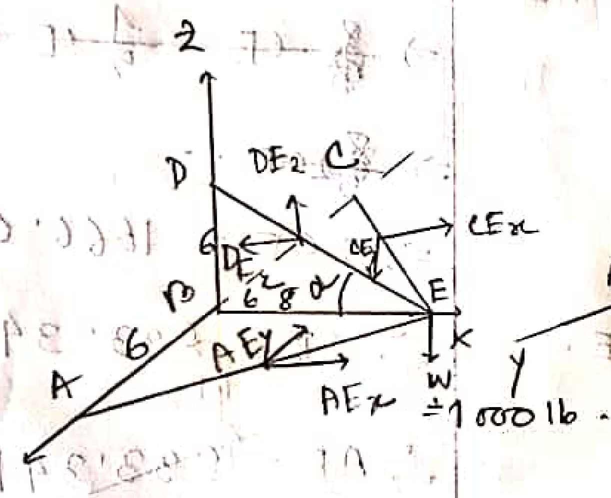
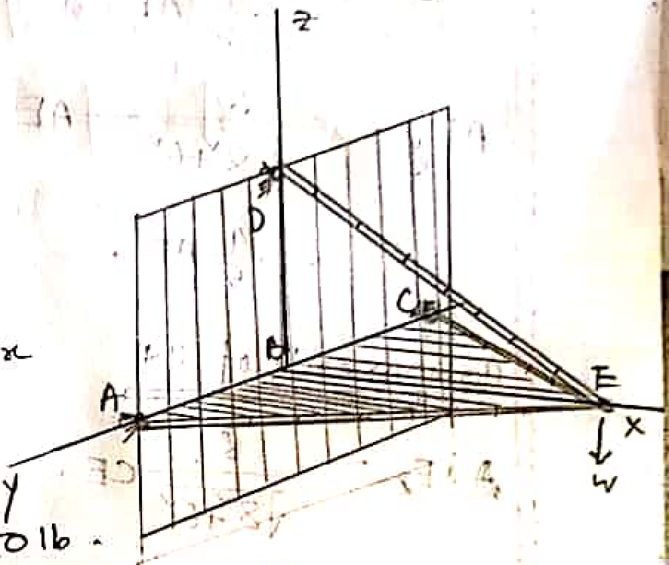
[3D] NON-COPLANAR FORCES.

703 Figure below represents a boom that supports a load W = 1000 lb. If AB = BC = BD = 6 ft, and DE = 8 ft. find the tension in the cable and the force in each timber.

Solⁿ:





Components of DE:

$$DE_z = \frac{8}{\sqrt{8^2+6^2}} DE.$$

$$\therefore DE_x = \frac{4}{5} DE.$$

$$D_z = \frac{6}{\sqrt{8^2+6^2}} DE$$

$$= \frac{3}{5} DE$$

NOW,

$\Sigma F_y = 0$:

$$-AE_y + CE_y = 0.$$

$$\Rightarrow AE_y = CE_y.$$

$$\Rightarrow \frac{3}{5} AE = \frac{3}{5} \cancel{A} CE.$$

$$\therefore AE = CE \quad \text{—— (1)}.$$

$\Sigma F_z = 0$.

$$DE_z - W = 0.$$

$$\Rightarrow \frac{3}{5} DE = 1000$$

$$\therefore DE = 1666.67 \text{ lb} \ (\underline{\text{Ans}})$$

Components of AE:

$$AE_x = \frac{8}{\sqrt{8^2+6^2}} AE$$

$$= \frac{4}{5} AE.$$

$$AE_y = \frac{6}{\sqrt{8^2+6^2}} AE$$

$$= \frac{4}{5} AE.$$

Components of CE

$$CE_x = \frac{8}{\sqrt{8^2+6^2}} CE.$$

$$= \frac{4}{5} CE$$

$$CE_y = \frac{3}{5} CE.$$

$$\Sigma F_x = 0.$$

$$AE_x + CE_x - DF_x = 0.$$

$$\Rightarrow \frac{4}{5} AE + \frac{4}{5} CE = \frac{4}{5} DE.$$

$$\Rightarrow \frac{4}{5} CE + \frac{4}{5} CE = \frac{4}{5} \times 1666.67$$

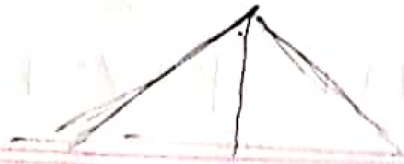
$$\Rightarrow \cancel{\frac{8}{5} CE = \frac{4}{5} CE = 1666.67}$$

$$\Rightarrow \cancel{\frac{8}{5} CE} \cdot\cdot$$

$$\Rightarrow 2CE = 1666.67.$$

$$\therefore CE = 833.34 \text{ lb. (Ans)}$$

$$\therefore AE = 833.34 \text{ lb. (Ans)}$$



704. $\underline{Sol^n}$: Here,

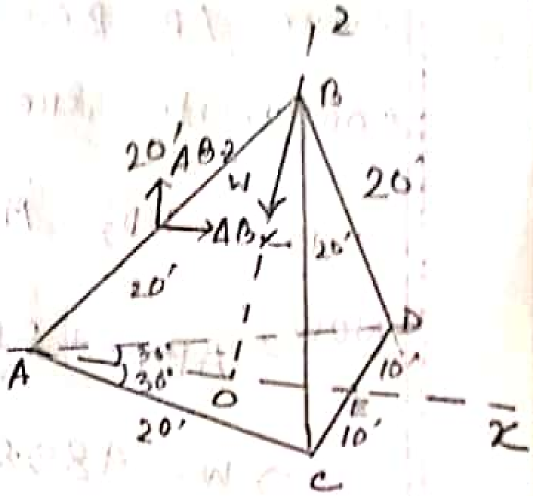
$$AC^2 = CE^2 + AE^2.$$

$$\Rightarrow AE^2 = AC^2 - CE^2.$$

$$= 20^2 - 10^2$$

$$AE = 10\sqrt{3}\ ft.$$

~~Again~~ $AO = \frac{2}{3} AE = \frac{20}{\sqrt{3}}\ ft.$



Again, $AB^2 = AO^2 + BO^2.$

$$\Rightarrow BO^2 = AB^2 - AO^2.$$

$$= 20^2 - \left(\frac{20}{\sqrt{3}}\right)^2.$$

$$\therefore BO = 16.33\ ft.$$

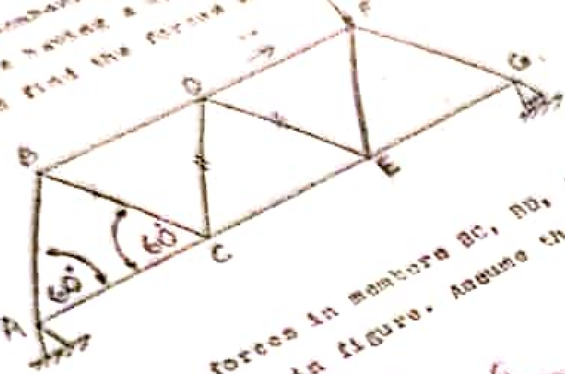
Now,

$$AB_2 = \frac{BO \times AB}{\sqrt{BO^2 + AO^2}}$$

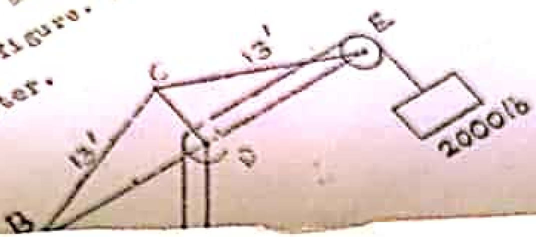
$$= \frac{16.33}{\sqrt{(16.33)^2 + \left(\frac{20}{\sqrt{3}}\right)^2}} \times \cancel{AB}\ 2500$$

$$= 16329\ lb.$$

355. The forces in the members ... compressive force having a ... the load P, and find the forces ...



356. Determine the forces in members BC, BD, AD, and AB of the crane truss shown in figure. Assume that the three pulleys ... the same diameter.



since, $AB = BC = BD$ and only the three z-axis components are responsible for the load W.

