701/-

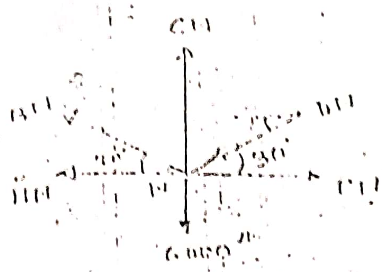
TRUSS

ND in compression (-ve)

Consider the joint at N.

$\Sigma F_x = 0$

$\Rightarrow FN - DN\cos 30^\circ - MN - BN\cos 30^\circ = 0$



$\Rightarrow 16900 - 7000\cos 30^\circ - 12956 - BN\cos 30^\circ = 0$

$\Rightarrow BN\cos 30^\circ = -1727.18$

$\Rightarrow BN = -1994.37$

$\therefore BN = 1994.37''$ (C)

Ans

$\Sigma F_y = 0$

$\Rightarrow NC - DN\sin 30^\circ + BN\sin 30^\circ - 6000 = 0$

$\Rightarrow NC = 6000 + 7000\sin 30^\circ + 1994.37\sin 30^\circ$

$\Rightarrow NC = 10497.19''$

$\therefore NC = 10497.19''$ (T)

Ans

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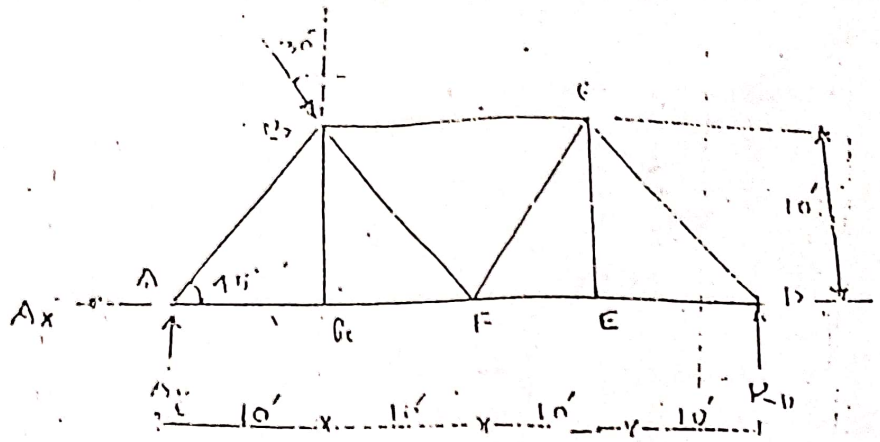
338.



$\Sigma M_D = 0$

$\Rightarrow A_y \times 40 + 2000 \sin 30^\circ \times 10 - 2000 \cos 30^\circ \times 30 = 0$

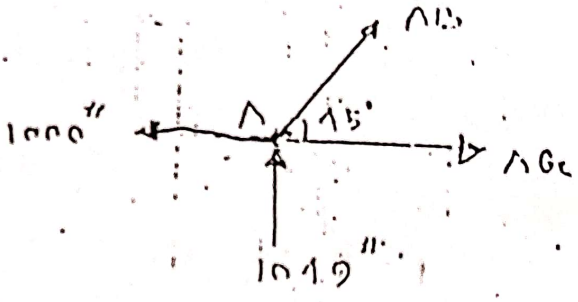
$\Rightarrow A_y = 1019^{\#}$ This part is used when reaction at A and D is missing

$\Sigma F_x = 0$

$\Rightarrow 2000 \sin 30^\circ - A_x = 0$

$\Rightarrow A_x = 1000^{\#}$

At the joint A:



$\Sigma F_y = 0$

$\Rightarrow 1019 + AB \sin 15^\circ = 0$

$\Rightarrow AB = -1183.56$

$\therefore AB = 1183.56^{\#}$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow AG - 1000 - 1183.56 \cos 15^\circ = 0$

$\Rightarrow AG = 2014.9^{\#}$ (T) Ans

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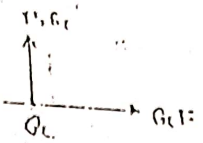
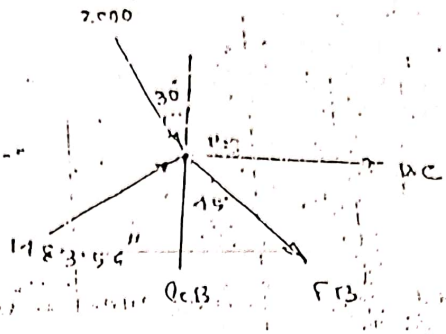
At joint B:





$\Sigma F_y = 0$

$\Rightarrow 148.56 \sin 15^\circ + F_B \cos 15^\circ - 2000 \cos 30^\circ = 0$

$\Rightarrow F_B = -965.9$

$\therefore F_B = 965.9^{\#}$ (C).

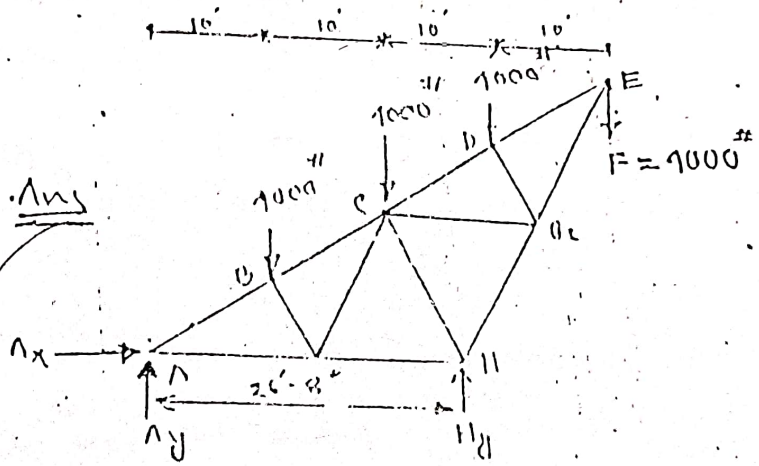
$\Sigma F_x = 0$

$\Rightarrow 2000 \sin 30^\circ + BC + 148.56 \cos 15^\circ - 965.9 \sin 15^\circ = 0$

$\Rightarrow BC = -1366$

$\therefore BC = 1366^{\#}$ (C)

Ans



Consider the free body of the truss.

$\Sigma M_A = 0$

$\Rightarrow 1000 \times 10 + 1000 \times 20 + 1000 \times 30 + 1000 \times 40 - H_y \times 26.67 = 0$

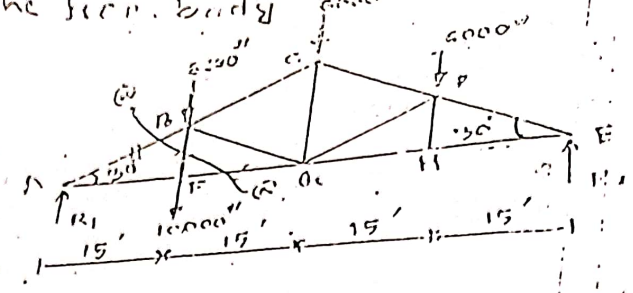
$\Rightarrow H_y = 15000^{\#}$ (↑) Ans

$\Sigma F_y = 0 \Rightarrow A_y + H_y - 1000 - 1000 - 1000 - 1000 = 0$

$\Rightarrow A_y = 1000^{\#}$ (↑) Ans

$\Sigma F_x = 0 \Rightarrow A_x = 0$ Ans

Consider the free body diagram.



$\Sigma M_E = 0$

$\Rightarrow R_1 \times 60 - 10000 \times 45 - 6000 \times 45 - 6000 \times 30 - 6000 \times 15 = 0$

$\Rightarrow R_1 = 16500^{\#} (\uparrow)$. Ans.

$\Sigma F_y = 0$

$\Rightarrow R_2 + 16500 - 10000 - 6000 - 6000 - 6000 = 0$

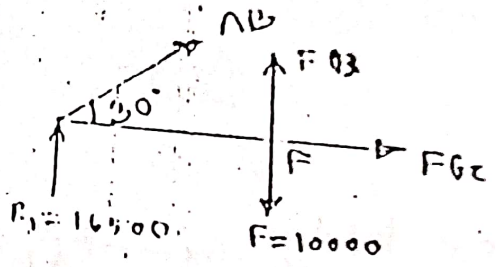
$\Rightarrow R_2 = 11500^{\#} (\uparrow)$ Ans.

Consider the left portion of (a-a) section.

$\Sigma M_A = 0$

$\Rightarrow 10000 \times 15 - F_B \times 15 = 0$

$\Rightarrow F_B = 10000^{\#} (T)$ Ans



$\Sigma F_y = 0$

$\Rightarrow AB \sin 30° + F_B - 10000 + 16500 = 0$

$\Rightarrow AB = -13000^{\#}$

$\therefore AB = 13000^{\#} (C)$. Ans.

$\Sigma F_x = 0$

$\Rightarrow AB \cos 30° + F_{BC} = 0$

$\Rightarrow -13000 \cos 30° + F_{BC} = 0$

$\Rightarrow F_{BC} = 11258.8^{\#} (T)$

Ans

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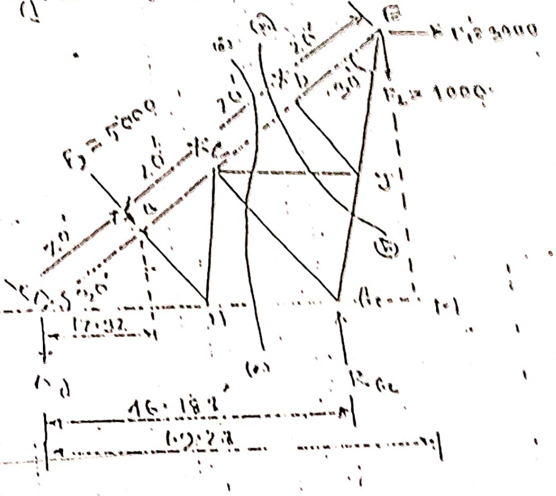
Consider the free body diagram of the truss.



$AGc = \frac{AE}{\cos 30} = 16.168'$

$AM = AE \cos 30°$

$= 69.28'$

$EM = AE \sin 30'$

$= 10'$

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$\Sigma M_A = 0$

$\Rightarrow 5000 \times 20 + 1000 \times 69.28 + 3000 \times 10 - R_{Gc} \times 16.182 = 0$

$\Rightarrow R_{Gc} = 10762.07''$ (↑) Ans

$\Sigma F_y = 0$

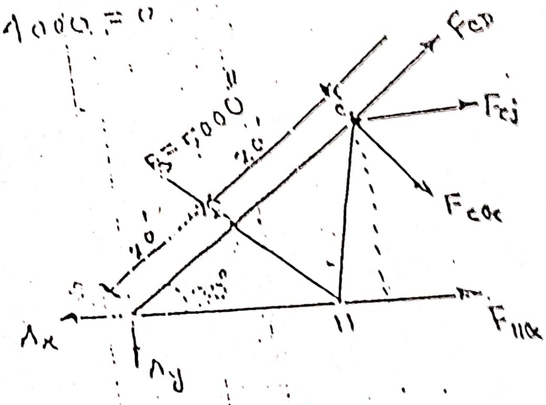
$\Rightarrow -A_y - 5000 \sin 60° + 10762.07 - 1000 = 0$

$\Rightarrow A_y = 2432.81''$ (↓) Ans

$\Sigma F_x = 0$

$\Rightarrow -A_x + 5000 \cos 60° + 3000 = 0$

$\Rightarrow A_x = 5500''$ (←). Ans



Consider the left portion of the section (1-1).

$\Sigma M_C = 0$

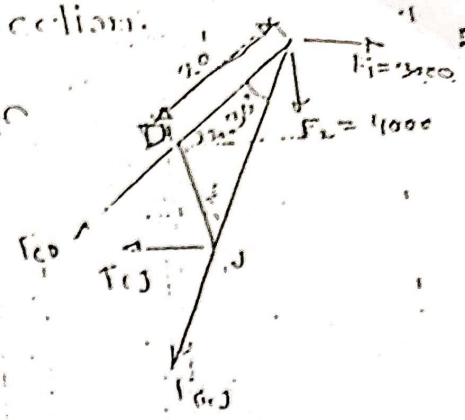
$\Rightarrow A_x \times 10 \sin 30° - A_y \times 10 \cos 30° - 5000 \times 20 - F_{HGc} \times 10 \sin 30 = 0$

$\Rightarrow F_{HGc} = -3713.8 \quad \therefore F_{HGc} = 3713.8''$ (C). Ans

$\Sigma M_A = 0 \Rightarrow -5000 \times 20 - 20 \times F_{Cj} \times 10 \sin 30° - F_{CGc} \times 10 = 0$

$\Rightarrow 2F_{CGc} + F_{Cj} = -5000$ .... (1)

Consider the right portion of (b-b) section.



$\Sigma M_E = 0$

$\Rightarrow F_{CJ} = 0$

From eq^n (i), we get,

$\therefore -i\,F_{CL} = -15000$

$\Rightarrow F_{CL} = -21100''$ $\quad \therefore F_{CL} = 21100''$ (C) Ans

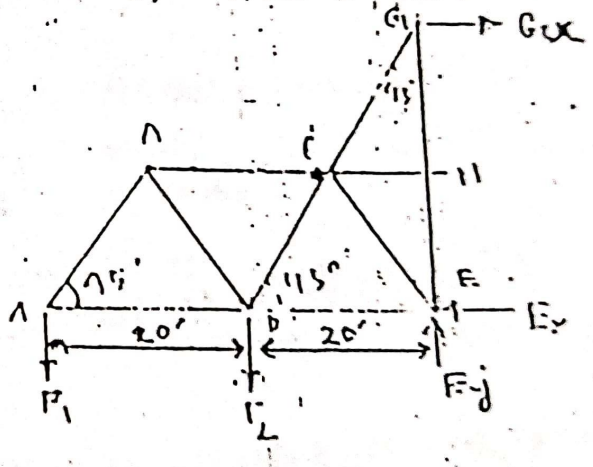
$\Sigma M_D = 0$

$\Rightarrow 3000 \times 20 \sin 30^\circ + 1000 \times 20 \cos 30^\circ + F_{GJ} \times 20 \sin 30^\circ = 0$

$\Rightarrow F_{GJ} = -9028.2$

$\therefore F_{GJ} = 9028.2''$ (C) Ans

Consider the free body diagram of the truss.



DF = GF

$\Sigma M_E = 0$

$\Rightarrow G_x \times 20 - F_1 \times 40 - F_2 \times 20 = 0$

$\Rightarrow G_x = 7000''$ Ans

$\Sigma F_x = 0$

$\Rightarrow E_x - G_x = 0$

$\Rightarrow E_x = G_x = 7000''$ Ans

$\Sigma M_G F_y = 0$

$\Rightarrow E_y - F_1 + F_2 = 0$

$\Rightarrow E_y = 6000''$ Ans

$\Sigma F_y = 0$

$\Rightarrow -F_{BC}\cos 45 - F_{BH} = 0 \Rightarrow F_{BH} = 7000\text{ lb}$

Joint H:

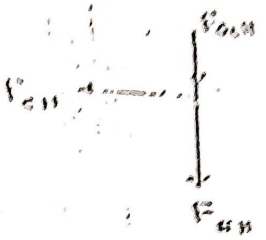
$\Sigma F_x = 0$

$\Rightarrow F_{GH} = 0$

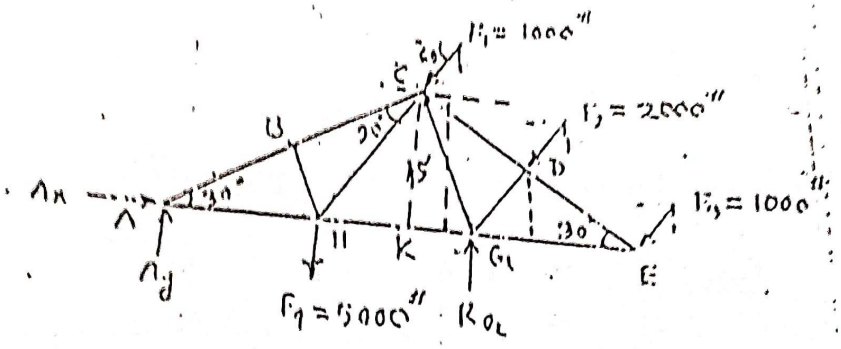
$\Sigma F_y = 0$

$\Rightarrow -F_{BH} - F_{DH} = 0 \Rightarrow F_{DH} = -7000\text{ lb}$

$\therefore F_{DH} = 7000\text{ lb (C)}$ Ans



Consider the free body diagram of the truss.



