos(90-\theta) + 27.2 \longrightarrow (B)$$

NOW,

$$600 = 200 + 240\sin(90-\theta) + 0 + \sqrt{\frac{3}{2}}\,T$$

$$\Rightarrow 400 = 240\sin(90-\theta) + \frac{\sqrt{3}}{2}\,T$$

$$800 = 480 \sin(90-\theta) + \sqrt{3}\,T \longrightarrow (C)$$

Put eq (B) in eq (C)

$$800 = 480 \sin(90-\theta) + \sqrt{3} \cdot 480 \cos 90-\theta + 27.2$$

$$1.6 = \sin(90-\theta) + 1.7 \cos 90-\theta$$

Thus from this calculation

$$\boxed{\theta = 21.6^{\circ}}$$

Put the value of θ in eq (2) for finding T

$$T = 480 \cos(90-\theta) + 27.2 \longrightarrow (2)$$

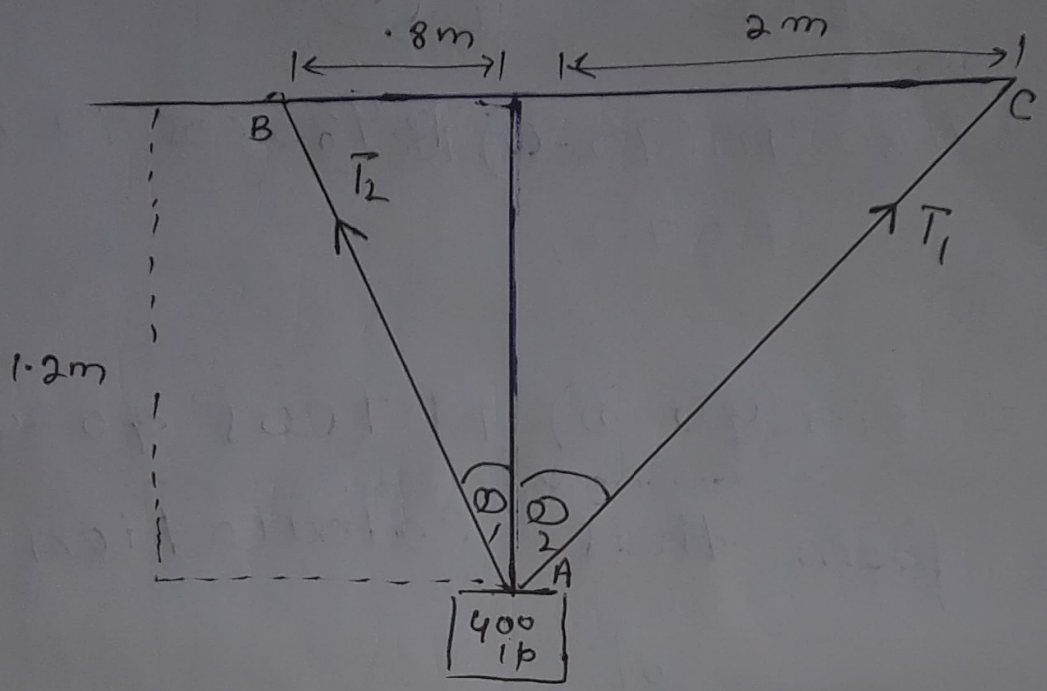
$$T = 480 \cos(90-21.6) + 27.2$$

$$T = 480 \cos(68.3) + 27.2$$

$$T = 480\,(.3697) + 27.2$$

$$\boxed{T = 204.6}$$ Hence find.

Q1 :-



Sol Part a

$$\rightarrow \tan\Phi_1 = \frac{.8m}{1.2m}$$

$$\Phi_1 = \tan^{-1}\frac{.8m}{1.2m}$$

$$\boxed{\Phi_1 = 33.7^\circ}$$

$$\rightarrow \tan\Phi_2 = \frac{2m}{1.2m}$$

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

$$\boxed{\Phi_2 = 59^\circ}$$

$$W = 0i + (-400\ lb)j \longrightarrow (A)$$

$$\vec{T_2} = -T_2 \sin 33.7 i + T_2 \cos 33.7 j$$

$$\vec{T_1} = T_1 \sin 59 i + T_1 \cos 59 j$$

So,

$$W = T_1 + T_2 = 0$$

$$400\ lbj = T_2 \cos 33.7 + T_1 \cos 59 \longrightarrow (B)$$

$$0 = -T_2 \sin 33.7 + T_1 \sin 59$$

$$\rightarrow T_1 \sin 59 = T_2 \sin 33.7 \longrightarrow (C)$$

$$T_1 = T_2 \frac{\sin 33.7}{\sin 59}$$

$$T_1 = .6\, T_2 \longrightarrow (D)$$

Put eq (D) in eq (B)

$$400\ lb = T_2 \cos 33.7 + (.6 T_2 \cdot \cos 59)$$

$$400 = T_2 (.83) + .6 T_2 \cdot (.85)$$

$$400 = .8 T_2 + 0.3 T_2$$

$$400 = 1.1\,T_2^2$$

$$T_2^2 = 400/1.1$$

$$\boxed{T_2^2 = 363.6 \text{ lb}}$$

Put the value of t_2 in eq (d)

$$T_1 = .6\,T_2$$

$$T_1 = .6\,(363.6)$$

$$\boxed{T_1 = 218 \text{ lb}}$$

The percentage of the whole weight is being held by a, b is

$$\Rightarrow \% = \begin{matrix} 400 & = & 363.6 \\ 100 & = & ? \end{matrix}$$

$$\Rightarrow \% = 100 \times 363.6 / 400$$

$$\% = 90.9\%$$

Part b

The weight and volume of water tank increase 15% and 35% . Respectively.

Thus.

$$\text{New weight} = \frac{400 \times 15}{100} + 400$$

$$W_{new} = 60 + 400 = 460$$

$$\boxed{W_{new} = 460}$$

$$\text{New volume} = \frac{4000 \times 35}{100} + 3000$$

$$V_{new} = 1050 + 300$$

$$\boxed{V_{new} = 4050}$$

we know from eq D of question part (A)

$$\bar{T}_1 = .6\bar{T}_2 \longrightarrow \text{eq } \star$$

~~we know that~~

~~$460 = \bar{T}_2 \cos 33.7 + \bar{T}_1 \cos 59$~~

~~$460 = .8\bar{T}_2$~~

We know that from eq B of question part (a)

$$460 = \bar{T}_2 \cos 33.7 + \bar{T}_1 \cos 59 \longrightarrow \text{eq } \#$$

put eq $\star$ in eq $\#$

we have.

$$460 = .8T_2 + .6t_2 (.5)$$

$$460 = .8\bar{T}_2 + .3T_2$$

$$460 = 1.1\ T_2$$

So,

$$T_2 = \frac{460}{1.1}$$

$$\boxed{T_2 = 418.18}$$

Put the value of t_2 in eq ✱

$$T_1 = .6\, t_2$$

$$T_1 = .6(418.18)$$

$$\boxed{T_1 = 250.9}$$

The percentage of whole is being held by (a, b) string is

$$\% = \frac{418.18 \times 100}{460}$$

% = 90.9

Hence we know that The Percentage of the weigh 400lb is held by a, b is 90.9 and the Percentage of the weight 460 lb is held by a, b is also 90.9 thus; It show that the Percentage of the weight held by A, b does not ~~depen~~ change with change of weight. gt can change when the angle change.

the new digram as:

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