$\therefore BC_z = BD_z = AB_z = 16329$ lb.

Now, $AB_z + BD_z + BC_z = W$.

48987 lb.

715. Soln:

Components of T_1:

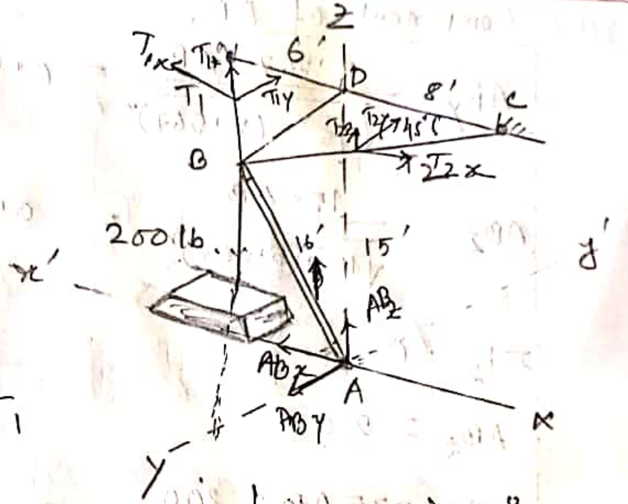
$$T_{1x} = \frac{6}{\sqrt{6^2+(5.567)^2}} T_1$$

$$T_{1x} = 0.733 T_1$$

$$T_{1y} = \frac{5.567}{\sqrt{6^2+(5.567)^2}} T_1$$

$$= 0.68 T_1$$

$$T_{1z} = 0.$$



$\therefore BD = 8 \sin 45°$

$= 5.567'$ ft

Compnents of T_2:

$$T_{2x} = \frac{8}{\sqrt{8^2+(5.567)^2}} T_2 = 0.821 T_2.$$

$$T_{2y} = \frac{5.567}{\sqrt{8^2+(5.567)^2}} T_2 = 0.51 T_2.$$

Components of AB.

$$AB_y = \frac{5.567 \times AB}{\sqrt{15^2 + (5.567)^2}} = 0.348\, AB.$$

$$AB_z = \frac{15 \times AB}{\sqrt{15^2 + (5.567)^2}} = 0.9375\, AB.$$

$\Sigma F_z = 0.$

$AB_z = 200$

$\Rightarrow 0.9375\, AB = 200$

$\therefore AB = 213.33$ lb. Ans

$\Sigma F_x = 0.$

$T_{2x} - T_{1x} = 0.$

$T_1\, 0.733 = T_2\, 0.821. \quad \text{--- } (1)$

$\Sigma F_y = 0.$

$T_{1y} + T_{2y} - AB_y = 0.$

$\Rightarrow T_1\, 0.69 + T_2\, 0.51 = 213.33 \times 0.34$

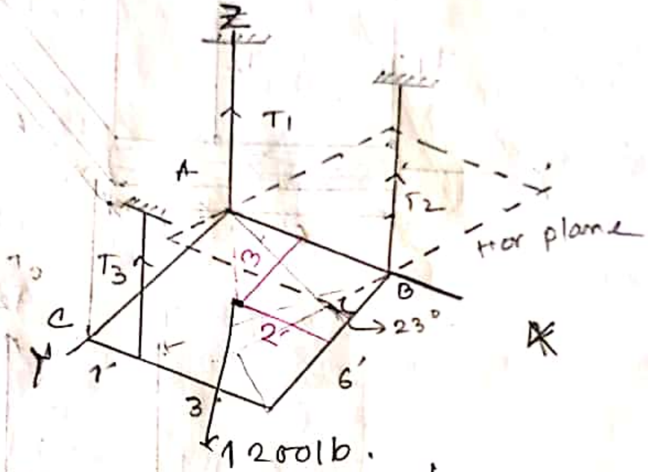
$\Rightarrow 0.68\, T_1 + \frac{0.733}{.821} \times 0.51\, T_1 = 74.28.$

$\therefore T_1 = 65.39$ lb. Ans

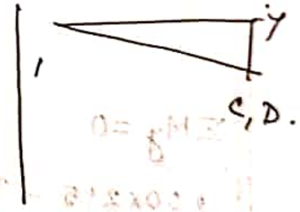
$\therefore T_2 = 58.38$ lb. Ans

216

Inclined to axis
about x-axis.



At point A,



$\Sigma M_x = 0.$

$1200 \times 3\cos\theta - T_3\, 6\cos\theta = 0.$

$\therefore T_3 = 600$ lb. Ans

$\Sigma M_y = 0.$

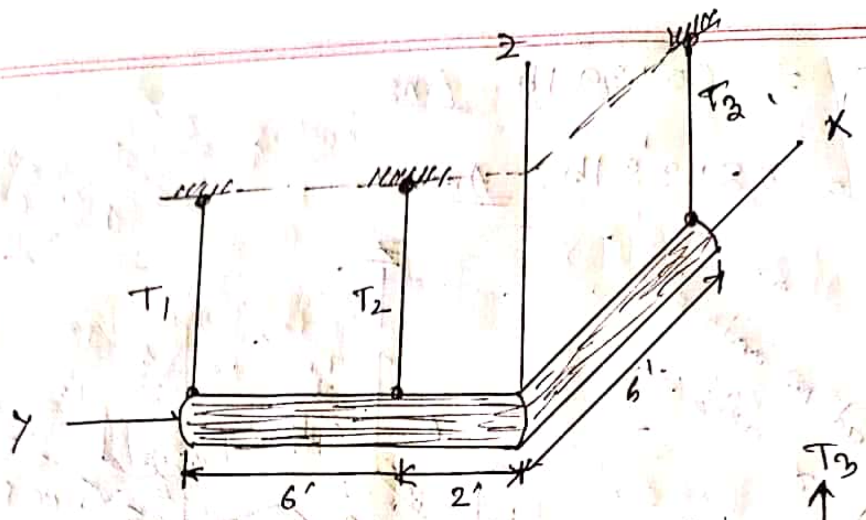
$1200 \times 2 - T_3 \times 1 - T_2 \times 4 = 0.$

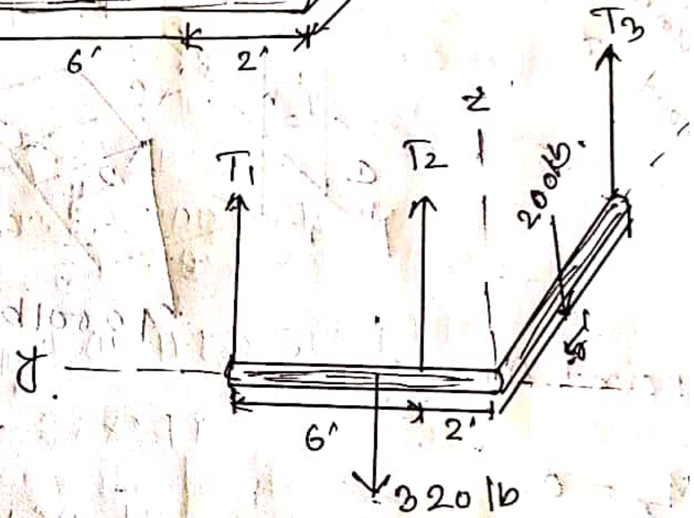
$\therefore T_2 = 450$ lb. Ans

$\Sigma F_z = 0.$

$T_1 + T_2 + T_3 - 1200 = 0 \quad \therefore T_1 = 150$ lb Ans

718 |





$\Sigma M_y = 0.$

$200 \times 2.5 - T_3 \times 5 = 0 \quad \therefore T_3 = 100 \text{ lb}$ Ans.