$AK = \frac{15}{\tan 30} = 26$

$AE = 2AK = 52'$

$AH = GH = GE = \frac{52'}{3}$

$= 17.33'$

$\Sigma M_A = 0$

$\Rightarrow 5000 \times 17.33 - R_{G_2} \times 34.66 + 1000\sin 60 \times 26 - 1000\cos 60 \times 15 - 2000\cos 60 \times 7.5 + 2000\sin 60 \times 30 + 1000\sin 60 \times 52 = 0$

$\Rightarrow R_{G_2} = 5965.07\text{ lb}$ Ans

$\Sigma F_y = 0$:

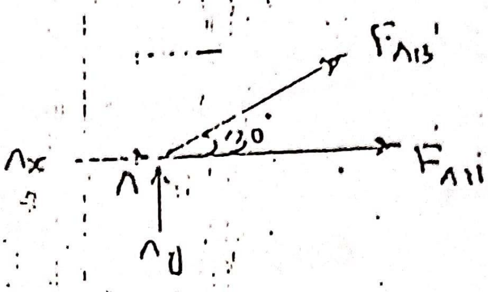
$\Rightarrow A_y - 1000 \sin 60 - 2000 \sin 60 - 1000 \sin 60 - 5000 + 5965.08 = 0$

$\Rightarrow A_y = 2499''$ Ans

$\Sigma F_x = 0$

$\Rightarrow A_x - 1000 \cos 60° - 2000 \cdot \cos 60° - 1000 \cos 60° = 0$

$\Rightarrow A_x = 2000''$ Ans



At joint A:

$\Sigma F_y = 0$

$\Rightarrow F_{AB} \sin 30° + 2499 = 0$

$\Rightarrow F_{AB} = -4998''$ $\therefore F_{AB} = 4998''$ (C)

$\Sigma F_x = 0$

$\Rightarrow 2000 + F_{AH} - 4998 \cos 30° = 0$

$\Rightarrow F_{AH} = 2328.39''$ (T) Ans

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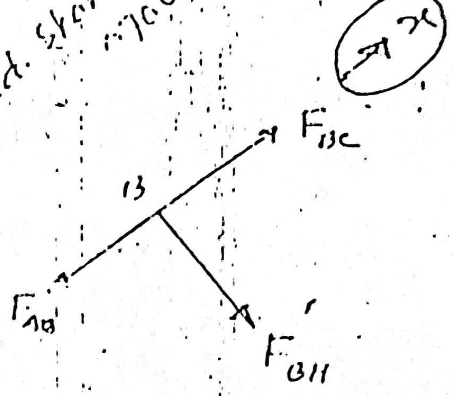

At joint B:

$\Sigma F_x = 0$

$\Rightarrow F_{BC} - F_{AB} = 0$

$\Rightarrow F_{BC} = F_{AB} = 4998''$ (C). Ans.

$\Sigma F_y = 0$

$\Rightarrow F_{BH} = 0$ Ans.

Free body diagram of the truss.

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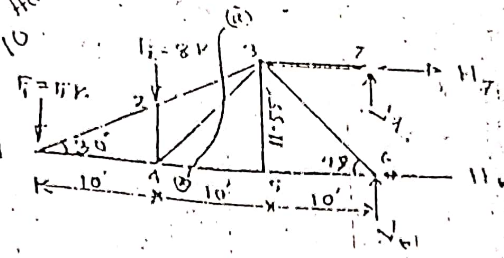


$\frac{y}{x} = \tan 30°$

$y = x \tan 30°$

$= 20 \tan 30°$

$= 11.55'$

$\Sigma M_7 = 0$

$\Rightarrow H_6 \times 11.55 - 8 \times 20 - 5 \times 30 = 0$

$\Rightarrow H_6 = 26.84$ kips ($\leftarrow$). Ans

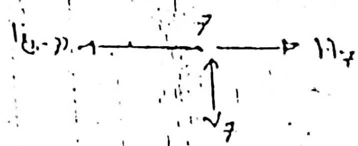
$\Sigma F_x = 0$

$\Rightarrow H_7 - H_6 = 0 \Rightarrow H_7 = H_6 = 26.84$ kips ($\rightarrow$). Ans

$\Sigma F_y = 0$

$\Rightarrow V_6 - 5 - 8 + V_7 = 0 \Rightarrow V_6 + V_7 = 13$ kips. ——— (1)

At joint 7.

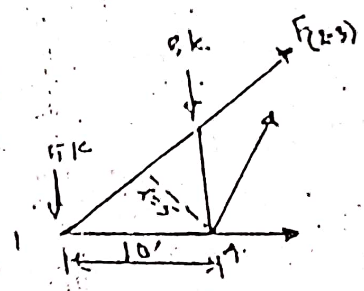


$\Sigma F_y = 0$

$\Rightarrow V_7 = 0$ Ans.

From eq^n (1), we get, $V_6 = 13$ kips. Ans

Consider the left portion of (a-a) section.

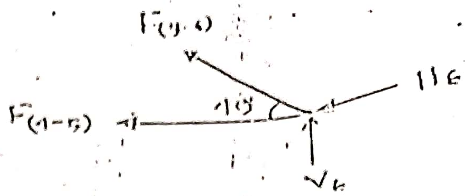


$\Sigma M_4 = 0$

$\Rightarrow F_{(2-3)} \times 10 \sin 30° - 5 \times 10 = 0$

$\Rightarrow F_{(2-3)} = 10$ kips. (30°) (C) Ans

At joint G :



$\Sigma F_x = 0$

$\Rightarrow 13 - F_{(3-6)} \sin 49 = 0$

$\Rightarrow F_{(3-6)} = 17.225$ kips. (T)

Ans

[3.15] Consider the free body diagram of the truss.

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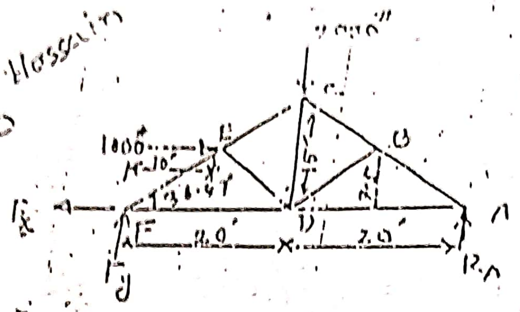


$\theta = \tan^{-1}\frac{15}{20} = 36.87°$

$10 \tan 36.87 = 7.5$

$BD = AD = 7.5$

$\Sigma M_F = 0$

$\Rightarrow 1000 \times 10 \tan 36.87 + 2000 \times 20 - R_A \times 40 = 0$

$\Rightarrow R_A = 1187.5$ # (↑)

Ans

$\Sigma F_y = 0$

$\Rightarrow F_y - 2000 + R_A = 0 \Rightarrow F_y = 812.5$ # (↑)

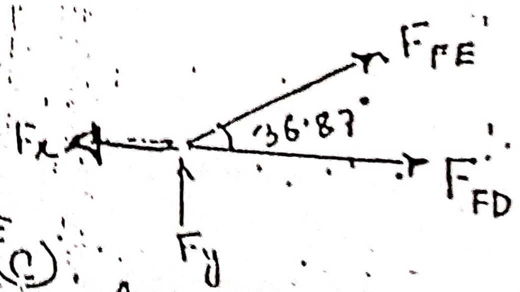
Ans

$\Sigma F_x = 0$

$\Rightarrow -F_x + 1000 = 0$

$\Rightarrow F_x = 1000$ # (←)

At joint F :



$\Sigma F_y = 0$

$\Rightarrow 812.5 + F_{FE} \sin 36.87° = 0$

$\Rightarrow F_{FE} = -1354.16$ $\therefore F_{FE} = 1354.16$ # (C)

Ans

$\Sigma F_x = 0$

$\Rightarrow F_{FD} - 1000 + (-1354.16) \cos 36.87 = 0$

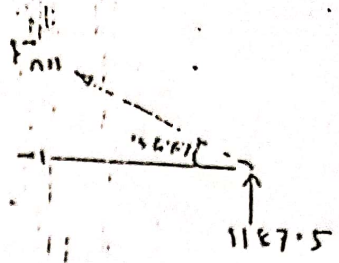
$\Rightarrow F_{FD} = 2083.33$ # (T)

Ans

$\Sigma F_y = 0$

$\Rightarrow 1187.5 - F_{AB}\sin 36.87° = 0$

$\Rightarrow F_{AB} = 1979.16^{\#}$ (C) Ans



$\Sigma F_x = 0$

$\Rightarrow -F_{AD} + F_{AB}\cos 36.87° = 0 \Rightarrow F_{AD} = 1583.33^{\#}$ (T) Ans

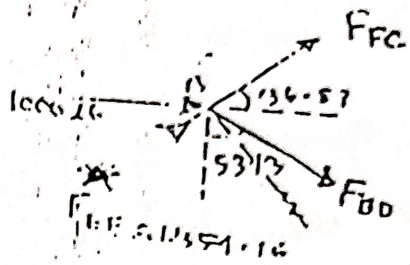
At joint E:

$\Sigma F_x = 0$

$\Rightarrow 1354.16\cos 36.87° + 1000 + F_{BD}\sin 53.13° = F_{FC}\cos 36.87°$

$\Rightarrow 0.8F_{BD} + 0.8F_{FC} = 2083.33$

$\Rightarrow F_{BD} + F_{FC} = 2604.16$ ——— (I)



$\Sigma F_y = 0$

$\Rightarrow 1354.16\sin 36.87° + F_{FC}\sin 36.87° - F_{BD}\cos 53.13° = 0$

$\Rightarrow F_{BD} - F_{FC} = 1354.16$ ——— (II)

From eqn (I) and (II)

$F_{BD} = 1979.16^{\#}$

$F_{FC} = 625^{\#}$

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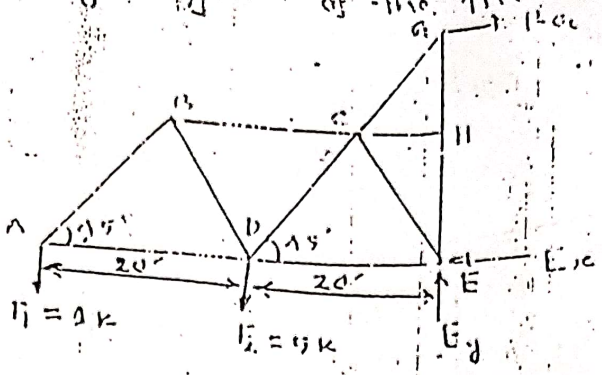
Free body diagram of the truss:



$\Sigma M_E = 0$

$\Rightarrow R_{Gx} \times 20 \tan 45° - 5 \times 20 - 1 \times 10 = 0$

$\Rightarrow R_{Gx} = 7$ kips. Ans

$\Sigma F_x = 0$

$\Rightarrow R_{Gx} - E_x = 0$

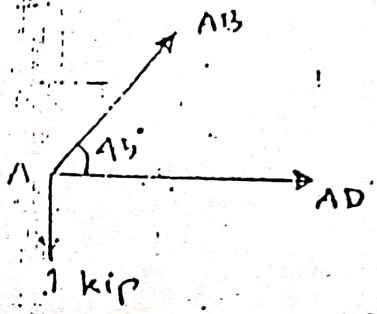
$\Rightarrow E_x = R_{Gx} = 7$ kips. Ans

$\Sigma F_y = 0$

$\Rightarrow E_y - 1 - 5 = 0$

$\Rightarrow E_y = 6$ kips. Ans

At joint A:



$\Sigma F_y = 0$

$\Rightarrow AB \sin 45° - 1 = 0$

$\Rightarrow AB = \sqrt{2}$ (T) Ans

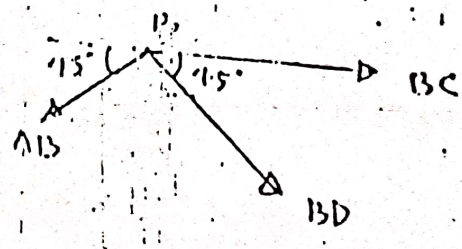
$\Sigma F_x = 0$

$\Rightarrow AD + AB \cos 45° = 0$

$\Rightarrow AD = -1$

$\therefore AD = 1$ kip (C). Ans

At joint B:



$\Sigma F_y = 0$

$\Rightarrow -\sqrt{2} \sin 45° - BD \sin 45° = 0$

$\Rightarrow BD = -\sqrt{2}$

$\therefore BD = \sqrt{2}$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow BC + BD \cos 45 - AB \cos 45 = 0$

$\Rightarrow BC + 1 - 1 = 0$

$\Rightarrow BC = 2$

$\therefore BC = 2$ kips (T) Ans

At joint G:

$\Sigma F_x = 0$

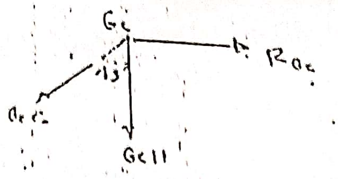
$\Rightarrow R_{Gx} - GC \sin 45^\circ = 0$

$\Rightarrow GC = 9.9$ kips. (T) Ans

$\Sigma F_y = 0$

$\Rightarrow -GH - GC \cos 45 = 0$

$\Rightarrow GH = -7$. $\therefore GH = 7$ kips (C) Ans



At joint H:

$\Sigma F_y = 0$

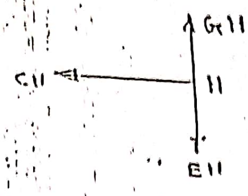
$\Rightarrow GH - EH = 0$

$\Rightarrow EH = GH = 7$ kips (C). Ans

$\Sigma F_x = 0$

$\Rightarrow CH = 0$

$\therefore CH = 0$ Ans



At joint E:

$\Sigma F_y = 0$

$\Rightarrow -EH + CE \sin 45^\circ + E_y = 0$

$\Rightarrow CE = \sqrt{2}$ kips (T) Ans

$\Sigma F_x = 0$

$\Rightarrow -E_x - DE - CE \cos 45 = 0$

$\Rightarrow DE = -8$ $\therefore DE = 8$ kips (C) Ans

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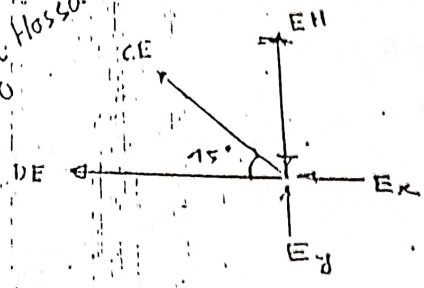
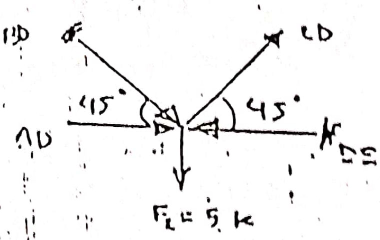


At joint D:

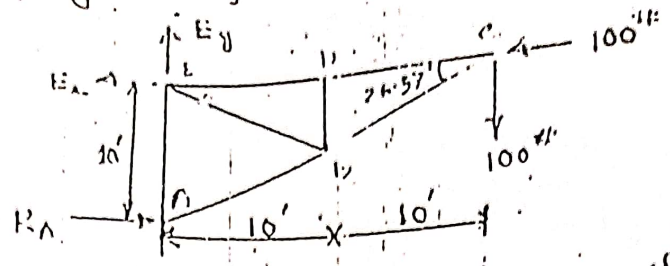
$\Sigma F_y = 0$

$\Rightarrow CD \sin 45^\circ - BD \sin 45^\circ - F_2 = 0$

$\Rightarrow CD = 8.49$ kips (T) Ans



Consider the free body diagram of the truss.