$\Sigma M_x = 0.$

$T_2 \times 2 + T_1 \times 8 - 320 \times 4 = 0.$

$\Rightarrow T_2 + 4T_1 - 640 = 0$ ——— (1).

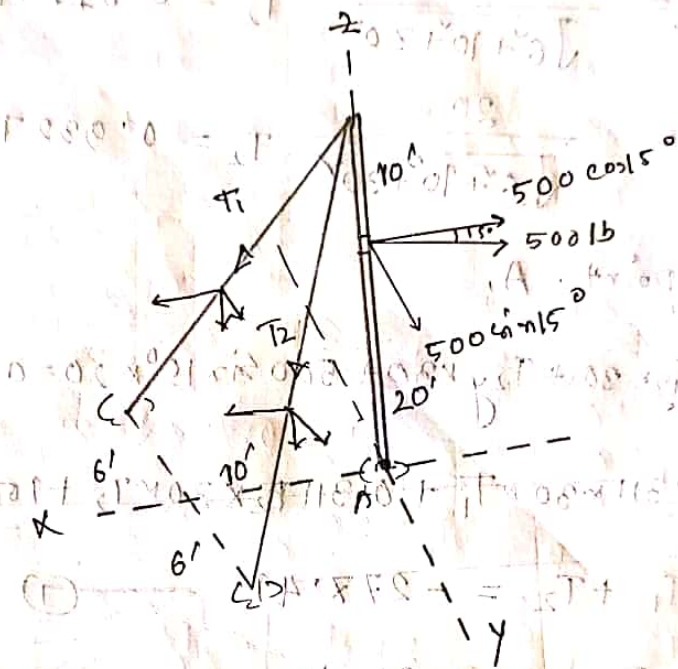
$\Sigma F_z = 0.$

$T_1 + T_2 - 320 + T_3 - 200 = 0.$

$\Rightarrow T_1 + T_2 - 420 = 0$ ——— (ii)

$$\left.\begin{aligned} T_1 &= 73.33 \text{ lb.} \\ T_2 &= 346.67 \text{ lb.} \end{aligned}\right\} \underline{\text{Ans}}$$

2.



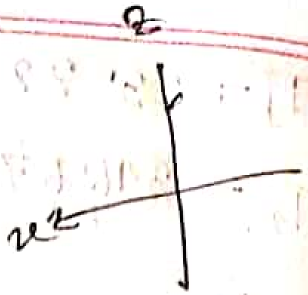
components :

$$T_{1x} = \frac{6}{\sqrt{6^2+10^2+30^2}} \times T_1 = 0.186\, T_1$$

$$T_{1y} = \frac{10}{\sqrt{6^2+10^2+30^2}} T_1 = 0.311\, T_1$$

$$T_{1z} = \frac{30}{\sqrt{6^2+10^2+30^2}} T_1 = 0.932\, T_1.$$

$$T_{2x} = \frac{6}{\sqrt{6^2+10^2+30^2}} T_2 = 0.186 T_1$$



$$T_{2y} = \frac{10}{\sqrt{6^2+10^2+30^2}} T_2 = 0.311 T_1$$

$\Sigma M_x = 0$

$$T_{2z} = \frac{30}{\sqrt{6^2+10^2+30^2}} T_2 = 0.932 T_1 .$$

At point A,

$\Rightarrow -T_{1y} \times 30 + T_{2y} \times 30 + 500 \sin 15^\circ \times 20 = 0 .$

$\Rightarrow \cancel{-0.311 \times 30 \times T_1 + 0.311 \times 30 \times T_2 + 10000 \sin 15 = 0}.$

$\Rightarrow \cancel{-T_1 + T_2 = -27.41} \text{ --- (1)}$

$\Rightarrow T_1 - T_2 = 463.8416$ --- (1)

$\Sigma M_y = 0.$

$\cancel{1200 \times 2} -$

$(T_{1x} + T_{2x}) \times 30 - 500 \times \cos 15^\circ \times 20 = 0 .$

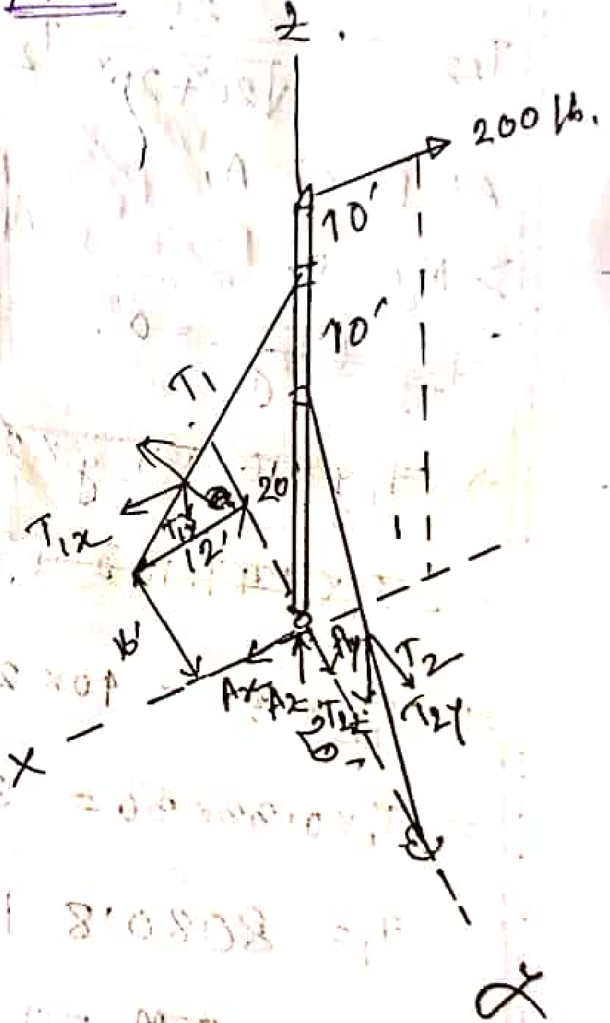
$\Rightarrow \cancel{(T_{1x} + T_{2x})\, 30}$

$\Rightarrow (T_1 \, \cancel{\times 0.311} + T_2)\, 0.311 \times 30 = 500 \cos 15^\circ \times 2$

$\therefore T_1 + T_2 = 1035{\cdot}29$ lb. — (11)

$\therefore$ $T_1 = 751{\cdot}23$ lb.

$T_2 = 087{\cdot}87$ lb } Ans



Components T_1:

$$T_{1x} = \frac{12}{\sqrt{12^2+16^2+30^2}} T_1$$

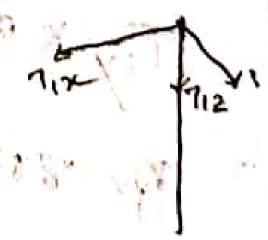
$$= 0{\cdot}33 T_1.$$

$$T_{1y} = \frac{16}{\sqrt{12^2+16^2+30^2}} T_1$$

$$= 0{\cdot}44 T_1$$

$$T_{1z} = \frac{30}{\sqrt{12^2+16^2+30^2}} T_1$$

$$= \cancel{0{\cdot}0079}, 0{\cdot}83 T_1.$$



Components of T_2:

$$T_{2y} = \frac{20}{\sqrt{20^2+20^2}} T_2 = 0.707\, T_2.$$

$$T_{2z} = \frac{20}{\sqrt{20^2+20^2}} T_2 = 0.707\, T_2.$$

At point A,

$\Sigma M_y = 0.$

$\cancel{T_{1y} + T_{2y}} = 0.$

$\Rightarrow \cancel{T_{1y} \times 16 + T_{2y} \times 20 = 0}.$

$\Rightarrow \cancel{T_1 \times 0.44 \times 16 + T_2 \times 0.707 \times 20 = 0}.$