$\Sigma M_E = 0$

$\Rightarrow 100 \times 20 - R_A \times 10 = 0$

$\Rightarrow R_A = 200^{lb}$

$\Sigma F_x = 0$

$\Rightarrow R_A - E_x - 100 = 0$

$\Rightarrow E_x = 100^{lb}$

$\Sigma F_y = 0$

$\Rightarrow E_y - 100 = 0$

$\Rightarrow E_y = 100^{lb}$

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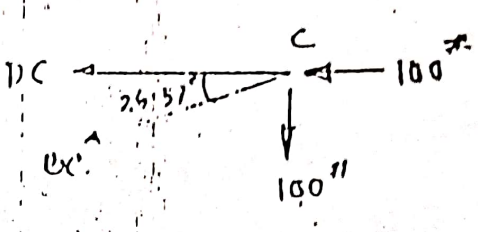
075010

At joint C :



$\Sigma F_y = 0$

$\Rightarrow -BC \sin 24.57^\circ - 100 = 0$

$\Rightarrow BC = -223.6$

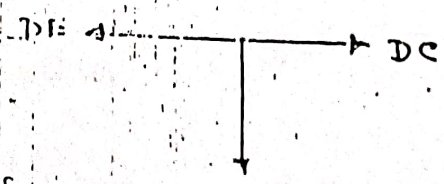
$\therefore BC = 223.6^{lb}$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow -DC - BC \cos 24.57^\circ - 100 = 0$

$\Rightarrow DC = 100^{lb}$ (T) Ans

At joint D :



$\Sigma F_x = 0$

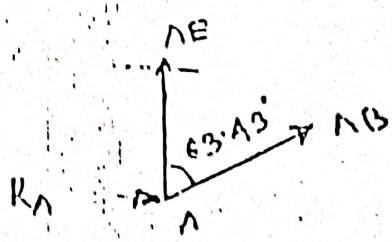
$\Rightarrow DC - DE = 0$

$\Rightarrow DE = DC = 100^{lb}$ (T) Ans

$\Sigma F_y = 0$

$\Rightarrow AB = 0$ Ans

At joint A :



$\Sigma F_x = 0$

$\Rightarrow AB \sin 63.43^\circ + R_A = 0$

$\Rightarrow AB = -223.6$

$\therefore AB = 223.6^{lb}$ (C) Ans

$\Sigma F_y = 0$

$\Rightarrow AE + AB \cos 63.43^\circ = 0$

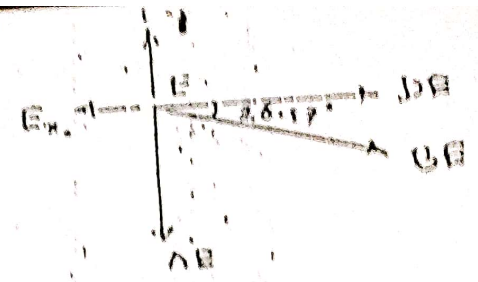
$\Rightarrow AE = 100^{lb}$ (T) Ans

At G:

$\Sigma F_x = 0$

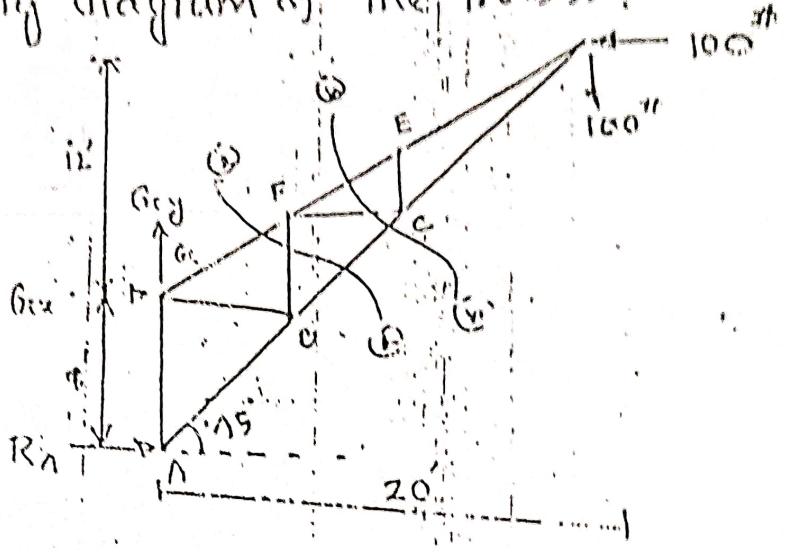
$\Rightarrow DE + BE \cos 26.57^\circ - E_x = 0$

$\Rightarrow BE = 0$ Ans



3-48.

Consider the free body diagram of the truss.



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$\Sigma M_G = 0$

$\Rightarrow -\Sigma \times R_A + 20 \times 100 - 100 \times 12 = 0$

$\Rightarrow R_A = 100\ lb\ (\rightarrow)$

$\Sigma F_y = 0$

$\Rightarrow G_y - 100 = 0$

$\Rightarrow G_y = 100\ lb\ (\uparrow)$

$\Sigma F_x = 0$

$\Rightarrow G_x + R_A - 100 = 0$

$\Rightarrow G_x = 0$

At Joint A:

$\Sigma F_x = 0$

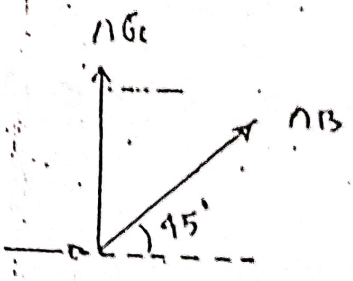
$\Rightarrow AB \cos 45^\circ + R_A = 0$

$\Rightarrow AB = -141.42$

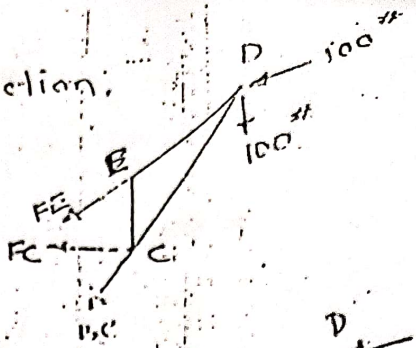
$\Sigma F_y = 0$

$\Rightarrow AB \sin 45^\circ + AG = 0$

$\Rightarrow AG = 100\ lb\ (\downarrow)$ Ans



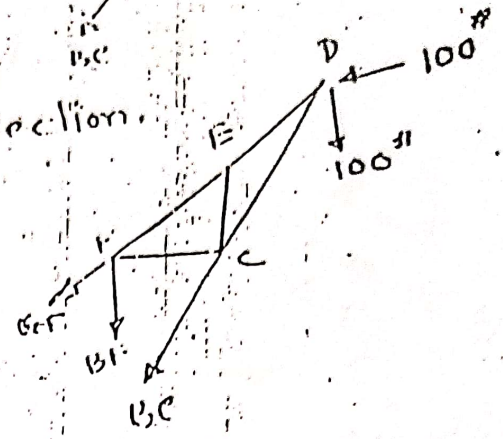
consider the right portion of (b-b) section.



$\Sigma M_D = 0$

$\Rightarrow FC = 0$ Ans:

consider the right portion of (a-a) section.



$\Sigma M_D = 0$

$\Rightarrow FB = 0$ Ans

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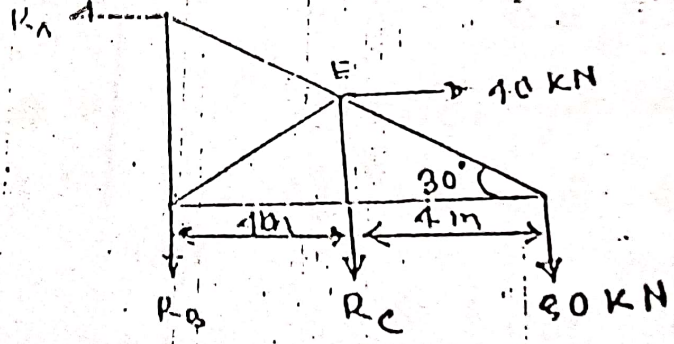
(Ans)

Consider the free body diagram of the truss.



$\Sigma F_{BC} = 0$

$\Rightarrow 10 - R_A = 0$

$\Rightarrow R_A = 10$ K.N ($\leftarrow$) Ans

$\Sigma M_B = 0$

$\Rightarrow R_C \times 14 + 80 \times 8 + 10 \times 14 \sin 30^\circ - R_A \times 8 \sin 30^\circ = 0$

$\Rightarrow R_C = -136.9$ $\therefore R_C = 136.9$ KN ($\uparrow$). Ans

$\Sigma F_y = 0$

$\Rightarrow -R_B - R_C - 80 = 0$

$\Rightarrow R_B = 56.9$ K ($\downarrow$)

Ans

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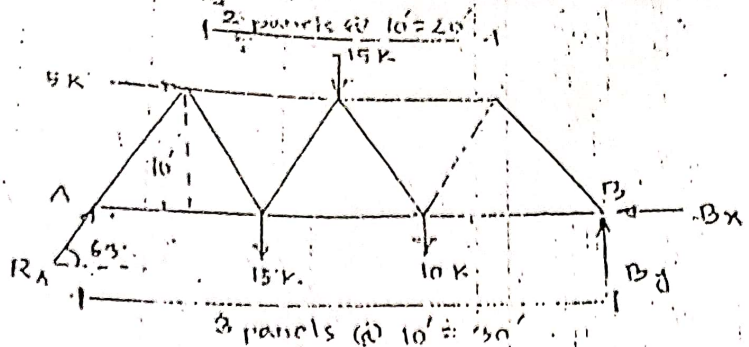
The free body diagram of the structure:



Assuming the hight of the truss 10' $\theta = \tan^{-1}\frac{10}{5} = 63.43°$

$\Sigma M_A = 0$

$\Rightarrow -B_y \times 30 + 10 \times 20 + 15 \times 10 + 15 \times 15 + 5 \times 10 = 0$

$\Rightarrow B_y = 20.83$ K (↑). Ans

$\Sigma F_y = 0$

$\Rightarrow R_A \sin 63.43° - 15 - 10 - 15 + 20.83 = 0$

$\Rightarrow R_A = 21.13$ K ($\nearrow 63.43°$) Ans

$\Sigma F_x = 0$

$\Rightarrow 5 + R_A \cos 63.43 - B_x = 0$

$\Rightarrow B_x = 14.59$ K (←)

∴ Reaction at B; $R_B = \sqrt{B_x^2 + B_y^2}$

$= \sqrt{(20.83)^2 + (14.59)^2}$

$= 25.45$ K. Ans

Q5. Consider the free body diagram of the structure.

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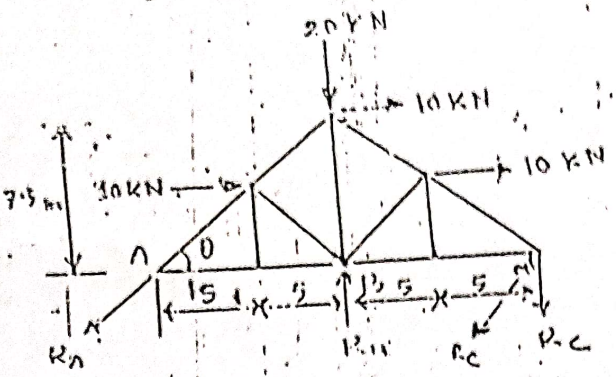

$\theta = \tan^{-1}\frac{7.5}{10} = 36.87°$

(a) when $\alpha = 90°$

$\Sigma F_x = 0$

$\Rightarrow -R_A \cos 36.87° + 10 + 10 - 10 = 0$

$\Rightarrow R_A = 37.5$ KN. $(\nearrow)$. Ans

$\Sigma M_B = 0$

$\Rightarrow 10 \times R_C - R_A \sin 36.87° \times 10 + 5 \times 10 - 10 \tan 36.87° + 7.5 \times 10$

$+ 5 \times 10 \tan 36.87 = 0$

$\Rightarrow R_C = 7.5$ KN $(\downarrow)$. Ans

$\Sigma F_y = 0$

$\Rightarrow R_B - R_C - R_A \sin 36.87° - 20 = 0$

$\Rightarrow R_B = 50$ KN $(\uparrow)$. Ans

$R_A \cos 36.87 - R_C \cos 36.87° + 10 + 10 + 10 = 0$

$\Rightarrow R_A + R_C = 37.5$ ——— (1)

$\Sigma F_y = 0$

$\Rightarrow -R_A \sin 36.87° - R_C \sin 36.87° + R_B - 20 = 0$

$\Rightarrow R_B = (R_A + R_C) \sin 36.87° + 20 = 22.5 + 20$

$\Rightarrow R_B = 42.5$ KN (↑). Ans

$\Sigma M_A = 0$

$\Rightarrow 10 \times 5 \tan 36.87 + 7.5 \times 10 + 20 \times 10 + 10 \times 5 \cdot \tan 36.87° - 10 \times R_B + 20 \sin 36.87 \times R_C = 0$

$\Rightarrow R_C = 6.25$ KN (↓). Ans

from eqn (1), we get,

$R_A + 6.25 = 37.5$

$\Rightarrow R_A = 31.25$ (point) Ans

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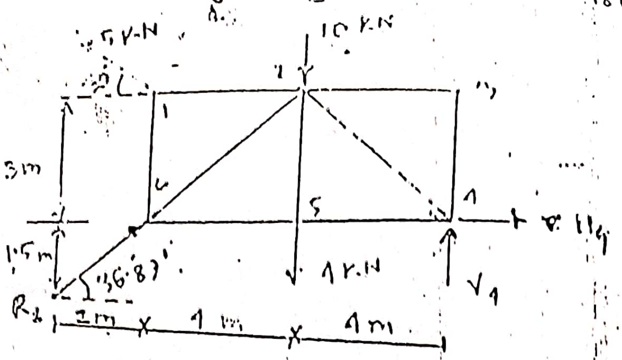
... diagram of the truss.



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$\Sigma M_1 = 0$

$\Rightarrow R_6 \times \sin 36.87° \times 8 - 4 \times 4 - 10 \times 4 - 5 \cos 30 \times 3 + 5 \sin 30 \times 8 = 0$

$\Rightarrow R_6 = 10.206$ KN $\quad \therefore F_{(6-1)} = R_6 = 10.206$ KN

Ans

$\Sigma F_x = 0$

$\Rightarrow R_6 \cos 36.87° + H_1 - 5 \cos 30° = 0$

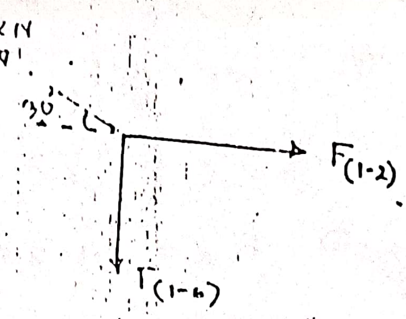
~~$\Rightarrow H_1 = -3.83$~~ $\Rightarrow H_1 = -3.83 \quad \therefore H_1 = 3.83 \; (\leftarrow)$.

$F_y = 0$

$\Rightarrow R_6 \sin 36.87° + 5 \sin 30° - 10 - 4 + V_1 = 0$

$\Rightarrow V_1 = 5.38$ KN $(\uparrow)$

At joint 1:



$\Sigma F_x = 0$

$\Rightarrow F_{(1-2)} = 5 \cos 30° = 4.33$ KN (T)

Ans

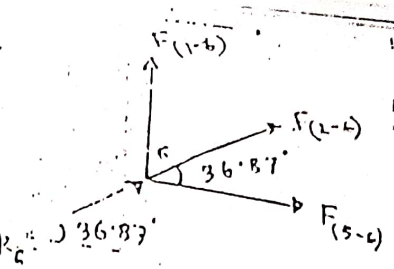
$\Sigma F_y = 0$

$\Rightarrow F_{(1-6)} = 5 \sin 30° = 2.5$ KN (T)

Ans

$F_{(1-6)} + F_{(2-6)} \sin 36.87° - K_6 \sin 36.87° = 0$

$\Rightarrow F_{(2-6)} = 6.04 \text{ KN (T)}$ Ans



$\Sigma F_x = 0$

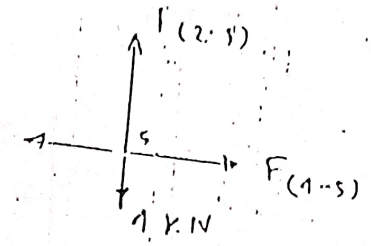
$\Rightarrow F_{(5-6)} + F_{(2-6)} \cos 36.87° + K_6 \cos 36.87° = 0$

$\Rightarrow F_{(5-6)} = -13 \text{ KN}$ $\therefore F_{(5-6)} = 13 \text{ KN (C)}$ Ans

At joint 5:

$\Sigma F_x = 0$

$\Rightarrow F_{(1-5)} = F_{(5-6)} = 13 \text{ KN (C)}$



$\Sigma F_y = 0$ Ans

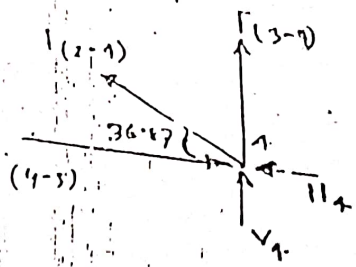
$\Rightarrow F_{(2-5)} = 1 \text{ KN (T)}$ Ans

At joint 1:

$\Sigma F_x = 0$

$\Rightarrow F_{(1-5)} - F_{(2-1)} \cos 36.87° - 11.4 = 0$

$\Rightarrow F_{(2-1)} = 11.46 \text{ KN (T)}$ Ans

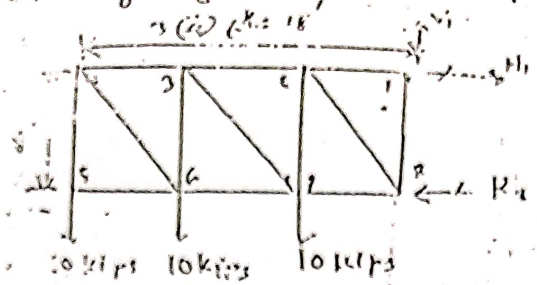


$\Sigma F_y = 0$

$\Rightarrow F_{(3-1)} + V_1 + F_{(2-1)} \sin 36.87° = 0$

$\Rightarrow$

Consider the free body diagram of the truss.



$\Sigma M_1 = 0$

$\Rightarrow R_2 \times 8 - 10\times 6 - 10\times 12 - 10\times 18 = 0$

$\Rightarrow R_2 = 45$ kips.

$\Sigma F_x = 0$

$\Rightarrow H_1 - R_2 = 0$

$\Rightarrow H_1 = R_2 = 45$ kips.

$\Sigma F_y = 0$

$\Rightarrow V_1 - 10 - 10 - 10 = 0$

$\Rightarrow V_1 = 30$ kips.

At joint 5:

$\Sigma F_x = 0$

$\Rightarrow -F_{(5-4)} = 0$

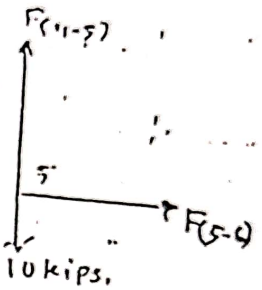
Ans

$\Sigma F_y = 0$

$\Rightarrow F_{(1-5)} - 10 = 0$

$\Rightarrow F_{(1-5)} = 10$ kips

Ans

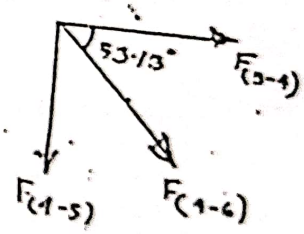


At joint 4:

$\Sigma F_y = 0$.

$\Rightarrow -F_{(4-3)} - F_{(4-1)} \sin 53.13^\circ = 0$

$\Rightarrow F_{(4-3)} =$



At joint 1:

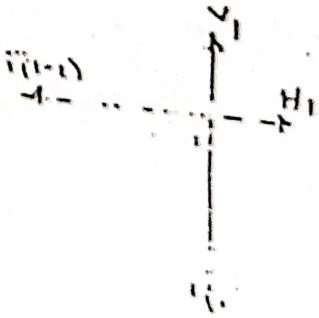
$\Sigma F_x = 0$

$\Rightarrow F_{(1-4)} =$

$\Sigma F_y = 0$

$\Rightarrow V_1 =$

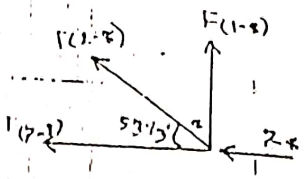
$\Rightarrow F_{(1-5)} =$



$\Rightarrow F_{(1-8)} + F_{(1-2)} \sin 53.13^\circ = 0$

$\Rightarrow F_{(2-8)} = -37.5$ kips

$\therefore F_{(1-8)} = 37.5$ kips (C) Ans



$\Sigma F_x = 0$

$\Rightarrow -R_8 - F_{(7-8)} - F_{(2-8)} \cos 53.13^\circ = 0$

$\Rightarrow F_{(7-8)} = -22.5$

$\therefore F_{(7-8)} = 22.5$ kips. (C) Ans

At joint 2:

$\Sigma F_y = 0$

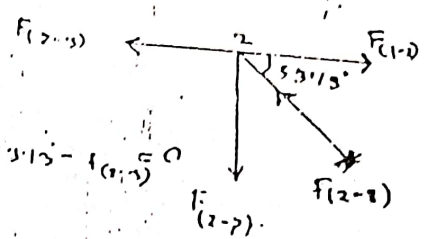
$\Rightarrow F_{(2-8)} \sin 53.13^\circ - F_{(2-7)} = 0$

$\Rightarrow F_{(2-7)} = 30$ kips (T) Ans

$\Sigma F_x = 0$

$\Rightarrow F_{(1-2)} - F_{(2-8)} \cos 53.13^\circ - F_{(2-7)} = 0$

$\Rightarrow F_{(2-7)} = 22.5$ kips (T) Ans



At joint 7:

$\Sigma F_y = 0$

$\Rightarrow F_{(2-7)} + F_{(7-8)} \sin 53.13^\circ - 10 = 0$

$\Rightarrow F_{(7-8)} = -22.5$

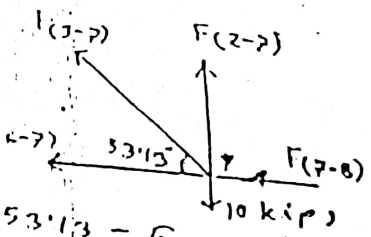
$\therefore F_{(7-8)} = 22.5$ kips (C)

$\Sigma F_x = 0$

$\Rightarrow -F_{(6-7)} - F_{(7-8)} \cos 53.13^\circ - F_{(7-8)} = 0$

$\Rightarrow F_{(6-7)} = -6$

$\therefore F_{(6-7)} = 6$ kips (C) Ans



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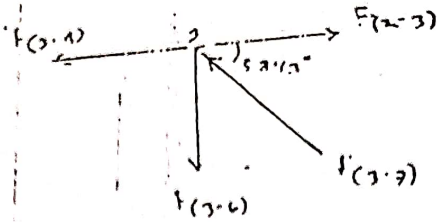
At joint 3:



$\Sigma F_x = 0$

$\Rightarrow F_{(3-2)} - F_{(3-1)} - F_{(3-7)} \cos 53.13 = 0$

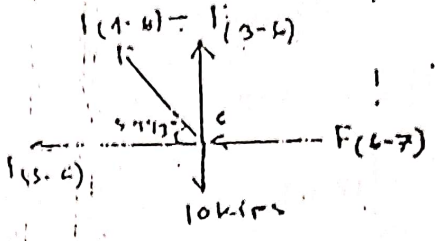
$\Rightarrow F_{(3-1)} = 6$ kips (T) Ans

$\Sigma F_y = 0$

$\Rightarrow F_{(3-7)} \sin 53.13 - F_{(3-6)} = 0$

$\Rightarrow F_{(3-6)} = 22.5$ kips (T) Ans

At joint 6:



$\Sigma F_y = 0$

$\Rightarrow F_{(3-6)} - 10 + F_{(1-6)} \sin 53.13 = 0$

$\Rightarrow F_{(1-6)} = -15$ +

$\therefore F_{(1-6)} = 15$ kips (C) Ans

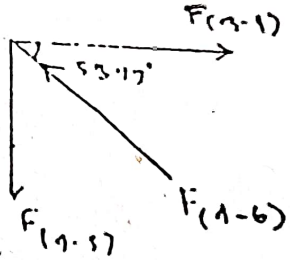
$\Sigma F_x = 0$

$\Rightarrow F_{(6-5)} - F_{(6-7)} - F_{(1-6)} \sin 53.13 = 0$

$\Rightarrow F_{(5-6)} = -9 - 15$ kips

$\therefore F_{(5-6)} = 6$ kips (C) Ans

At joint 1:



$\Sigma F_y = 0$

$\Rightarrow F_{(1-6)} \sin 53.13 - F_{(1-5)} = 0$

$\Rightarrow F_{(1-5)} = 12$ kips (T) Ans

... free body diagram of the truss.

$\Sigma M_A = 0$

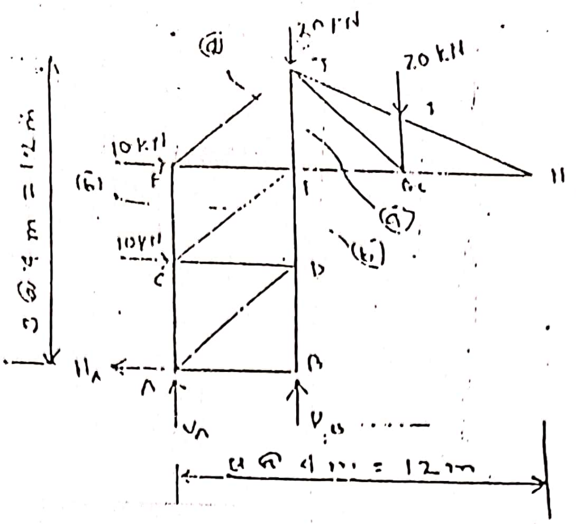
$\Rightarrow 20\times 4 + 20\times 8 + 10\times 4 + 10\times 8 - R_B\times 4 = 0$

$\Rightarrow R_B = 90$ KN (↑)

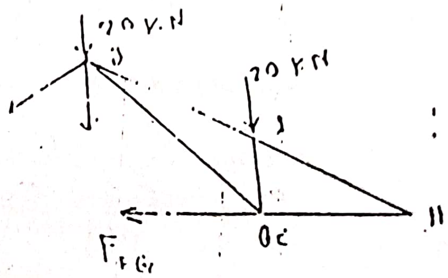
$\Sigma F_x = 0$

$\Rightarrow 10 + 10 - H_A = 0$

$\Rightarrow H_A = 20$ KN (←)



Consider the the right portion of (a–a) section.



$\Sigma M_J = 0$

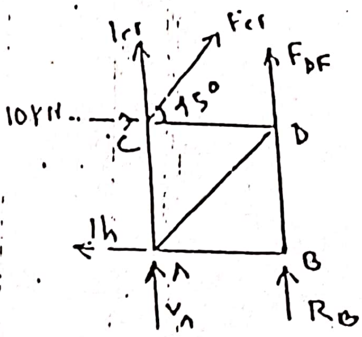
$\Rightarrow F_{FG}\times 4 + 20\times 4 = 0$

$\Rightarrow F_{FG} = -20$

$\therefore F_{FG} = 20$ KN (C)

Ans

Consider the lower portion of (b–b) section.



$\Sigma F_x = 0$

$\Rightarrow 10 + F_{CF}\cos 45° - H_A = 0$

$\Rightarrow F_{CF} = \frac{10}{\cos 45°}$

$\Rightarrow F_{CF} = 14.14$

$\therefore F_{CF} = 14.14$ KN (T)

Ans.

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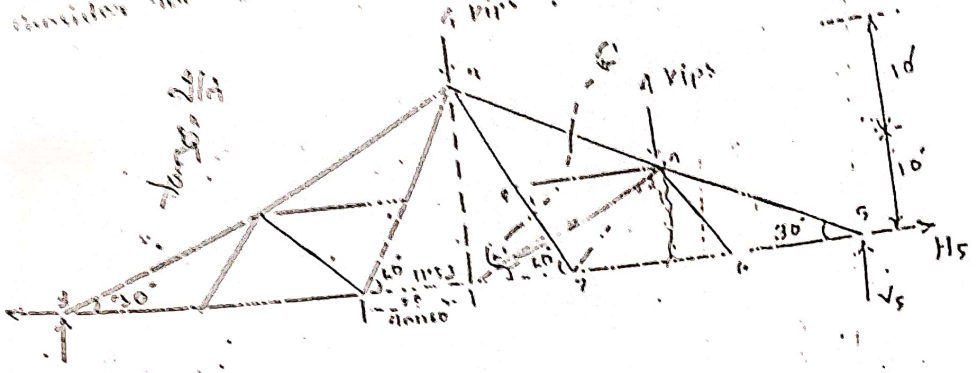
Consider the free body diagram of the structure.



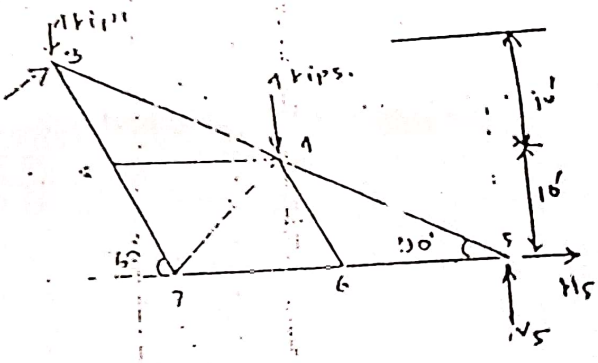
$\Sigma M_1 = 0$

$\Rightarrow 4 \times \frac{20}{\tan 30^\circ} + 4 \times \left(\frac{20}{\tan 30^\circ} + \frac{10}{\tan 30^\circ}\right) - V_5 \times 2 \times \frac{20}{\tan 30^\circ} = 0$

$\Rightarrow V_5 \times 69.28 = 346.41$

$\Rightarrow V_5 = 5$ kips.

Consider the left portion of the truss.



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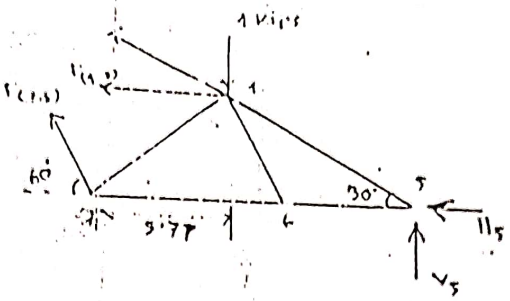
$\Sigma M_3 = 0$

$\Rightarrow 4 \times \frac{10}{\tan 30^\circ} - V_5 \times \frac{20}{\tan 30^\circ} - H_5 \times 20 = 0$

$\Rightarrow H_5 = -5.2$

$\therefore H_5 = 5.2$ kips ($\leftarrow$)

Consider the right portion of (a-a) section.



$\Sigma M_4 = 0$

$\Rightarrow F_{(7-8)} \cos 60^\circ \times 10 + F_{(7-8)} \sin 60^\circ \times 5.77 + H_5 \times 10 - V_5 \times 17.32 = 0.$

$\Rightarrow 10 \times F_{(7-8)} = 31.6$

$\therefore F_{(7-8)} = 3.16$ kips. Ans

$\Sigma M_5 = 0$

$\Rightarrow F_{(7-8)} \sin 60^\circ \times 23.1 - 4 \times 17.32 - F_{(4-8)} \times 10 = 0$

$\Rightarrow 10 \times F_{(4-8)} = -0.06$

$\Rightarrow F_{(4-8)} = -0.006$ (C)

$\therefore F_{(4-5)} = 0$ Ans

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Sol:- Consider the free body diagram of the truss.

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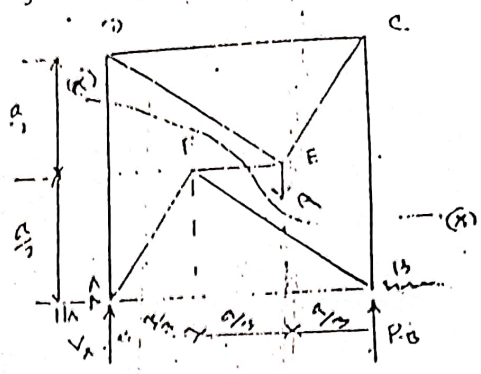


$\Sigma M_A = 0$

$\Rightarrow Q \times \frac{2}{3}a - R_B \times a = 0$

$\Rightarrow R_B = \frac{2}{3}Q = \frac{2}{3} \times 3000 = 2000$

$\therefore R_B = 2000$ kg.

$\Sigma F_y = 0$

$\Rightarrow V_A + R_B - Q = 0$

$\Rightarrow V_A = 3000 - 2000 = 1000$

$\Rightarrow V_A = 1000$ kg.

$\Sigma F_x = 0$

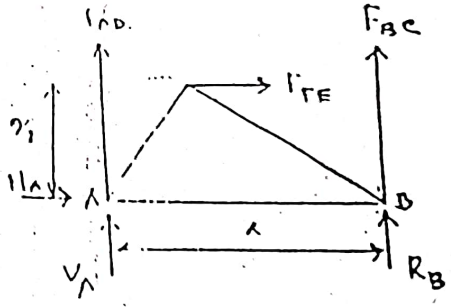
$\Rightarrow H_A = 0$ ..... (i)

Consider the lower portion of (x-x) section.

$\Sigma F_x = 0$

$\Rightarrow F_{FE} + H_A = 0$

$\Rightarrow F_{FE} = 0$ Ans



$\Sigma M_A = 0$

$\Rightarrow F_{FE} \times \frac{a}{2} - R_B \times a - F_{BC} \times a = 0$

$\Rightarrow F_{BC} = -R_B = -2000$ $\therefore F_{BC} = 2000$ kg (C) Ans

$\Sigma F_y = 0$

$\Rightarrow F_{AB} + V_A + F_{BC} + R_{BD} = 0$

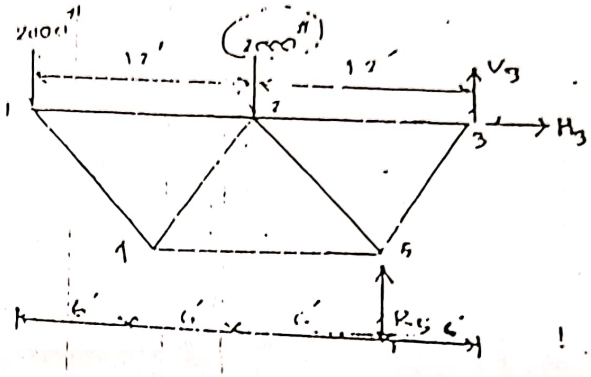
$\Rightarrow F_{AB} + 0 + 0 + 1000 = 0$

$\Rightarrow F_{AB} = -1000$

$\therefore F_{AB} = 1000$ kg (c). Ans

365.

Consider the free body diagram of the truss.



$\Sigma M_3 = 0$

$\Rightarrow R_5 \times 6 - 2000 \times 12 - 2000 \times 24 = 0$

$\Rightarrow R_5 = 12000$ #

$\Sigma F_y = 0$

$\Rightarrow R_5 - 2000 - 2000 + V_3 = 0$

$\Rightarrow V_3 = -8000 \quad \therefore V_3 = 8000$ # (↓)

$\Sigma F_x = 0$

$\Rightarrow H_3 = 0$

[This problem was solved by taking 2000# instead of 1000#.] Ans.