$\Rightarrow T_{1x} \times 30 - 40 \times 2000 = 0.$

$\Rightarrow T_1 \times 0.33 \times 30 = 80000$

$\therefore T_1 = 8080.8$ lb. Ans

$\cancel{\Sigma M_z = 0}.$ $\Sigma M_x = 0.$

$T_{1y} \times 30 - T_{2y} \times 20 = 0.$

$\Rightarrow T_{1y} \times 8080.8 \times 0.44 \times 30 - T_2 \times 707 \times 20 = 0$

$T_2 = 7511.74$ lb. Ans

Ans

$\Sigma F_x = 0.$

$T_{1x} + A_x - 2000 = 0$

$\Rightarrow 8080.87 \times 0.33 - 2000 = -A_x.$

$\Rightarrow A_x = -666.66 \text{ lb}.$

$A_x = 666.66 \text{ lb} (\longrightarrow)$ (Ans)

$\Sigma F_y = 0.$

$-T_{1y} + T_{2y} + A_y = 0.$

$\Rightarrow A_y = (0.49 \times 8080.8) - (0.707 \times 7511.74)$

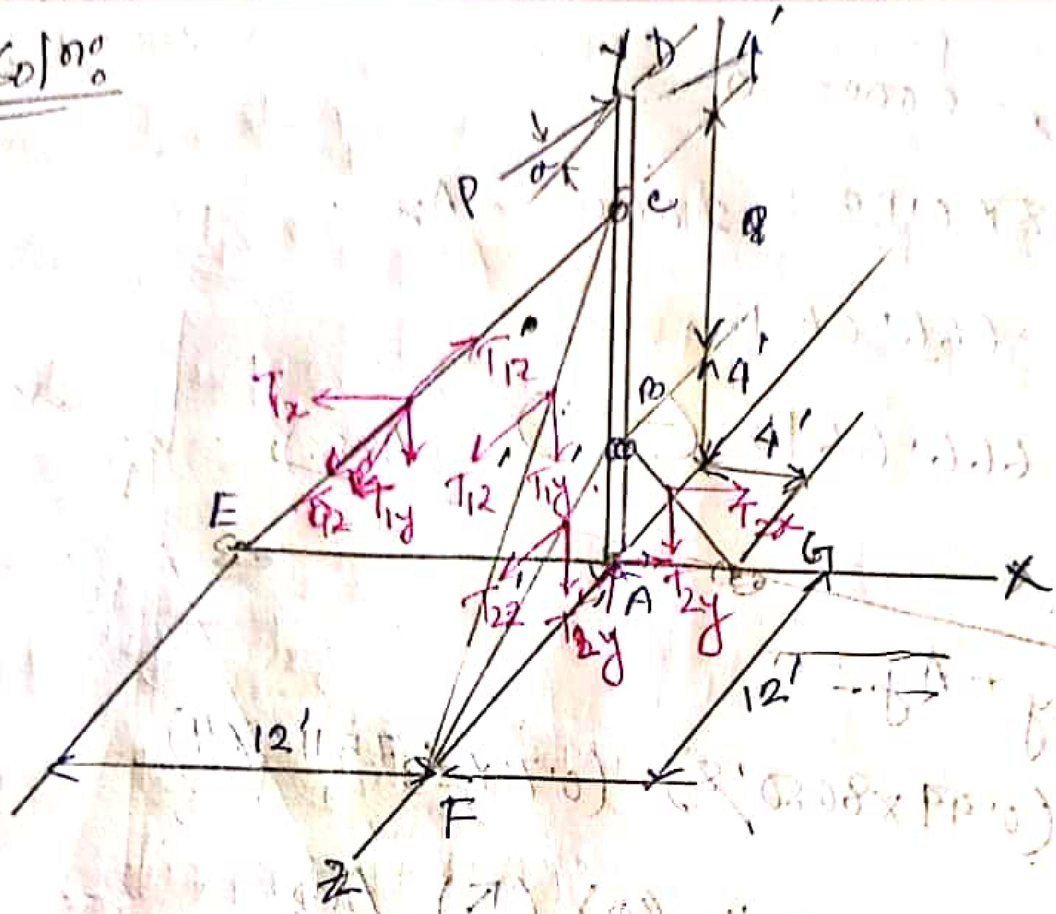
$\therefore A_y = -1755.25 \text{ lb} (\nwarrow).$ Ans

$\Sigma F_z = 0.$

$A_z - T_{1z} - T_{2z} = 0.$

$A_z = 1096.26 \text{ lb}.$ (Ans)

734. Soln:



Compounds of T_1

$$T_{1x} = \frac{12}{\sqrt{12^2+12^2}} T_1 = \frac{T_1}{\sqrt{2}}$$

$$T_{1y} = \frac{12}{\sqrt{12^2+12^2}} T_1 = \frac{T_1}{\sqrt{2}}$$

$$T_{1y}' = \frac{12 T_1}{\sqrt{12^2+12}}$$

$$T_{1z}' = \frac{T_1}{\sqrt{2}}$$

Components of T_2 :

$$T_{2x} = \frac{4\,T_2}{\sqrt{4^2+4^2}}$$

$$= \frac{1}{\sqrt{2}} T_2 .$$

$$T_{2y} = \frac{1}{\sqrt{2}} T_2 .$$

$$T_{2x}' = \frac{12}{\sqrt{12^2+4^2}} T_2$$

$$= 0.95 T_2 .$$

$$T_{2y}' = \frac{4}{\sqrt{12^2+4^2}} T_2 .$$

$$= 0.32\, T_2 .$$

$$\Sigma M_2 = 0.$$

$$(300 \times 16) - (T_{1x}' \times 12) - (T_{2x}' \times 4) = 0 .$$

$$\Rightarrow T_2 + 2.24 T_1 = 3789.47 .$$

$$\therefore T_2 + 2.24 T_1 = 3789.47 \text{ --- (i)}$$

$$\Sigma M_2 = 0 .$$

$$\cancel{(T_{1y} \times 12) + (T_{1y}'} \times$$

$$(T_{2x} \times 4) - (T_{1x} \times 12) = 0 .$$

$$\Rightarrow T_2 - 3T_1 = 0. \text{ ——— (ii)}$$

solving the equations (i) and (ii),

$T_1 = 723.18$ lb . (Ans)

$T_2 = 2169.54$. (Ans)

$\therefore \Sigma F_x = 0,$

$A_x + T_{2x} - T_{1x} = 0$

$\Rightarrow A_x = (T_{1x} - T_{2x}) = \frac{1}{\sqrt{2}}(723.18 - 2169.54).$

$\therefore A_x = -1026.92$ lb $= 1026.92$ lb $(\leftarrow)$ (Ans)

$\Sigma F_y = 0.$

$A_y - T_{2y} - T_{2y}' - T_{1y}' - T_{1y} = 0.$

$\Rightarrow A_y = T_{2y} + T_{2y}' + T_{1y}' + T_{1y}$

$= 0.71 T_1 + 0.32 T_2 + 0.71 T_2 + 0.71 T_1.$

$= 0.71(2 \times 723.18) + 0.32 \times 2169.54 + 0.71 \times 2169$

$\therefore A_y = 3261.54$ lb. (Ans)