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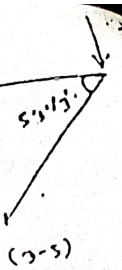
ID: 0700106



Consider joint 3:

$\Sigma F_y = 0$

$\Rightarrow -V_{13} - F_{(3-5)} \sin 53.13° = 0$

$\Rightarrow F_{(3-5)} = -10000$

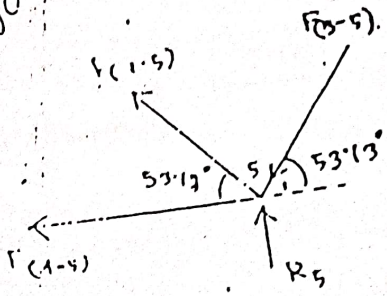
$\therefore F_{(3-5)} = 10000\ N\ (C)$. Ans

$\Sigma F_x = 0$

$\Rightarrow -F_{(2-3)} - F_{(3-5)} \cos 53.13° = 0$

$\Rightarrow F_{(2-3)} = -10000 \cos 53.13°$

$\therefore F_{(2-3)} = -6000\ N$ (T) Ans (1)



At joint 5:

$\Sigma F_y = 0$

$\Rightarrow F_{(2-5)} \sin 53.13° - F_{(3-5)} \sin 53.13° - R_5 = 0$

$\Rightarrow F_{(2-5)} = 5000\ N$ $\therefore F_{(2-5)} = 5000\ N$ (C) Ans.

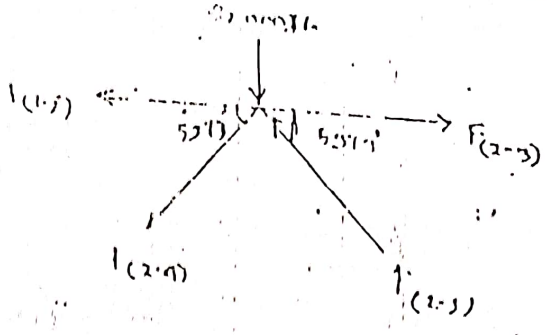
$\Sigma F_x = 0$

$\Rightarrow -F_{(1-5)} - F_{(2-5)} \cos 53.13° - F_{(3-5)} \cos 53.13° = 0$

$\Rightarrow F_{(1-5)} = -10000 \cos 53.13° + 5000 \cos 53.13°$

$= -9000$

$\therefore F_{(1-5)} = 9000\ N$ (C) Ans



$\Sigma F_y = 0$

$\Rightarrow F_{(2-5)} \sin 53.13 - F_{(2-4)} \sin 53.13 - 2000 = 0$

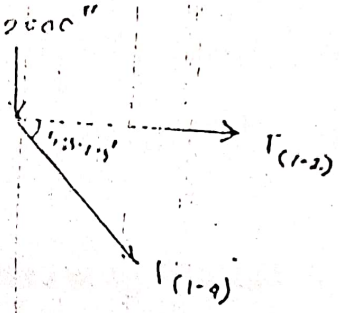
$\therefore F_{(2-4)} = 2500\ \text{lb}\ (T)$ Ans

$\Sigma F_x = 0$

$\Rightarrow F_{(2-3)} - F_{(2-5)} \cos 53.13 - F_{(2-4)} \cos 53.13 - F_{(1-2)} = 0$

$\Rightarrow F_{(1-2)} = 1500\ \text{lb}\ (-T)$ Ans

At joint 1 :



$\Sigma F_y = 0$

$\Rightarrow -2000 - F_{(1-4)} \sin 53.13 = 0$

$\Rightarrow F_{(1-4)} = -2500$

$\therefore F_{(1-4)} = 2500\ \text{lb}\ (C)$ Ans

Solved-
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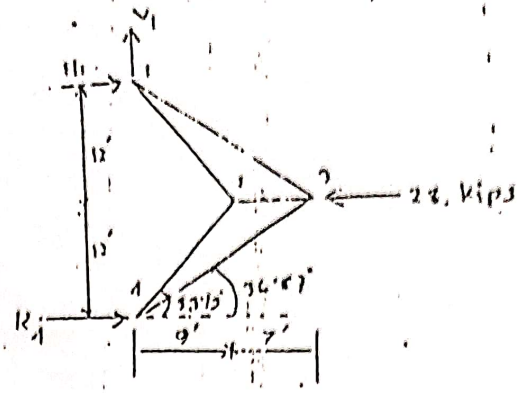
07001/0

2.001

Consider the free body diagram of the truss.



$\Sigma M_1 = 0$

$\Rightarrow 28 \times 12 - R_A \times 24 = 0$

$\Rightarrow R_A = 14$ kips.

$\Sigma F_x = 0$

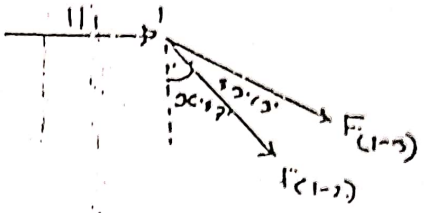
$\Rightarrow R_A + H_1 - 28 = 0$

$\Rightarrow H_1 = 14$ kips.

$\Sigma F_y = 0$

$\Rightarrow V_1 = 0$

At joint - 1 :



$\Sigma F_y = 0$

$\Rightarrow F_{(1-2)} \cos 36.87° + F_{(1-3)} \cos 53.13° = 0$

$\Rightarrow F_{(1-3)} = -1.333 F_{(1-2)} \quad \cdots (1)$

$\Sigma F_x = 0$

$\Rightarrow H_1 + F_{(1-3)} \sin 53.13 + F_{(1-2)} \sin 36.87 = 0$

$\Rightarrow 14 - 0.467 F_{(1-2)} = 0$

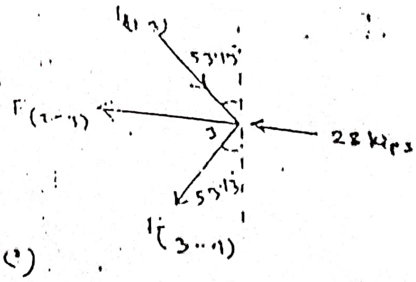
$\Rightarrow F_{(1-2)} = 30.$

$\therefore F_{(1-2)} = 30$ kips (T) Ans

From eqn (1) $\Rightarrow F_{(1-3)} = -30 \times 1.333 = -40$

$\therefore F_{(1-3)} = 40$ kips (C) Ans

At joint - 3:



$\Sigma F_y = 0$

$\Rightarrow -F_{(3-4)} \cos 53.13^\circ - F_{(1-3)} \cos 53.13^\circ = 0$

$\Rightarrow F_{(3-4)} = -40$

$\therefore F_{(3-4)} = 40$ kips (C)

Ans

$\Sigma F_x = 0$

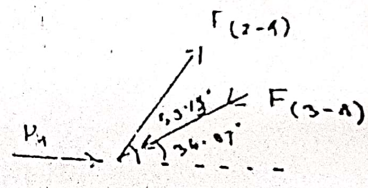
$\Rightarrow F_{(1-3)} \sin 53.13^\circ - F_{(3-4)} \sin 53.13^\circ - F_{(2-3)} - 28 = 0$

$\Rightarrow F_{(2-3)} = -28 + 40 \sin 53.13^\circ + 40 \sin 53.13^\circ$

$\Rightarrow F_{(2-3)} = 36$

$\therefore F_{(2-3)} = 36$ kips Ans

At joint - 4:



$\Sigma F_y = 0$

$\Rightarrow F_{(2-4)} \sin 53.13^\circ - F_{(3-4)} \sin 36.87^\circ = 0$

$\Rightarrow F_{(2-4)} = 30$ kips (T) Ans

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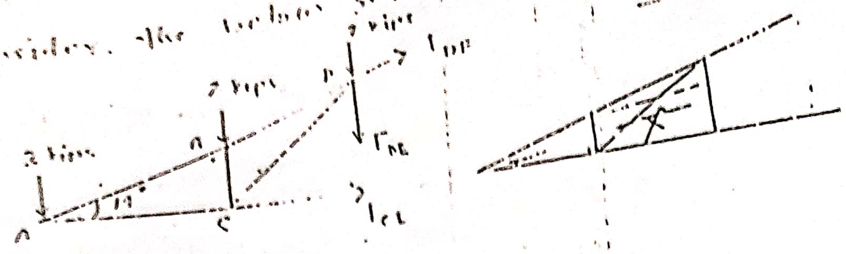
Consider the below section.



Here, $DE = 6 \times \frac{16}{24} = 4'$

$\Sigma M_D = 0$

$\Rightarrow 2 \times 16 + 2 \times 8 + F_{CE} \times 4 = 0$

$\Rightarrow F_{CE} = -12$ $\therefore F_{CE} = 12$ kips (C) Ans

$\Sigma M_A = 0$

$\Rightarrow 2 \times 8 + 2 \times 16 + 8 \times F_{DE} = F_{DE} \times 16$

$\Rightarrow F_{DE} = -6$ $\therefore F_{DE} = 6$ kips (C) Ans

$\Sigma F_x = 0$

$\Rightarrow F_{CE} + F_{DF} \cos 14° = 0$

$\Rightarrow F_{DF} \cos 14° = -F_{CE} = 12$

$\Rightarrow F_{DF} = 12.37$ kips (T) Ans

$\Sigma F_y = 0$

$GH + DF \cos\theta = 0$

$\Sigma F_x = 0$

GH 27 $+ DF\cos\theta = 0$

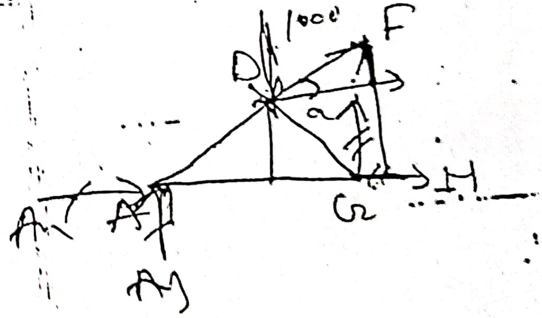
$DF \times$

$\Sigma M_A = 0$

$DF = 916.87$

Md. Shahadat Hossain 1700010

$\tan\theta$



$\frac{3a}{2} - \frac{3a}{4}$

$\frac{6a - 3a}{4} = \frac{3a}{4}$

$\Sigma M_A = 0$

$1000 \times a - F_G \times 2a = 0$

$F_G = 500$ kg

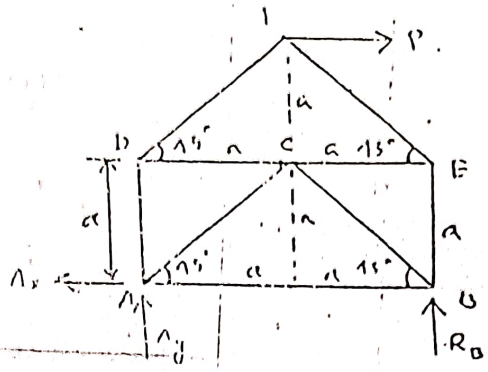
$GH \times \frac{3}{2} = 500$

$\Sigma M_F = 0$

$750 \times 2a - GH \times \frac{3a}{2} - 100 \times a = 0$

$GH = 333.33$

Consider the free body diagram of the truss.

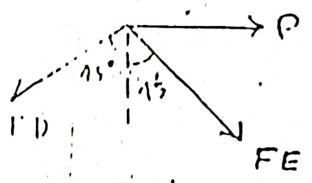


Let, $AD = a$,

$\Sigma M_A = 0$

$\Rightarrow P \times 2a - R_B \times 2a = 0$

$\Rightarrow R_B = P$



At point F :

$\Sigma F_y = 0$

$\Rightarrow -FD \cos 45^\circ - FE \cos 45^\circ = 0$

$\Rightarrow FD = -FE$ ——— (1)

$\Sigma F_x = 0$

$\Rightarrow P + FE \sin 45^\circ - FD \sin 45^\circ = 0$

$\Rightarrow 2FE \sin 45^\circ = -P$

$\Rightarrow FE = -\frac{P}{\sqrt{2}}$

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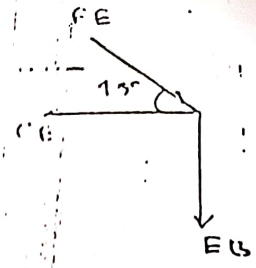
At joint E:

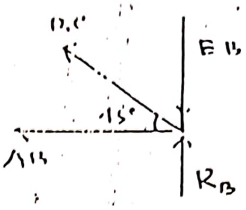


$\Sigma F_y = 0$

$\Rightarrow -EB - FE \sin 45° = 0$

$\Rightarrow EB = -FE \frac{1}{\sqrt{2}} = -\frac{P}{2}$

At joint B:



$\Sigma F_y = 0$

$\Rightarrow BC \sin 45° - EB - R_B = 0$

$\Rightarrow BC \sin 45° = -\frac{P}{2}$

$\Rightarrow BC = -\frac{P}{\sqrt{2}}$

Fabricated-
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070615

$\Sigma F_x = 0$

$\Rightarrow -AB - BC \cos 45° = 0$

$\Rightarrow AB = -BC \cos 45° = -\frac{P}{\sqrt{2}} \cdot \frac{1}{\sqrt{2}}$

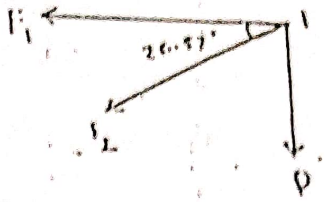
$\Rightarrow AB = \frac{P}{2}$

∴ Force in the bar $AB = \frac{P}{2}$

Ans

Consider the joint 1.

$\Sigma F_y = 0$



$\Rightarrow -P - F_2 \sin 26.57° = 0$

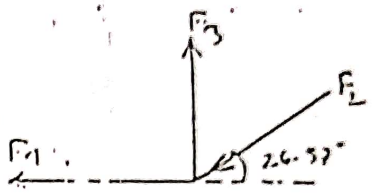
$\Rightarrow F_2 = -2.24P \quad \therefore F_2 = 2.24P$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow -F_1 - F_2 \cos 26.57° = 0$

$\Rightarrow F_1 = -F_2 \cos 26.57 = 2P \quad \therefore F_1 = 2P$ (T) Ans

Consider the joint 2.



$\Sigma F_y = 0$

$\Rightarrow F_3 - F_2 \sin 26.57° = 0$

$\Rightarrow F_3 = F_2 \sin 26.57 = P \quad \therefore F_3 = P$ (T) Ans

$\Sigma F_x = 0$

$\Rightarrow -F_1 - F_2 \cos 26.57 = 0$

$\Rightarrow F_1 = -F_2 \cos 26.57 = -2P \quad \therefore F_1 = 2P$ (C) Ans

Solved by:
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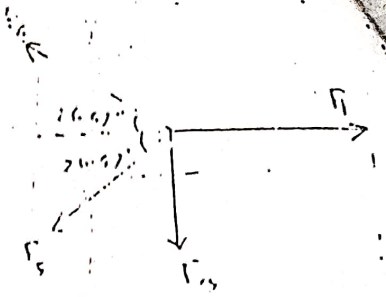
07CC10

Consider the joint 3.



$\Sigma F_x = 0$

$\Rightarrow F_1 - F_6 \cos 26.57° - F_5 \cos 26.57° = 0$

$\Rightarrow F_6 + F_5 = 1.118 F_1$

$\Rightarrow F_6 + F_5 = 2.236$ ... (I)

$\Sigma F_y = 0$

$\Rightarrow F_6 \sin 26.57° - F_5 \sin 26.57° = 0$

$\Rightarrow F_6 - F_5 = 2.236$ ... (II)

(I) + (II) $\Rightarrow 2F_6 = 4.472$

$\Rightarrow F_6 = 2.24$ kN $\therefore F_6 = 2.24$ kN (T)

From eqn (I) $\Rightarrow F_5 = 2.24 - 2.24$

$= 0$

$\therefore F_5 = 0$ kN

Submitted.
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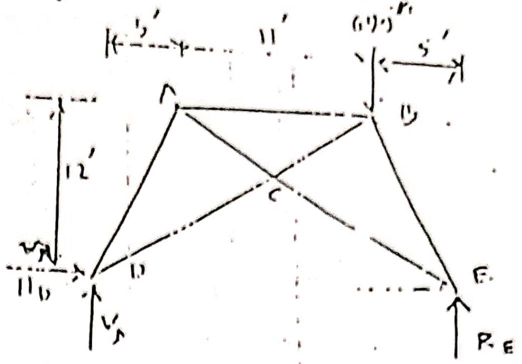
2006

Consider the free body diagram of the truss.



$\sum M_D = 0$

$\Rightarrow 693 \times 16 - R_E \times 21 = 0$

$\Rightarrow R_E = 528^{\#}$

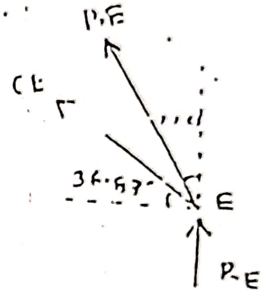
$\sum F_y = 0$

$\Rightarrow V_D - 693 + R_E = 0$

$\Rightarrow V_D = 165^{\#}$

$\sum F_x = 0$

$\Rightarrow H_D = 0$



At joint E:

$\sum F_x = 0$

$\Rightarrow - CE \cos 36.87^\circ - BE \sin 22.62^\circ = 0$

$\Rightarrow BE = -2.08\ CE$ .... (I)

$\sum F_y = 0$

$\Rightarrow BE \cos 22.62^\circ + CE \sin 36.87^\circ + R_E = 0$

$\Rightarrow -1.92 CE + 0.6 CE = -528$

$\Rightarrow CE = 400$

$\therefore CE = 400^{\#}$ (T) } Ans

$\therefore BE = 832^{\#}$ (C) }

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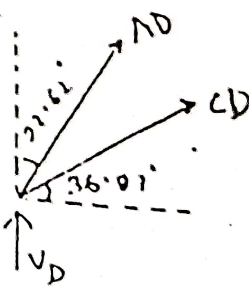
Consider the joint D.



$\sum F_x = 0$

$\Rightarrow CD \cos 36.87^\circ + AD \sin 22.62^\circ = 0$

$\Rightarrow AD = -2.08\ CD$ ————— (II)

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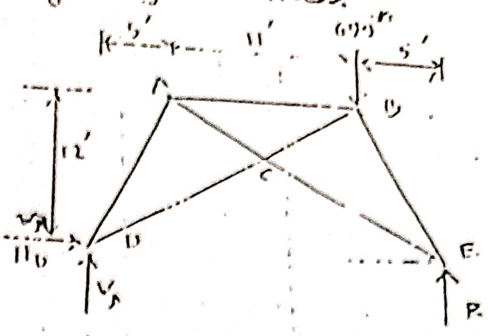
2006

Consider the free body diagram of the truss.



$\Sigma M_D = 0$

$\Rightarrow 693 \times 16 - R_E \times 21 = 0$

$\Rightarrow R_E = 528$ #

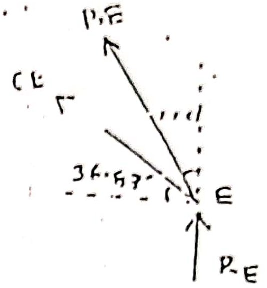
$\Sigma F_y = 0$

$\Rightarrow V_D - 693 + R_E = 0$

$\Rightarrow V_D = 165$ #

$\Sigma F_x = 0$

$\Rightarrow H_D = 0$



At joint E:

$\Sigma F_x = 0$

$\Rightarrow -CE \cos 36.87° - BE \sin 22.62° = 0$

$\Rightarrow BE = -2.08\ CE$ .... (i)

$\Sigma F_y = 0$

$\Rightarrow BE \cos 22.62° + CE \sin 36.87° + R_E = 0$

$\Rightarrow -1.92 CE + 0.6 CE = -528$

$\Rightarrow CE = 400$

$\therefore CE = 400$ # (T) Ans

$\therefore BE = 832$ # (C)

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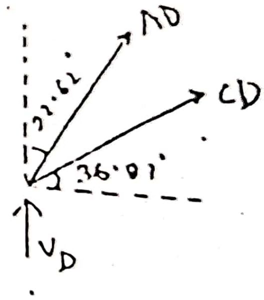


Consider the joint D.

$\Sigma F_x = 0$

$\Rightarrow CD \cos 36.87° + AD \sin 22.62° = 0$

$\Rightarrow AD = -2.08\ CD$ ———— (ii)

$\Sigma F_y = 0$

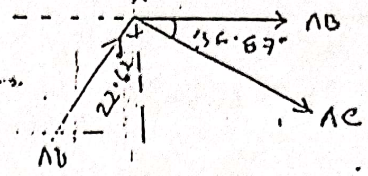
$\Rightarrow AD \cos 22.62 + CD \sin 36.87° + V_D = 0$

$\Rightarrow -1.32\, CD = -16.5$

$\Rightarrow CD = 12.5$ $\therefore$ $CD = 12.5^{\#}$ (T) Ans

from eqn (ii) $\Rightarrow$ $AD = 260^{\#}$ (C) Ans

Consider the joint A.



$\Sigma F_y = 0$

$\Rightarrow AD \cos 22.62 - AC \sin 36.87° = 0$

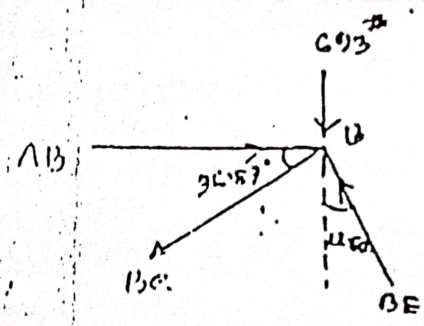
$\Rightarrow AC = 400$ $\therefore$ $AC = 400^{\#}$ (T) Ans

$\Sigma F_x = 0$

$\Rightarrow AB + AD \sin 22.62 + AC \cos 36.87° = 0$

$\Rightarrow AB = -420$ $\therefore$ $AB = 420^{\#}$ (C) Ans

Consider the joint B.



$\Sigma F_y = 0$

$\Rightarrow -BC \sin 36.87° + BE \cos 22.62 - 693 = 0$

$\Rightarrow BC = 12.5$ $\therefore$ $BC = 12.5^{\#}$ (T) Ans

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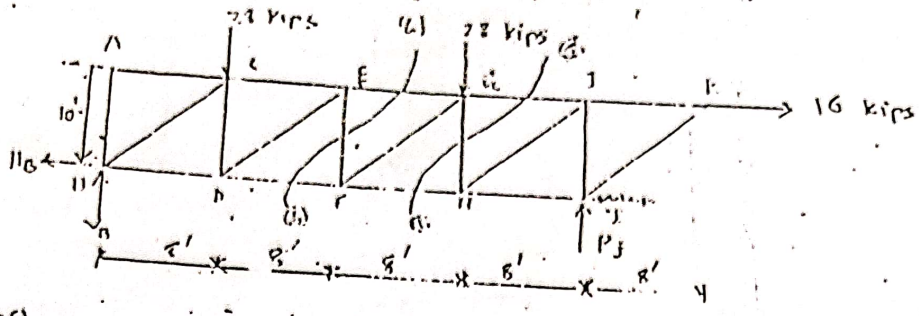
Q.no 77.

Consider the free body diagram of the truss.



$\Sigma M_B = 0$

$\Rightarrow 28 \times 8 + 28 \times 24 - R_J \times 32 + 16 \times 10 = 0$

$\Rightarrow 32 R_J = 1056$

$\Rightarrow R_J = 33$ kips.

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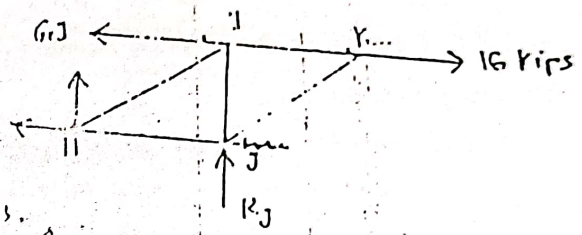
Consider the right portion of (1-1) section.



$\Sigma M_H = 0$

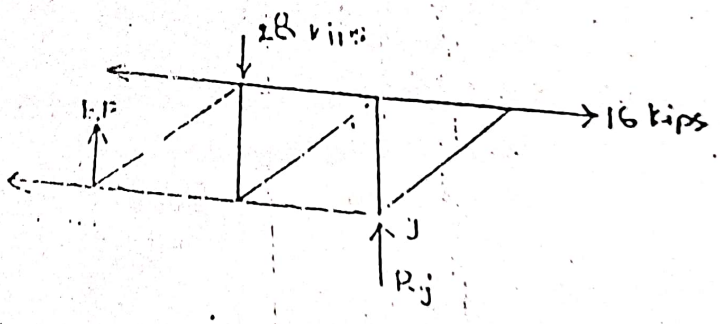
$\Rightarrow 16 \times 10 - R_J \times 8 - G_1 I \times 10 = 0$

$\Rightarrow 10 \times G_1 I = 104$

$\Rightarrow G_1 I = 10.4$ $\quad \therefore G_1 J = 10.4$ kips.

Ans

Consider the right portion of (2-2) section.



$\Sigma F_y = 0$

$\Rightarrow EF + R_J - 28 = 0$

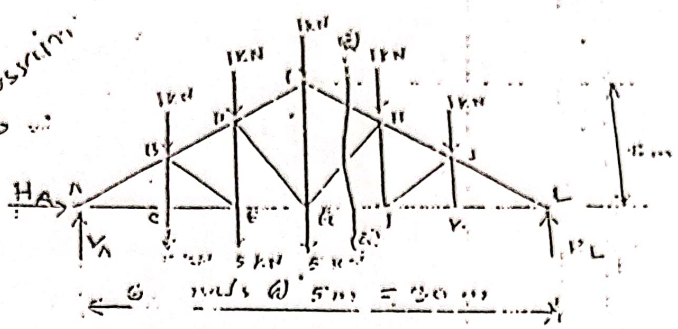
$\Rightarrow EF = 28 - 33 = -5$

$\therefore EF = 5$ kips (C) Ans

3.75

2004

Consider the free body diagram of the truss.



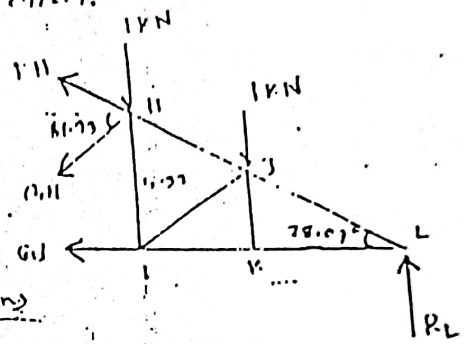
$\Sigma M_A = 0$

$\Rightarrow 6\times5 + 6\times10 + 6\times15 + 1\times20 + 1\times25 - R_L\times30 = 0$

$\Rightarrow 30R_L = 225$

$\Rightarrow R_L = 7.5$ kN.

Consider the right portion of x-x section.



$\Sigma M_L = 0$

$\Rightarrow 1\times5 + 1\times10 + G_{11}\times15\cos25.07 = 0$

$\Rightarrow 13.24\, G_{11} = -15$

$\Rightarrow G_{11} = -1.13$ $\quad \therefore G_{11} = 1.13$ kN (C) Ans

$\Sigma M_H = 0$

$\Rightarrow 1\times5 - R_L\times10 + G_1\times5.33 = 0$

$\Rightarrow 5.33\, G_1 = 70$

$\Rightarrow G_1 = 13.13$

$\therefore G_1 = 13.13$ kN (T)

Ans

$\Sigma F_y = 0$

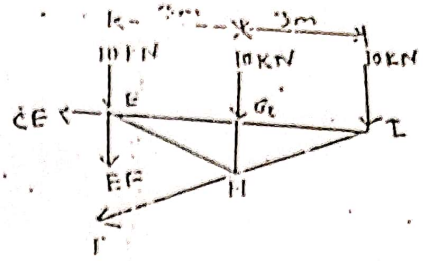
$\Rightarrow F_H\sin28.07 - G_{11}\sin61.93 - 1 - 1 + R_L = 0$

$\Rightarrow F_H = -13.81$

$\therefore F_H = 13.81$ kN (C)

Ans

379. Consider the below section.



$\Sigma M_J = 0$

$\Rightarrow -10 \times 3 - 10 \times 6 - EF \times 6 = 0$

$\Rightarrow EF = -15$

$\therefore EF = 15$ KN (C) Ans

Here, $GH = 5 \times \frac{3}{12} = \frac{5}{4}$

$\Sigma M_H = 0$

$\Rightarrow 10 \times 3 - 10 \times 3 - EF \times 3 - CE \times \frac{5}{4} = 0$

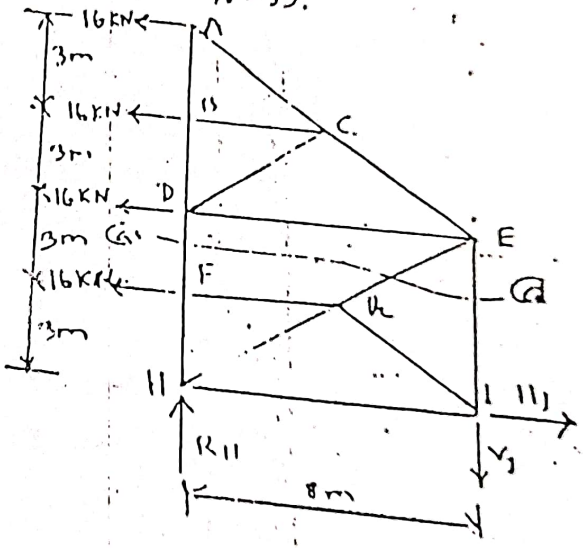
$\Rightarrow CE \times \frac{5}{4} = 9.5$

$\Rightarrow CE = 36$

$\therefore CE = 36$ KN (T) Ans

Solved by
Md. Shahadat Hossain
070010

380. Consider the free body diagram of the truss.



$\Sigma M_I = 0$

$\Rightarrow R_H \times 8 - 16 \times 3 - 16 \times 6 - 16 \times 9 - 16 \times 12 = 0$

$\Rightarrow 8 R_H = 480$

$\Rightarrow R_H = 60$ KN

$\Sigma F_y = 0$

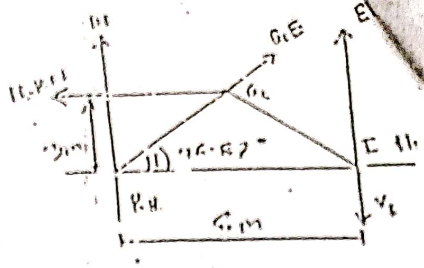
$\Rightarrow R_H - V_I = 0$

$\Rightarrow V_I = R_H = 60$ KN.

$\Sigma F_x = 0$

$\Rightarrow H_I - 16 - 16 - 16 - 16 = 0 \Rightarrow H_I = 64$ KN.

Consider the new portion of (a-a) section.



$\Sigma F_y = 0$

$\Rightarrow V_J \times 8 - 30 \times 8 - 16 \times 3 = 0$

$\Rightarrow F_{GE} \times EJ = 60 \times 8 - 16 \times 3$

$\Rightarrow EJ = 54 \quad \therefore EJ = 54\ KN$ (T) Ans

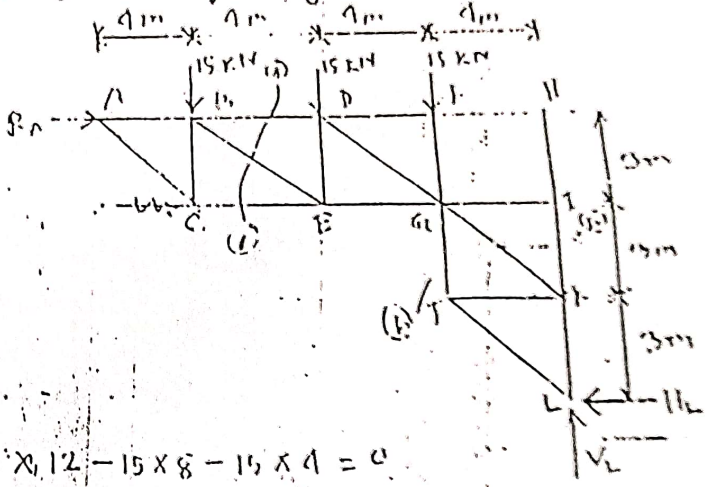
$\Sigma F_x = 0$

$\Rightarrow GE \cos 36.87° + HJ - 16 = 0$

$\Rightarrow GE \times 0.8 = 48 \quad \therefore GE = 60\ KN$ (C) Ans

381. Consider the free body diagram of the truss.

1993



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$\Sigma M_L = 0$

$\Rightarrow R_A \times 9 - 15 \times 12 - 15 \times 8 - 15 \times 4 = 0$

$\Rightarrow R_A = 40\ KN.$

$\Sigma F_x = 0$

$\Rightarrow R_A - H_L = 0$

$\Rightarrow H_L = 40\ KN$

$\Sigma F_y = 0$

$\Rightarrow V_L - 15 - 15 - 15 = 0$

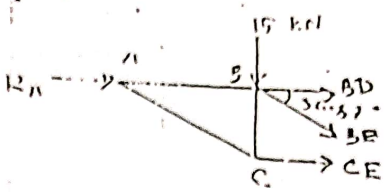
$\Rightarrow V_L = 45\ KN.$

Consider the left portion of (a-a) section.

$\Sigma M_B = 0$

$\Rightarrow CE \times 3 = 0$

$\Rightarrow CE = 0$ Ans



$\Sigma M_A = 0$

$\Rightarrow 15 \times 4 + BE \cos 36.87 \times 4 = 0$

$\Rightarrow BE = -25$ $\therefore BE = 25\,kN$ (C)

Ans

$\Sigma F_y = 0 \quad \Sigma F_x = 0$

$\Rightarrow R_A + BE \cos 36.87 + BD = 0$

$\Rightarrow BD = -20$

$\therefore BD = 20\,kN$ (C) Ans

Consider the lower portion of (b-b) section.