$\Sigma F_z = 0.$

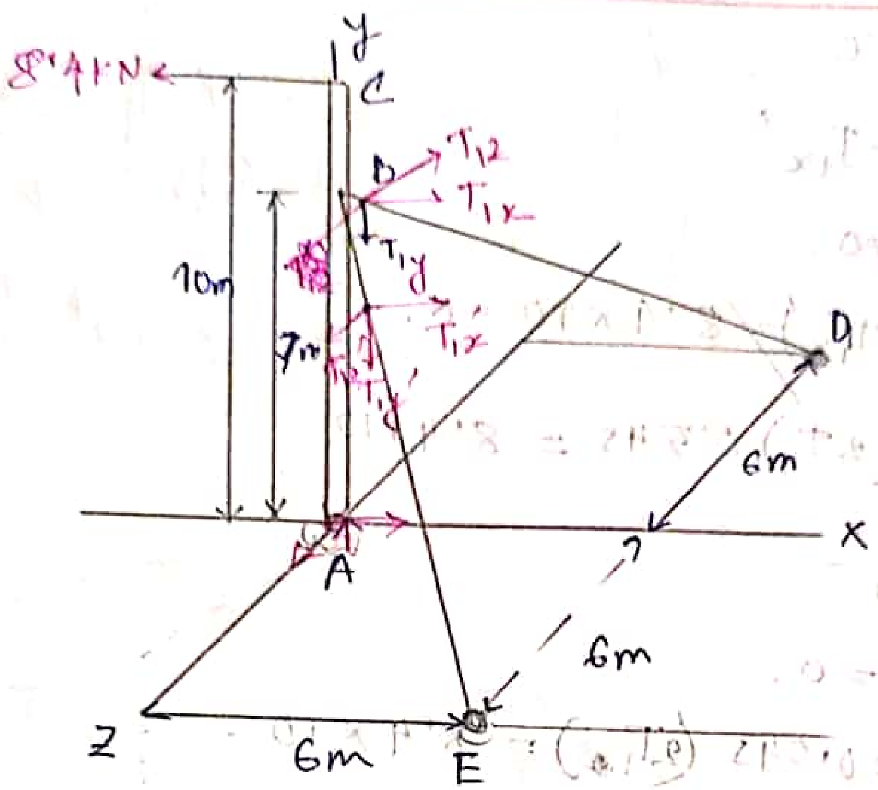
$A_z + T_{1z}' + T_{2z}' = 0.$

$A_z = -0.71 T_1 - 0.95 T_2$

$= -1673$ lb

$= 1673$ lb $(\rightarrow)$ Ans

37/ Soln:



Components of T_1:

$$T_{1x} = \frac{6}{\sqrt{6^2+6^2+7^2}} T_1$$

$$= 0.545 T_1.$$

$$T_{1z} = \frac{6}{\sqrt{6^2+6^2+7^2}} T_1$$

$$= 0.545 T_1$$

$$T_{1y} = \frac{7}{\sqrt{6^2+6^2+7^2}} T_1$$

$$= 0.636 T_1.$$

$T_{1x}' = 0.545 T_1$

$T_{1z}' = 0.545 T_1$

$T_{1y}' = 0.636 T_1.$

$\cancel{\Sigma F_x = 0}$.

$\cancel{T_{1x} + T_{1x}'}$

$\Sigma M_2 = 0$.

$\cancel{7(T_{1x} + T_{1x}') - 8.4 \times 10 = 0}$.

$\cancel{\Rightarrow 7(2T_1)\, 0.545 = 8.4 \times 10}$

$\Rightarrow T_1 =$

$\Sigma M_2 = 0$.

$7 \times 0.545\,(2T_{1x}) = 8.4 \times 10$.

$\Rightarrow T_1 = 11$ K.N. (An)

$\therefore T_1' = 11$ KN. (Ans)

$\Sigma F_x = 0$.

$A_x + T_{1x} + T_{1x}' - 8.4 = 0$.

$\Rightarrow A_x = 8.4 - 11 \times 0.545 - 11 \times 0.545$

$= -3.59$ KN

$\therefore A_x = 3.59$ KN $(\longleftarrow)$

$\Sigma F_y = 0.$

$A_y - T_{1y} - T_{1y}' = 0.$

$\Rightarrow A_y = 2 \times \overset{0.636}{\cancel{0.545}} \times 11$

$= \cancel{18}\ 14\ \cancel{00}\ \text{KN}.$

$\Sigma F_z = 0.$

$A_z + T_{1z}' - T_{1z} = 0.$

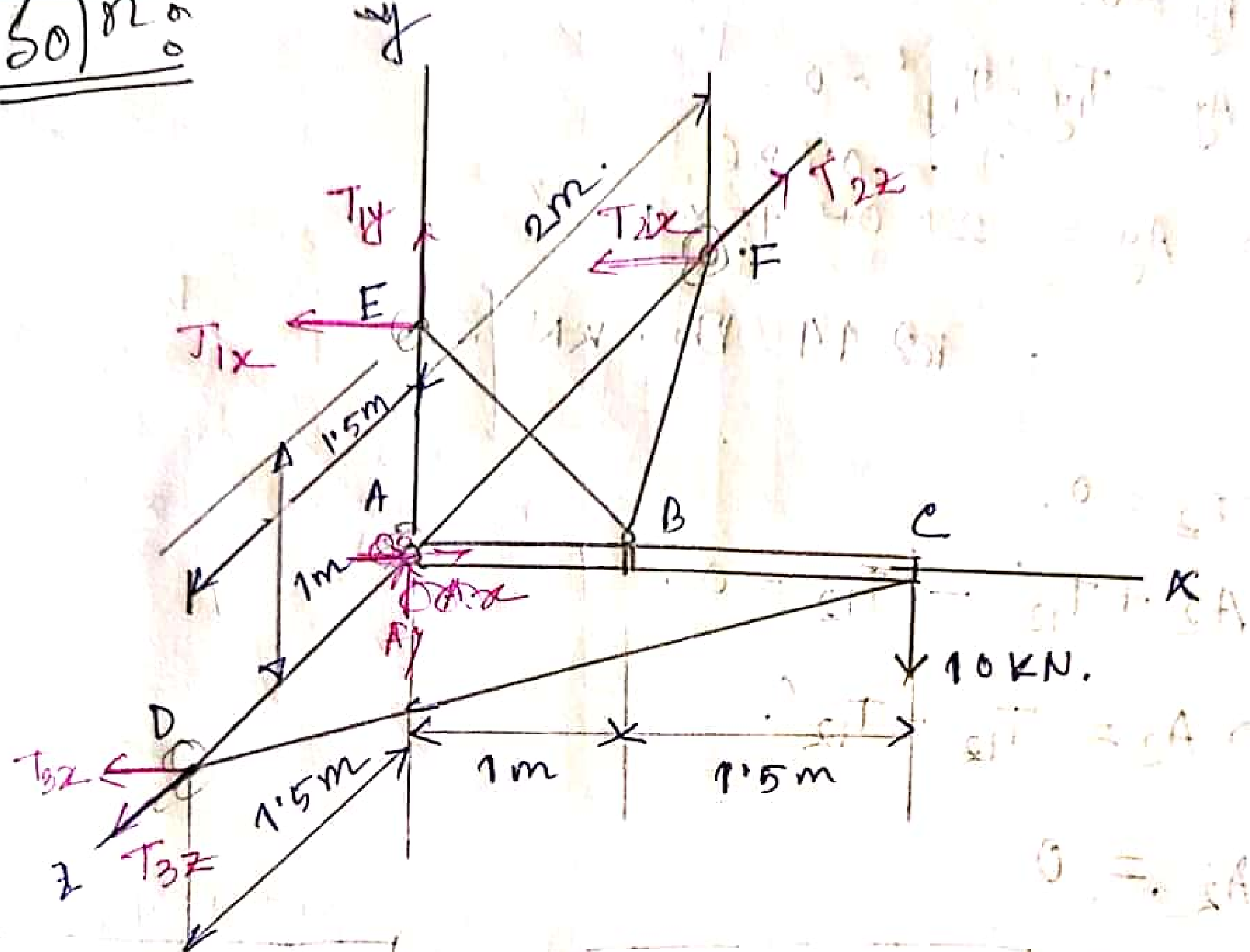
$\Rightarrow A_z = T_{1z} - T_{1z}'.$

$A_z = 0$

$\therefore R_A = \sqrt{A_x^2 + A_y^2 + A_z^2} = \sqrt{(3.59)^2 + (14)^2}$

$= 14.45\ \text{KN}.$ Ans

39) Soln:



Components of T_1:

$$T_{1x} = \frac{1}{\sqrt{1^2+1^2}} T_1$$

$$= 0.707 T_1$$

$$T_{1y} = 0.707 T_1$$

Components of T_2:

$$T_{2x} = \frac{1}{\sqrt{1^2+2^2}} T_2$$

$$= \cancel{0.58} T_2 \; . \; 0.45 T_1$$

$$T_{2z} = \frac{2}{\sqrt{5}} T_2$$

$$= 0.89 T_2 .$$

Components of T_3:

$$T_{3x} = \frac{2.5}{\sqrt{(2.5)^2+(1.5)^2}} T_3 = 0.857\, T_3 .$$

$$T_{3z} = \frac{1.5}{\sqrt{(2.5)^2+(1.5)^2}} T_3 = 0.514\, T_3 .$$

$\Sigma M_z = 0.$

$\cancel{(T_{2x} \times 1) + (T_{1x} \times}$

$(T_{1y} \times 1) - 10 \times 2.5 = 0.$

$T_{1y} = 25 \quad \therefore T_1 \times 0.707 = 25$

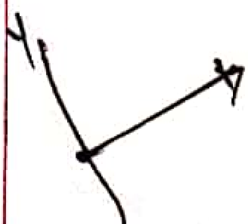
$\therefore T_1 = 35.36$ kN (Ans)

$\Sigma M_y = 0.$

$(T_{3z} \times 1.5) - (T_{2z} \times 2) = 0.$

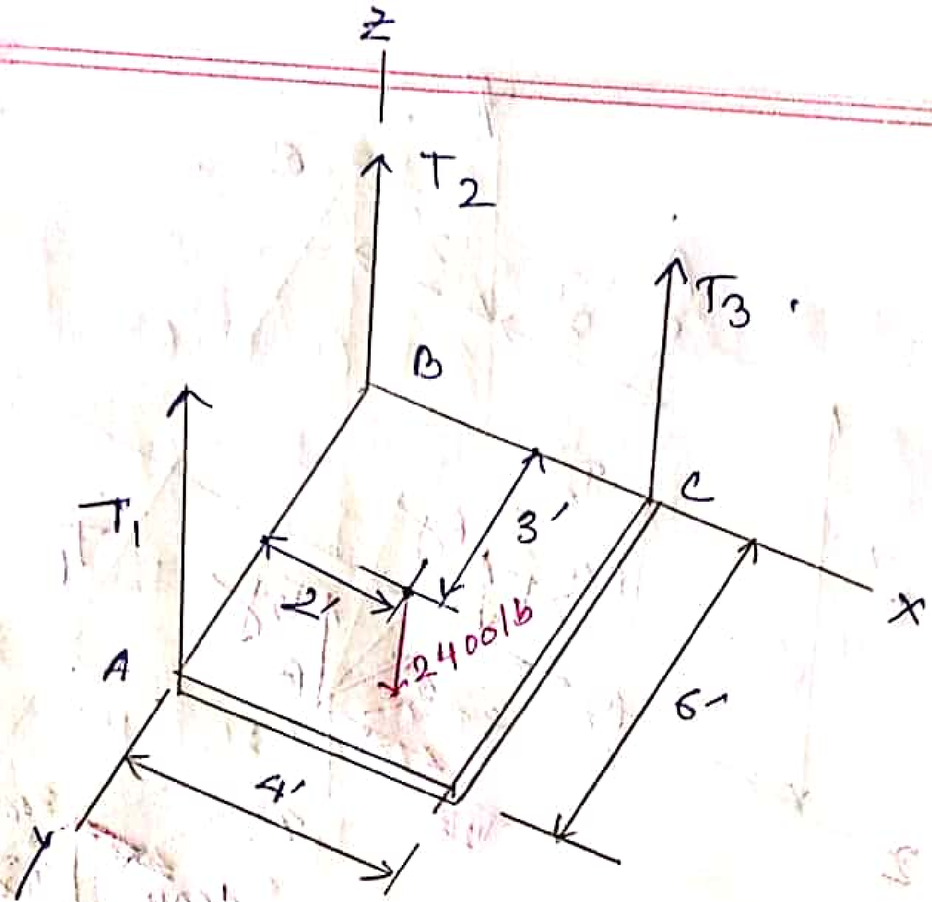
$= 0.514 \times T_3 - T_2 \times 0.89 \times 2 = 0. \quad \text{---} (1)$

$\cancel{\Sigma M_x = 0}$, $\therefore T_3 = \dfrac{35.36 \times 0.89 \times 2}{0.514}$



$= 81.64$ kN (Ans)

57) Solⁿ:



Area $= 6 \times 4 = 24$ ft^2 ; $w = 24 \times 100 = 2400$ lb.

$\Sigma M_x = 0$.

$T_1 \times 6 - 2400 \times 3 = 0$.

$\Rightarrow T_1 = 1200$ lb. (Ans)

$\Sigma M_y = 0$

$T_3 \times 4 - 2400 \times 2 = 0$

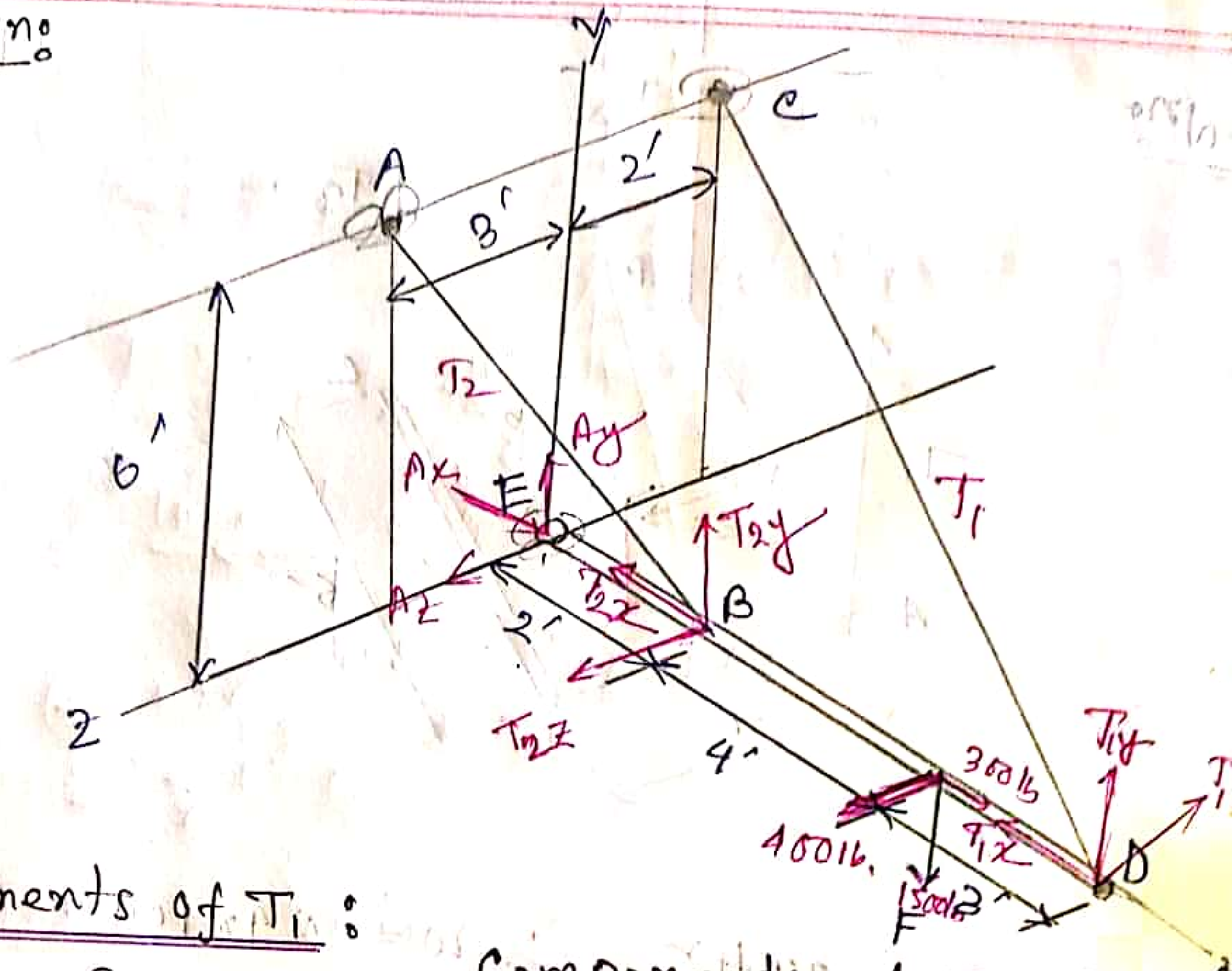
$\therefore T_3 = 1200$ lb. (Ans)