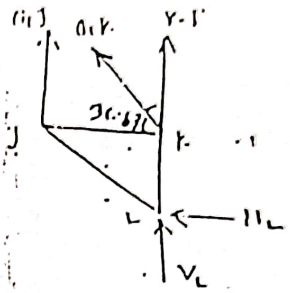
$\Sigma M_K = 0$

$\Rightarrow G_{IJ} \times 4 + H_L \times 3 = 0$

$\Rightarrow G_{IJ} = -\frac{40 \times 3}{4} = -30$

$\therefore G_{IJ} = 30\,kN$ (C)

Ans



$\Sigma F_x = 0$

$\Rightarrow -H_L - G_{IK} \cos 36.87 = 0$

$\Rightarrow G_{IK} = -50$

$\therefore G_{IK} = 50\,kN$ (C)

Ans

$\Sigma F_y = 0$

$\Rightarrow V_L + G_{IJ} + V_J + G_{IK} \sin 36.87 = 0$

$\Rightarrow V_J = 15\,kN$ (↑)

Ans

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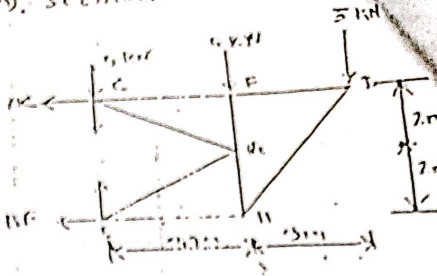
383. Consider the right portion of (a-a) section.

2003



$\Sigma M_C = 0$

$\Rightarrow 5 \times 3 + 6 \times 6 + BE \times 4 = 0$

$\Rightarrow BE = -11.25$

$\therefore BE = 11.25$ KN (C) Ans

$\Sigma F_x = 0$

$\Rightarrow -AC - BE = 0$

$\Rightarrow AC = -BE = 11.25$

$\therefore AC = 11.25$ KN (T) Ans

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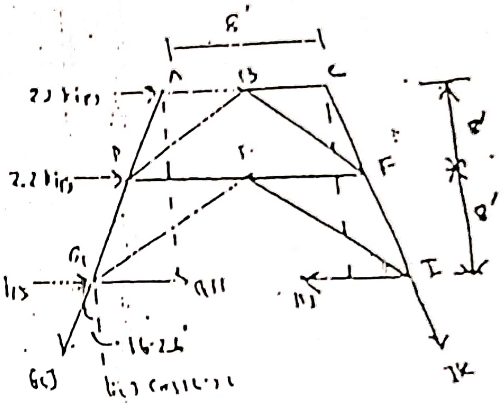
384. Consider the section (a-a) (using upper portion).



$\Sigma M_I = 0$

$\Rightarrow 22 \times 8 + 22 \times 16 - GJ \cos 16.26 \times 17.33 = 0$

$\Rightarrow GJ = 31.71$

$\therefore GJ = 31.71$ Kips (T)

Ans

$\Sigma M_I = 0$

$\Rightarrow 22 \times 8 - 22 \times 16 + GJ \times \cos 16.26 \times (8 + 16 \times 2 \cdot \tan 16.26) = 0$

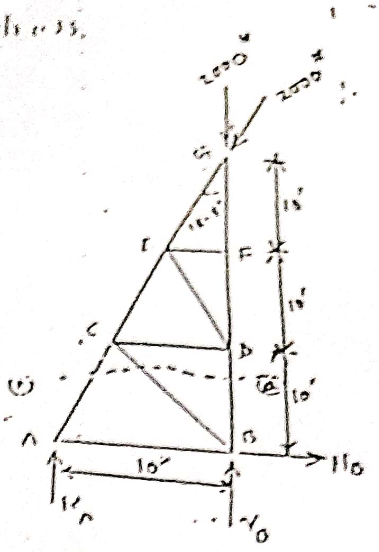
$\Rightarrow GJ \times 17.33 = 17.6$

$\Rightarrow GJ = 10.16 \Rightarrow GJ \times 16.64 = 17.6$

$\Rightarrow GJ = 10.58$ KN (T) Ans

$GJ = 8 + 2 \times 16 \cdot \tan 16.26$
$= 17.33$

3.87. Consider the free body diagram of the truss.



$\Sigma M_B = 0$

$\Rightarrow R_A \times 10 - 2000 \sin 18.44° \times 45 = 0$

$\Rightarrow R_A = 1896.87^{\#}$

$\Sigma F_x = 0$

$\Rightarrow H_B - 2000 \sin 18.44 = 0$

$\Rightarrow H_B = 632.62^{\#}$

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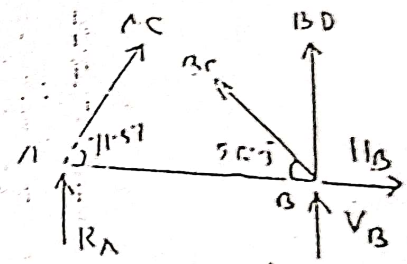
$\Sigma F_y = 0$

$\Rightarrow V_B + R_A - 2000 - 2000 \cos 18.44 = 0$

$\Rightarrow V_B = 2000$

Consider the lower portion of (a-a) section.



$\Sigma M_B = 0$

$\Rightarrow R_A \times 10 + AC \sin 71.57 \times 10 = 0$

$\Rightarrow AC = -1999.42 \simeq -2000$

$\therefore AC = 2000^{\#}$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow H_B - BC \cos 56.3° + AC \cos 71.57 = 0$

$\Rightarrow BC = ~~2279.16~~^{\#} = 0.50^{\#}$ (T) Ans

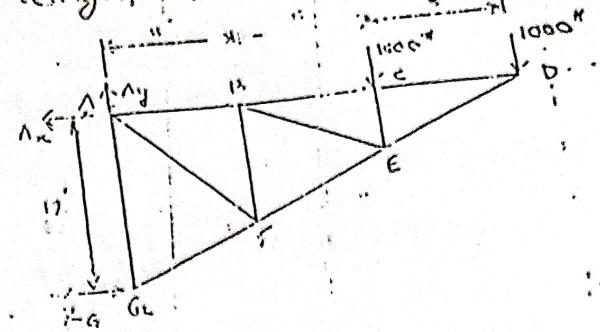
$\Sigma F_y = 0 \Rightarrow BD + AC \sin 71.57 + BC \sin 56.3 + R_A + V_B = 0$

$\Rightarrow BD = -2000$ $\therefore BD = 2000^{\#}$ (C) Ans

358.

2008

Consider the free body diagram of the truss.



Md. Shakadat Hossain
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$\Sigma M_A = 0$

$\Rightarrow 1000 \times 16 + 1000 \times 24 - R_{G_2} \times 12 = 0$

$\Rightarrow R_{G_2} = 3333.33$ lb

$\Sigma F_x = 0$

$\Rightarrow R_{G_2} - A_x = 0$

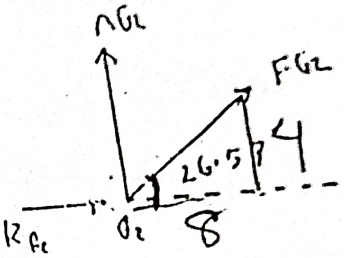
$\Rightarrow A_x = R_{G_2} = 3333.33$ lb

$\Sigma F_y = 0$

$\Rightarrow A_y - 1000 - 1000 = 0$

$\Rightarrow A_y = 2000$ lb

Consider the point G_2:



$\Sigma F_x = 0$

$\Rightarrow R_{G_2} + F_{G_2} \cos 26.57 = 0$

$\Rightarrow F_{G_2} = -3726.09$

$\therefore F_{G_2} = 3726.09$ lb (C) Ans

$\Sigma F_y = 0$

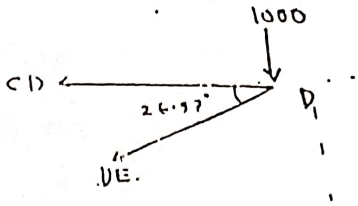
$\Rightarrow A_{G_2} - F_{G_2} \sin 26.57 = 0$

$\Rightarrow A_{G_2} = 1666$

$\therefore A_{G_2} = 1666$ lb (T) Ans

$\sin\theta =$

Consider the point - D :



$\Sigma F_y = 0$

$\Rightarrow -1000 - DE \sin 26.57° = 0$

$\Rightarrow DE = -2235.66\ lb = -2.24\ k.lb$

$\therefore DE = 2.24\ k.lb\ (C)$ Ans

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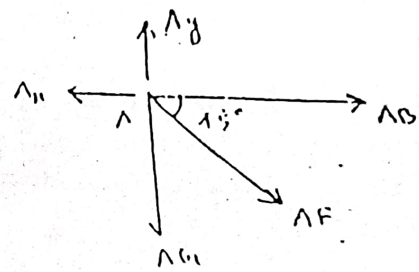
$\Sigma F_x = 0$

$\Rightarrow -CD - DE \cos 26.57° = 0$

$\Rightarrow CD = 2 \quad \therefore CD = 2\ k.lb\ (T)$ Ans

Consider the point A :



$\Sigma F_y = 0$

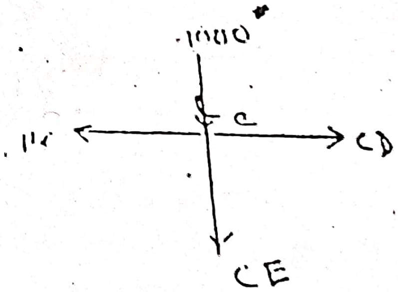
$\Rightarrow A_y - AG - AF \sin 45° = 0$

$\Rightarrow AF = 0.48\ k\ lb \quad \therefore AF = 0.48\ k\ lb\ (T)$ Ans

$\Sigma F_x = 0$

$\Rightarrow AB + AF \cos 45° - A_x = 0$

$\Rightarrow AB = 3 \quad \therefore AB = 3\ k.lb\ (T)$ Ans



Consider the point C :

$\Sigma F_x = 0$

$\Rightarrow CD - BC = 0$

$\Rightarrow BC = CD = 2\ k.lb\ (T)$ Ans

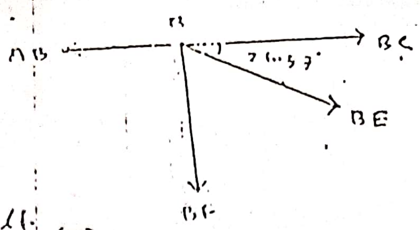
$\Sigma F_y = 0$

$\Rightarrow -1000 - CE = 0$

$\Rightarrow CE = -1000\ lb\ (C)$

$\therefore CE = 1\ k.lb\ (C)$ Ans

Consider the joint B :



$\Sigma F_x = 0$

$\Rightarrow BC - AB + BE \cos 26.57 = 0$

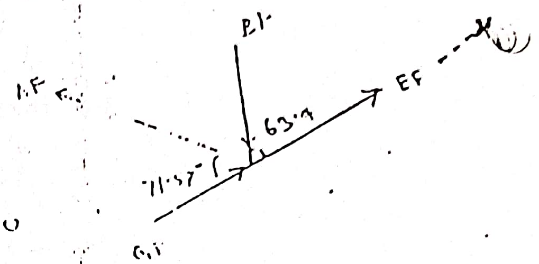
$\Rightarrow BE = 1.12$ $\therefore BE = 1.12$ KN (T) Ans

$\Sigma F_y = 0$

$\Rightarrow - BF - BE \sin 26.57 = 0$

$\Rightarrow BF = -0.5$ $\therefore BF = 0.5$ KN (C) Ans

Consider the joint F :



$\Sigma F_x = 0$

$\Rightarrow EF + GF - BF \cos 63.4 - AF \cos 71.57 = 0$

$\Rightarrow EF = 3.34$ KN

$\therefore$ EF = 3.34 KN (T) Ans

BE = 1192816

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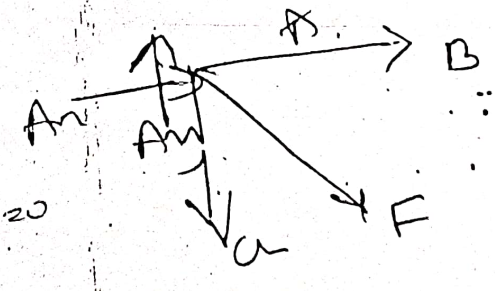
07601U



$-3333.33 + AB + 900.56 \times \frac{8}{19.92} = 0$

AB = -311.10

$\Sigma F_x = 0$

$Ax + AB + AF \cos\theta = 0$

$-3333.33 + AB + AF \times \frac{8}{19.92}$

$\Sigma F_y = 0$

$Ax + Ay - AF \sin\theta = 0$

$-3333.33 - AF \times \frac{12}{19.92} = 0$

$1666.66 + 2000 - AF \times \frac{12}{19.92}$

AF = 900.56

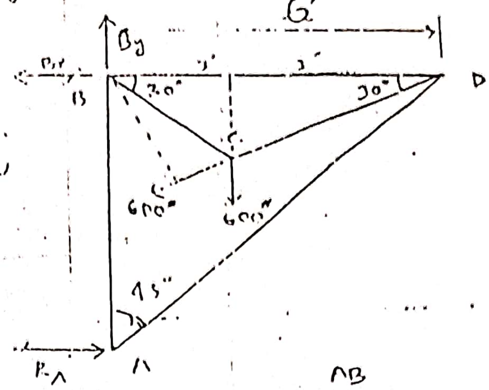
$\Sigma F_y = 0$

$Ay - AF \sin\theta$

$2000 - AF \times \frac{12}{19.92}$

AF = 2903.7

389. Consider the free body diagram of the truss.



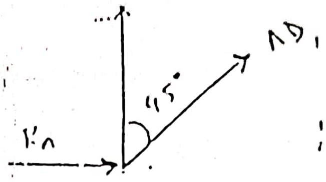
$\Sigma M_B = 0$

$\Rightarrow 600\times 3 + 600 \sin 30^\circ \times 6 - R_A \times 6 = 0$

$\Rightarrow R_A = 600^{\#}$

Md. Shahadul Hossain
070010

Consider the point A:

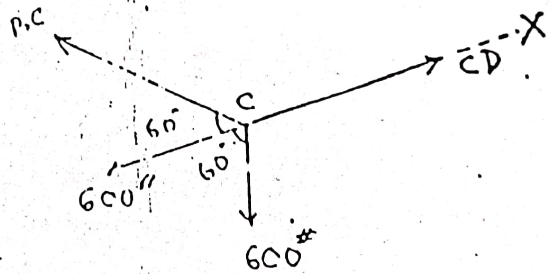


$\Sigma F_x = 0$

$\Rightarrow R_A + AD \sin 45^\circ = 0$

$\Rightarrow AD = -848.53$ ∴ $AD = 848.53$ lb (C) Ans

Consider the joint C:



$\Sigma F_y = 0$

$\Rightarrow BC \sin 60^\circ - 600 \sin 60^\circ = 0$

$\Rightarrow BC = 600^{\#}$ (T) Ans

$\Sigma F_x = 0$

$\Rightarrow CD - 600 - 600 \cos 60^\circ - BC \cos 60^\circ = 0$

$\Rightarrow CD = 1200^{\#}$ (T) Ans

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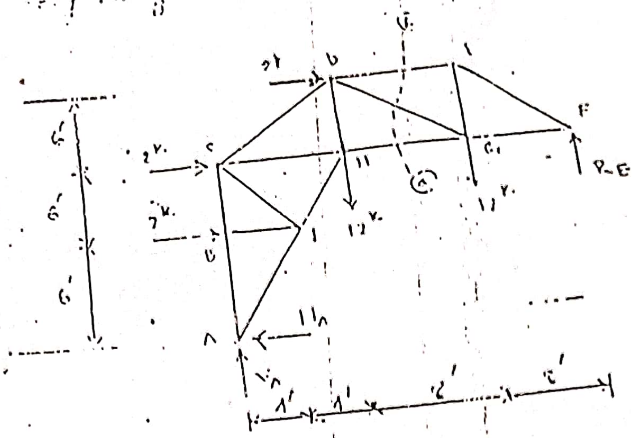
2006

Consider the free body diagram of the truss.



Md. Shahadat Hossain
0700010

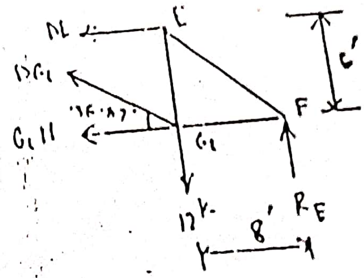
$\Sigma M_A = 0$

$\Rightarrow 2 \times 6 + 2 \times 12 + 2 \times 18 + 12 \times 8 + 12 \times 16 - R_E \times 24 = 0$

$\Rightarrow 24 R_E = 360$

$\Rightarrow R_E = 15$

Consider the right portion of section (a-a).



$\Sigma M_G = 0$

$\Rightarrow -DE \times 6 - R_E \times 8 = 0$

$\Rightarrow DE = -20 \quad \therefore DE = 20^k$ (C) Ans

$\Sigma F_y = 0$

$\Rightarrow R_E - 12 + DG \sin 36.87° = 0$

$\Rightarrow DG = -5$

$\therefore DG = 5^k$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow -DE - GH - DG \cos 36.87° = 0$

$\Rightarrow GH = 24$

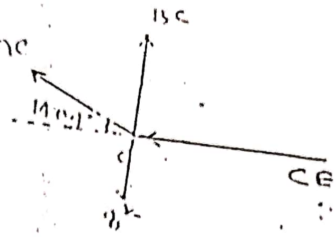
$\therefore GH = 24^k$ (T) Ans

Consider the joint C:

$\Sigma F_x = 0$

$\Rightarrow AC \cos 14.04 + CE = 0$

$\Rightarrow AC = -12.37 \quad \therefore AC = 12.37^k (C)$ Ans



$\Sigma F_y = 0$

$\Rightarrow BC + AC \sin 14.04 - 8 = 0$

$\Rightarrow BC = 11 \quad \therefore BC = 11^k (T)$ Ans

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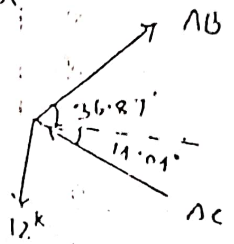
Consider the joint A:



$\Sigma F_x = 0$

$\Rightarrow AB \cos 36.87° - AC \cos 14.04 = 0$

$\Rightarrow AB = 15 \quad \therefore AB = 15^k (T)$ Ans

103. Consider the free body diagram of the truss:

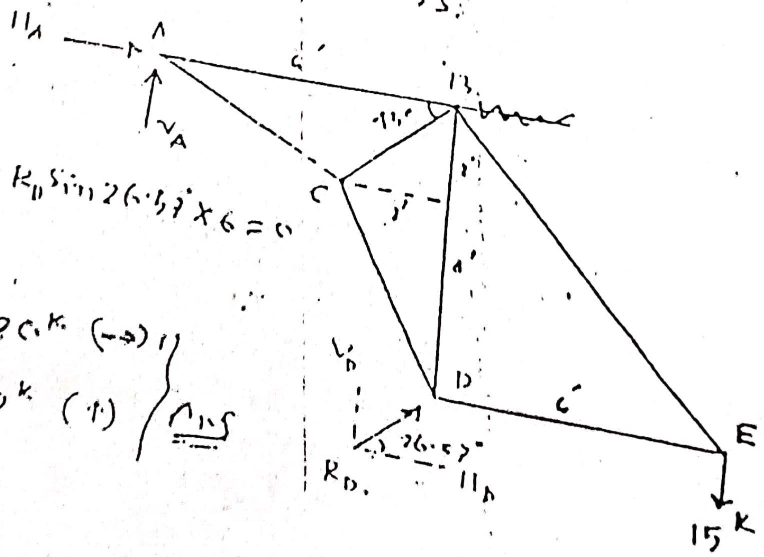
$\Sigma M_A = 0$

$\Rightarrow 15 \times 12 - R_D \cos 26.57° \times 6 - R_D \sin 26.57° \times 6 = 0$

$\Rightarrow R_D = 22.36\ k$

$\therefore H_D = 22.36 \cos 26.57° = 20^k (\rightarrow)$

$V_D = 22.36 \sin 26.57° = 10^k (\uparrow)$ Ans



$\Sigma F_x = 0$ | $\Sigma F_y = 0$

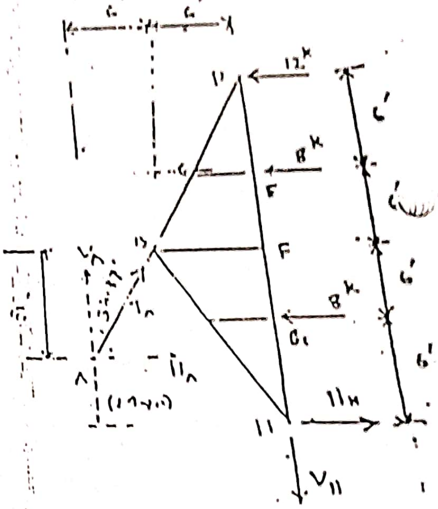
$\Rightarrow H_A + H_B = 0$ | $\Rightarrow V_A + V_B \ldots$

$\Rightarrow H_A = -H_B = -20$ | $\Rightarrow V_A = 5$

$\therefore H_A = 20^k$ (←) Ans | $\therefore V_A = 5^k$ (↑) Ans

394 : Consider the free body diagram of the truss.

390



$\Sigma M_H = 0$

$\Rightarrow T_A \cos 36.87^\circ \times 12 + T_A \sin 36.87^\circ \times 4 - 8\times 6 - 8\times 18 - 12\times 24 = 0$

$\Rightarrow 12\, T_A = 480$

$\Rightarrow T_A = 40^k$

$\therefore H_A = 40 \sin 36.87^\circ = 24^k$ (←)
$V_A = 40 \cos 36.87^\circ = 32^k$ (↑) Ans

$\Sigma F_x = 0$

$\Rightarrow H_A + H_H - 8 - 8 - 12 = 0$

$\Rightarrow H_H = 4^k$ (→) Ans

$\Sigma F_y = 0$

$\Rightarrow V_A - V_H = 0$

$\Rightarrow V_H = V_A = 32^k$ $\quad\therefore V_H = 32^k$ (↓) Ans

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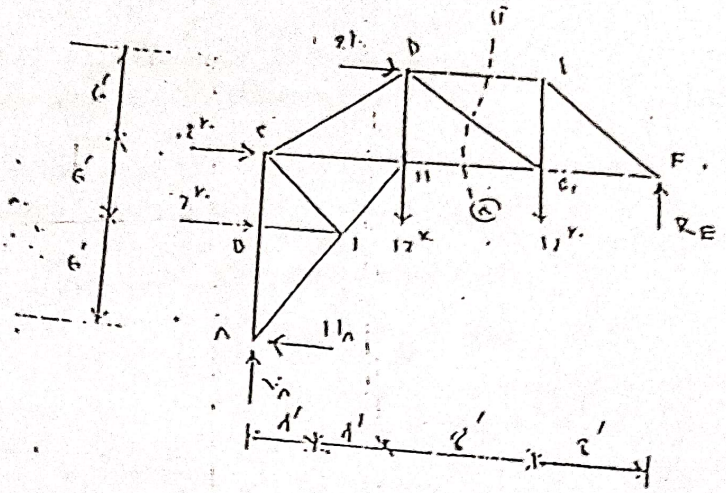
306.

Consider the free body diagram of the truss.



Md. Shahadat Hossain
C170210

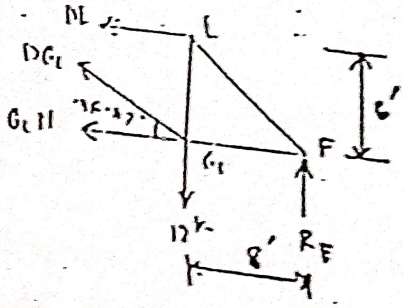
$\Sigma M_A = 0$

$\Rightarrow 2\times 6 + 2\times 12 + 2\times 18 + 12\times 8 + 12\times 16 - R_E \times 24 = 0$

$\Rightarrow 24 R_E = 360$

$\Rightarrow R_E = 15$ ∴

Consider the right portion of section (a-a).



$\Sigma M_G = 0$

$\Rightarrow -DE \times 6 - R_E \times 8 = 0$

$\Rightarrow DE = -20$ ∴ $DE = 20^K$ (C) Ans

$\Sigma F_y = 0$

$\Rightarrow R_E - 12 + DG_1 \sin 36.87^\circ = 0$

$\Rightarrow DG_1 = -5$

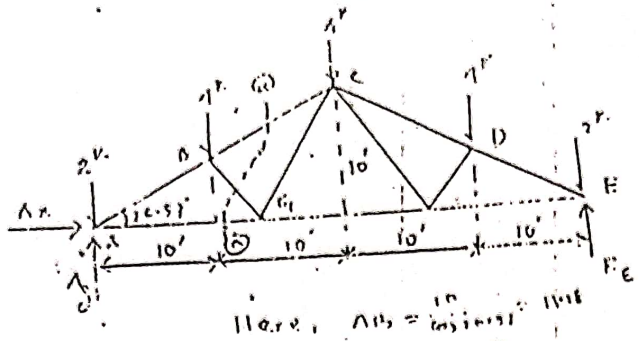
∴ $DG_1 = 5^K$ (C) Ans

$\Sigma F_x = 0$

$\Rightarrow -DE - GH - DG_1 \cos 36.87^\circ = 0$

$\Rightarrow GH = 24$

∴ $GH = 24^K$ (T) Ans



Here, $AB = \frac{10}{\cos 26.57^\circ} = 11.18'$

$AG_1 = 11.5'$

$\Sigma M_E = 0$

$\Rightarrow A_y \times 40 - 2\times40 - 4\times30 - 4\times20 - 4\times10 = 0$

$\Rightarrow 40 A_y = 320$

$\Rightarrow A_y = 8^K$

$\Sigma F_x = 0$

$\Rightarrow A_x = 0$

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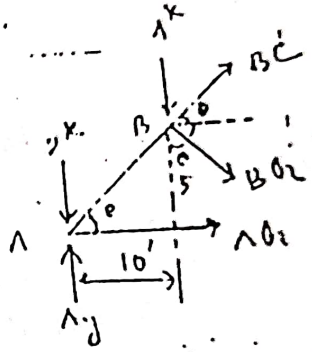
Consider the left portion of (a-a) section.



$\Sigma M_B = 0$

$\Rightarrow 4\times10 + BG_2 \times 11.18 = 0$

$\Rightarrow BG_2 = -3.58$ $\therefore BG_2 = 3.58^K$ (C) Ans

$\Sigma M_G = 0$

$\Rightarrow A_y \times 10 - 2\times10 - AG_2 \times 5 = 0$

$\Rightarrow AG_2 = 12$ $\therefore AG_2 = 12^K$ (T) Ans

$\Sigma F_x = 0 \Rightarrow AG_2 + BC\cos 26.57 + BG_2 \sin 26.57 = 0$

$\Rightarrow ABC = -11.63$ $\therefore BC = 11.63^K$ (C) Ans

3.08. Consider the free body diagram of the truss.

Here,

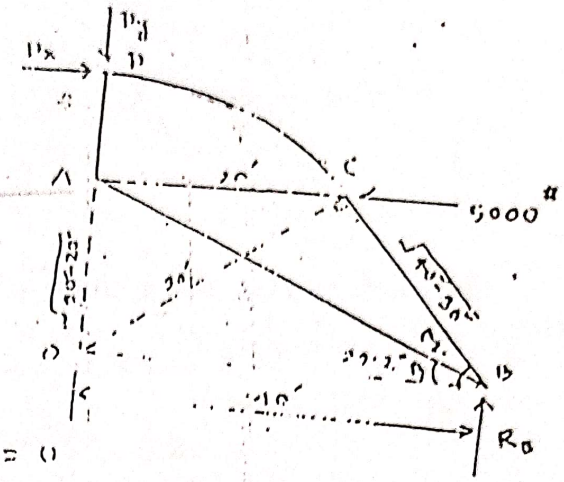
$\theta = \sin$

$\theta_1 = \tan^{-1}\left(\frac{22.30}{40}\right)$

$= 29.21°$

$\theta_2 = \sin^{-1}\left(\frac{30}{40}\right)$

$= 48.59°$

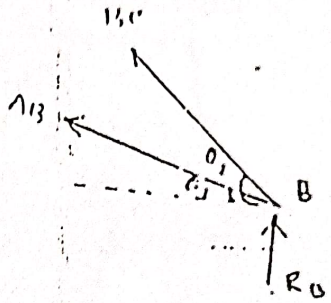


$\Sigma M_D = 0$

$\Rightarrow 5000 \times (30 + 30\sin 20°) - R_B \times 40 = 0$

$\Rightarrow R_B = 955^{\#}$

Consider the joint B:



$\Sigma F_x = 0$

$\Rightarrow -AB\cos 29.21 - BC\cos 48.59 = 0$

$\Rightarrow AB = -0.758\, BC$ ... (1)

$\Sigma F_y = 0$

$\Rightarrow R_B + AB\sin 29.21 + BC\sin 48.59 = 0$

$\Rightarrow 0.38\, BC = 955$

$\Rightarrow BC = 2513.16^{\#}$ (T) Ans

from eqn (1), $AB = -1905$

$\therefore AB = 1905^{\#}$ (C) Ans

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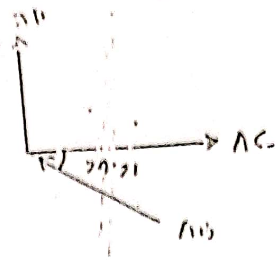
Consider the joint A:



$\Sigma F_y = 0$

$\Rightarrow AD + AB \sin 29.21 = 0$

$\Rightarrow AD = -929.66$

$\therefore AD = 929.66\#$ (C). Ans

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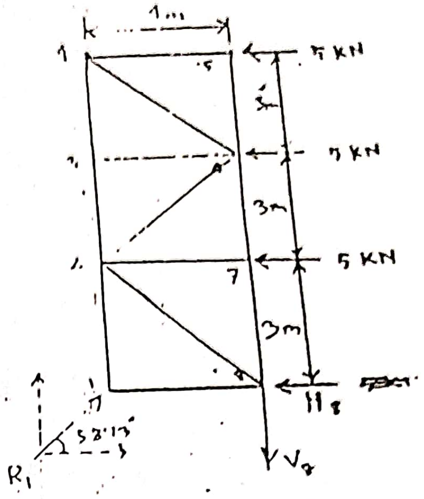
$\Sigma F_x = 0$

$\Rightarrow AC - AB \cos 29.21 = 0$

$\Rightarrow AC = 1662.75$ $\therefore AC = 1662.75''$ (T) Ans.

35: Consider the free body diagram of the truss.



$\Sigma M_1 = 0$

$\Rightarrow V_8 \times 4 - 5 \times 3 - 5 \times 6 - 5 \times 9 = 0$

$\Rightarrow V_8 = 22.5$ KN ($\downarrow$)

$\Sigma F_y = 0$

$\Rightarrow R_1 \sin 53.13° - V_8 = 0$

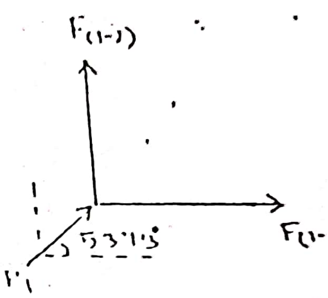
$\Rightarrow R_1 = 28.125$ KN.

$\Sigma F_x = 0$.

$\Rightarrow R_1 \cos 53.13° - H_8 - 5 - 5 - 5 = 0$

$\Rightarrow H_8 = 1.875$ KN.

Consider the joint - 1 :



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$\Sigma F_x = 0$

$\Rightarrow R_1 \cos 53.13° + F_{(1-8)} = 0$

$\Rightarrow F_{(1-8)} = -16.88$ $\therefore F_{(1-8)} = 16.88$ KN (C) Ans.

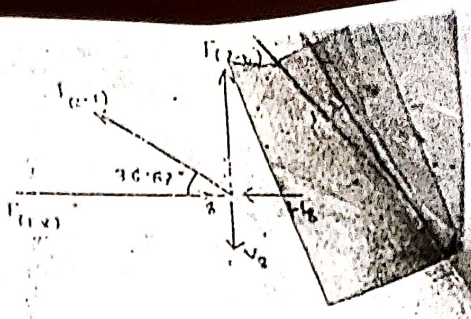
$\Sigma F_y = 0$.

$\Rightarrow R_1 \sin 53.13° + F_{(1-2)} = 0$

$\Rightarrow F_{(1-2)} = -22.5$ $\therefore F_{(1-2)} = 22.5$ KN (C)

Ans

Consider the joint - 1 :



$\Sigma F_x = 0$

$\Rightarrow F_{(1-8)} - H_8 - F_{(2-8)} \cos 36.87° = 0$

$\Rightarrow F_{(2-8)} = 18.75 \text{ KN}$ (T) Ans

$\Sigma F_y = 0$

$\Rightarrow F_{(2-8)} + F_{(2-8)} \sin 36.87° - V_8 = 0$

$\Rightarrow F_{(2-8)} = 11.24 \text{ KN}$ (T) Ans

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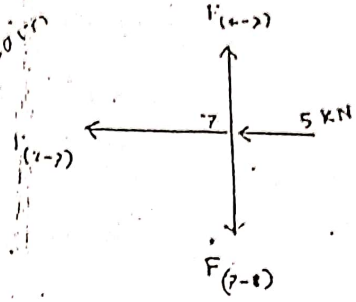
Consider the joint-7 :



$\Sigma F_y = 0$

$\Rightarrow F_{(6-7)} - F_{(7-8)} = 0$

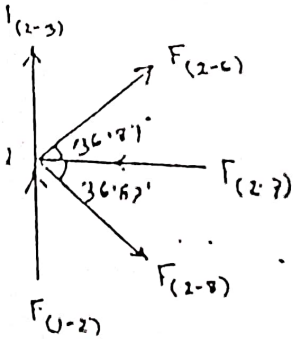
$\Rightarrow F_{(6-7)} = F_{(7-8)} = 11.24 \text{ KN}$ (T) Ans

$\Sigma F_x = 0$

$\Rightarrow -F_{(7-7)} - 5 = 0$

$\Rightarrow F_{(7-7)} = -5 \quad \therefore F_{(7-7)} = 5 \text{ KN}$ (C) Ans

Consider the joint - 2 :



$\Sigma F_x = 0$

$\Rightarrow -F_{(2-7)} - F_{(2-6)} \cos 36.87° - F_{(2-8)} \cos 36.87° = 0$

$\Rightarrow F_{(2-6)} = -12.5$

$\therefore F_{(2-6)} = 12.5 \text{ KN}$ (C) Ans