$\Sigma F_z = 0$.

$T_1 + T_2 + T_3 - 2400 = 0$.

$\therefore T_3 = 0$ lb. (Ans)

767. Soln:



Components of T_1 :

$$T_{1x} = \frac{9}{\sqrt{9^2+6^2+2^2}} T_1$$

$$= \frac{9}{11} T_1$$

$$T_{1y} = \frac{6}{11} T_1$$

$$T_{1z} = \frac{2}{11} T_1 .$$

Components of T_2 :

$$T_{2x} = \frac{2}{\sqrt{2^2+6^2+3^2}} = \frac{2}{7} T_2$$

$$T_{2y} = \frac{6}{7} T_2$$

$$T_{2z} = \frac{3}{7} T_2 .$$

$\Sigma M_y = 0$.

$$T_{2z} \times 2 - T_{1z} \times 9 + 400 \times 6 = 0 .$$

$$\Rightarrow \frac{6}{7} T_2 - \frac{18}{11} T_1 + 400 \times 6 = 0 . \quad \text{(1)}$$

$\Sigma M_z = 0.$

$T_{2y} \times 2 + T_{1y} \times 9 - 1500 \times 6 = 0.$

$\Rightarrow \frac{12}{7} T_2 + \frac{54}{11} T_1 = 9000$ ——— (II).

Solving equation (I) and (II),

$T_1 = 1686.67$ lb (Ans)

$T_2 = 420$ lb. (Ans)

$\Sigma F_x = 0.$

$A_x - T_{1x} - T_{2x} + 300 = 0$

$\Rightarrow A_x = \frac{9}{11} \times 1686.67 + \frac{2}{7} \times 420 - 300$

$= 1200.125$ lb. (Ans)

$\Sigma F_y = 0.$

$A_y + T_{2y} + T_{1y} - 1500 = 0.$

$A_y = 1500 - \frac{6}{11} \times 1686.67 - \frac{6}{7} \times 420.$

$\therefore A_y = 220$ lb. (Ans)

$\Sigma F_z = 0.$

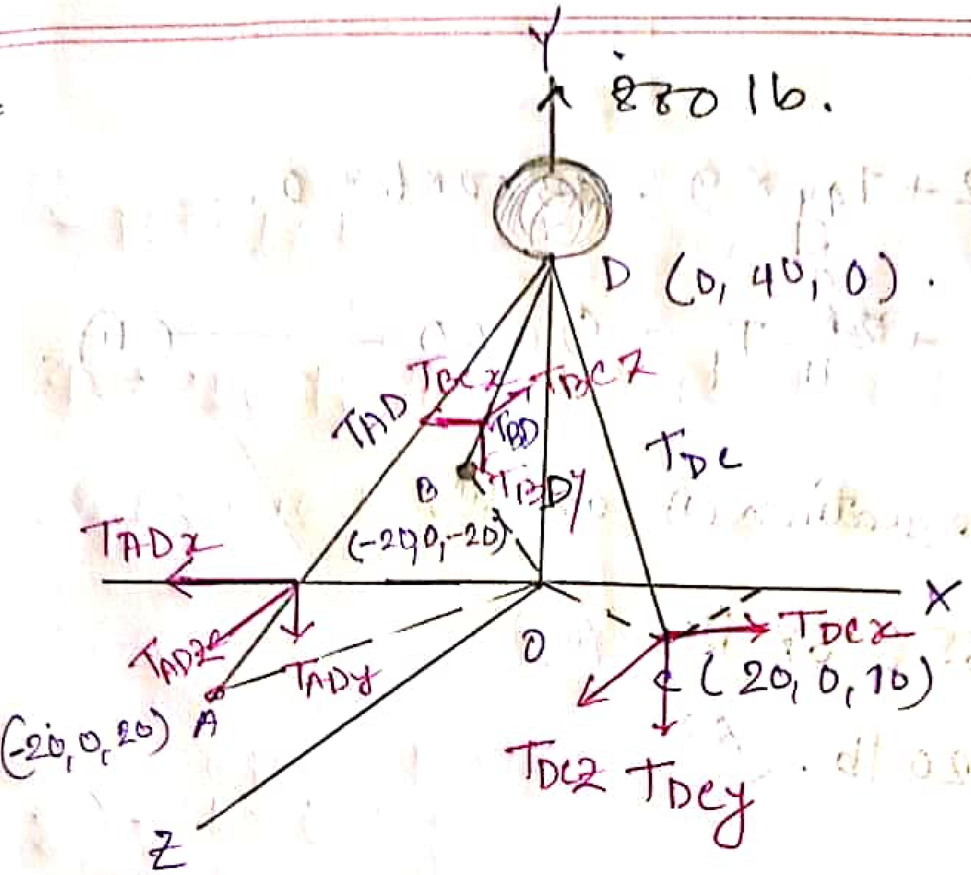
$A_z + T_{2z} + 400 - T_{1z} = 0.$

$\Rightarrow A_z = \frac{2}{11} \times 1686.67 - 400 - \frac{6}{7} \times 420.$

$\therefore A_z = \cancel{453}$ 300 lb. (Ans)

46

7741 Soln:



Components of T_{AD}:

$$T_{ADx} = \frac{20}{\sqrt{20^2+40^2+20^2}} T_{AD}$$

$$= \frac{T_{AD}}{\sqrt{6}},$$

$$T_{ADy} = \frac{40}{20\sqrt{6}} T_{AD}$$

$$= \frac{2}{\sqrt{6}} T_{AD}.$$

$$T_{ADz} = \frac{20}{20\sqrt{6}} T_{AD}$$

$$= \frac{T_{AD}}{\sqrt{6}}.$$

Components of T_{DC}:

$$T_{DCx} = \frac{20}{\sqrt{20^2+40^2+10^2}} T_{DC}.$$

$$= \frac{2 T_{DC}}{\sqrt{21}}.$$

$$T_{DCy} = \frac{40}{10\sqrt{21}} T_{AC}.$$

$$= \frac{4 T_{AC}}{10\sqrt{21}},$$

$$T_{DCz} = \frac{10}{10\sqrt{21}} T_{AC}$$

$$= \frac{T_{DC}}{\sqrt{21}}.$$

Components of T_{BD} :

$$T_{BDx} = \frac{20}{20\sqrt{6}} T_{BD} = \frac{T_{BD}}{\sqrt{6}}.$$

$$T_{BDy} = \frac{2T_{BD}}{\sqrt{6}}, \quad T_{BDz} = \frac{T_{BD}}{\sqrt{6}}.$$

$\Sigma F_x = 0.$

$$T_{DCx} - T_{BDx} - T_{ADx} = 0.$$

$$\Rightarrow \frac{2}{\sqrt{21}} T_{BC} - \frac{T_{BD}}{\sqrt{6}} - \frac{T_{AD}}{\sqrt{6}} = 0. \text{ ——— (I)}$$

$\Sigma F_y = 0.$

$$-T_{DCy} - T_{ADy} - T_{BDy} + 800 = 0.$$

$$\Rightarrow \cancel{8} \quad \frac{4T_{DC}}{\sqrt{21}} + \frac{2}{\sqrt{6}} T_{AD} + \frac{2}{\sqrt{6}} T_{BD} = 800 \text{ ——— (II)}.$$

$\Sigma F_z = 0.$

$$T_{ADz} + T_{DCz} - T_{BCz} = 0.$$

$$\Rightarrow \frac{T_{AD}}{\sqrt{6}} + \frac{T_{DC}}{\sqrt{21}} - \frac{T_{BD}}{\sqrt{6}} = 0 \text{ ——— (III)}$$

solving the equations (I), (II) and (III).

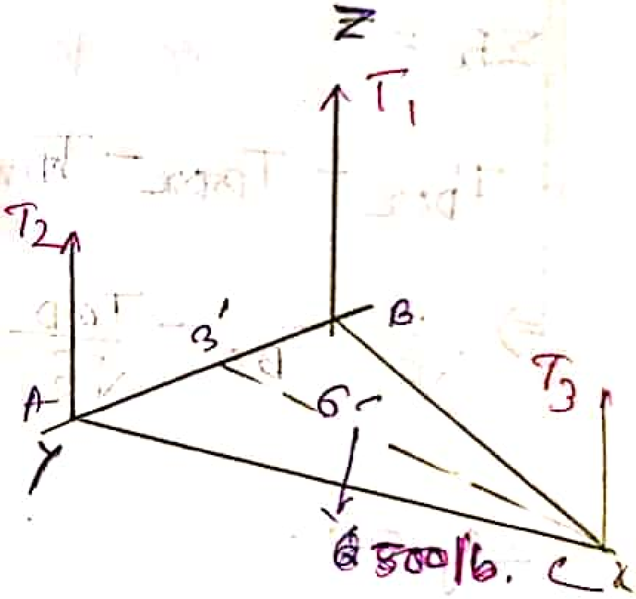
$T_{AD} = -122.47\ lb = 122.47\ lb\ (\downarrow)$

$T_{DC} = -458.26\ lb = 458.26\ lb\ (\downarrow)$

$T_{BD} = -367.42\ lb = 367.42\ lb\ (\downarrow)$

Ans

778/ $\Sigma M_y = 0.$



$(500 \times 2) - T_3 \times 6 = 0.$

$\therefore T_3 = 166.67\ lb.$ Ans

$\Sigma M_x = 0.$

$T_2 \times 1.5 - T_1 \times 1.5 = 0$

$\Rightarrow T_1 = T_2.$

$\Sigma F_z = 0.$

$T_1 + T_2 + T_3 - 500 = 0.$

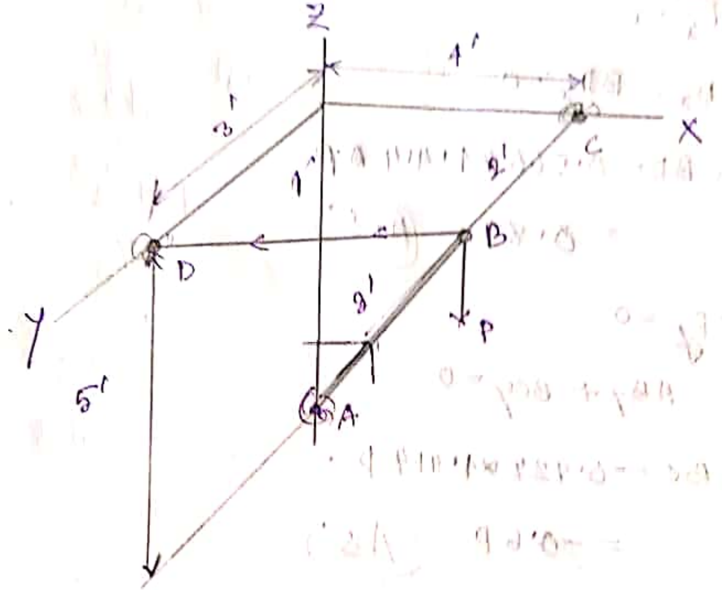
$\Rightarrow T_1 + T_2 = 333.33.$

$\therefore T_1 = 166.67\ lb$

$\therefore T_2 = 166.67\ lb.$

Ans

78/ Soln.



Components of AB:

$AB_x = \frac{4 \times AB}{\sqrt{3^2+4^2+5^2}} = 0.566\,AB.$

$AB_y = \frac{3 \times AB}{\sqrt{3^2+4^2+5^2}} = 0.424\,AB.$

$AB_z = \frac{5 \times AB}{\sqrt{3^2+4^2+5^2}} = 0.707\,AB.$

Here,
$BC_y = BC$
$BD_x = BD.$

$\Sigma F_z = 0.$

$AB_z + P = 0.$ $\quad 0.707\,AB = P$

$\therefore\ AB = -1.414\,P.$ (Ans)

$= \cancel{1}\ 0$

$+ 2 \times 8$ ... $= 3.46$

$\Sigma F_x = 0.$

$AB_x - BD_x = 0.$

$\therefore BD = 0.566 \times 1.414\, P$

$= 0.8\, P.$ (Ans)

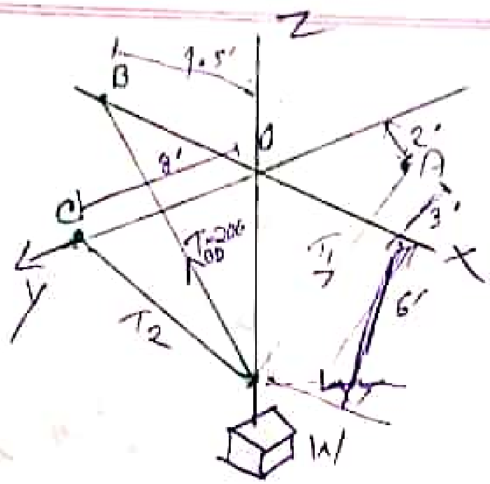
$\Sigma F_y = 0.$

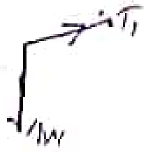
$AB_y + BC_y = 0$

$BC = -0.424 \times 1.414\, P.$

$= -0.6\, P$ (Ans)

7.97'





$T_{1x} = \frac{2T_1}{\sqrt{2^2+3^2+6^2}}$, $T_{1y} = \frac{3'}{7}T_1$, $T_{1z} = \frac{6}{7}T_1$

$T_{2x} = 0$, $T_{2y} = \frac{8 \cdot T_2}{\sqrt{100}}$, $T_{2z} = \frac{6}{10}T_2$

$T_{BDx} = \frac{200 \times 4.5}{7.5}$, $T_{BDz} = 160$

$= 120$

$\Sigma F_z = 0$

$160 + \frac{6}{10}T_2 + \frac{6}{7}T_1 - W = 0$

$\Sigma F_y = 0$

$\frac{3}{7}T_1 - \frac{8}{10}T_2 = 0$

$\Sigma F_x = 0$

$-120 + \frac{2}{7}T_1 = 0$

$T_1 = 420$

$T_2 = 225$

$W = 655$ lb