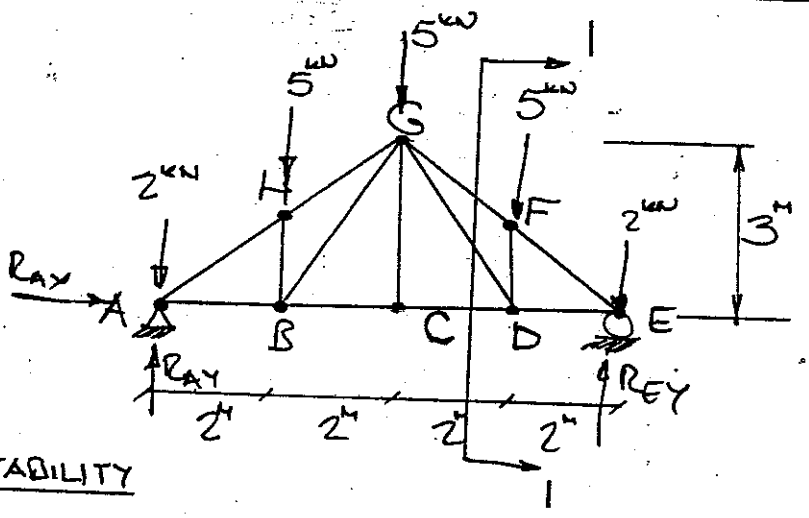
PROBLEM # 6-42



(1.) DETERMINANCY & STABILITY

3 EXTERNAL REACTIONS = # GLOBAL EQUILIBRIUM EQUATIONS

1 REACTION IN X

1+1 REACTIONS IN Y

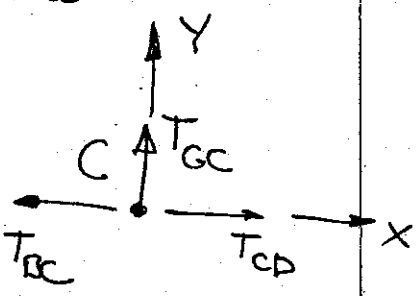
REACTIONS / MEMBERS / JOINTS

$3 + 13 = 16 = 2 * 8$

⟶ STRUCTURE DETERMINATE & STABLE

(2.) FORCE IN MEMBER GC

JOINT METHOD W/ FBD AT C



$\Sigma F_Y = 0 \longrightarrow \underline{T_{GC} = 0}$

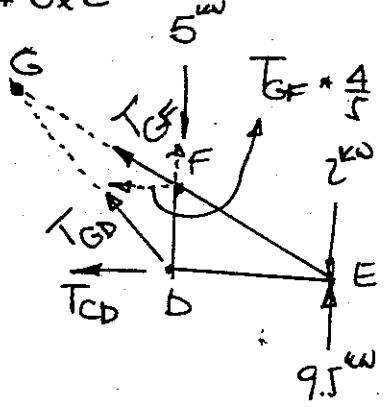
(3.) FORCES IN MEMBERS GF & CD

LET US FIND R_{EY} FIRST

$\Sigma M_A = 0 \longrightarrow 8R_{EY} = 8\times2 + 6\times5 + 4\times5 + 2\times5 + 0\times2$

$\underline{R_{EY} = 9.5^{KN}\uparrow}$

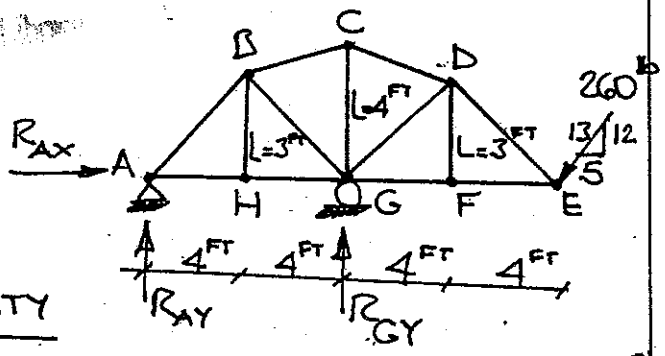
SECTION METHOD: CUT I–I, TAKE FDE



$\Sigma M_G = 0,\ 3T_{CD} = 7.5 * 4 - 10,\ \underline{T_{CD} = 6.67^{KN}\ (T)}$ (5×2)

$\Sigma M_D = 0,\ \left(T_{GF} * \frac{4}{5}\right) * 1.5 = 2 * 7.5 \qquad \underline{T_{GF} = 12.5^{KN}\ (C)}$

PROBLEM 6.46



(1-) DETERMINANCY & STABILITY

3 EXTERNAL REACTIONS = # GLOBAL EQUATIONS

1 IN X DIRECTION
2 IN Y DIRECTION

REACTIONS, MEMBERS, JOINTS

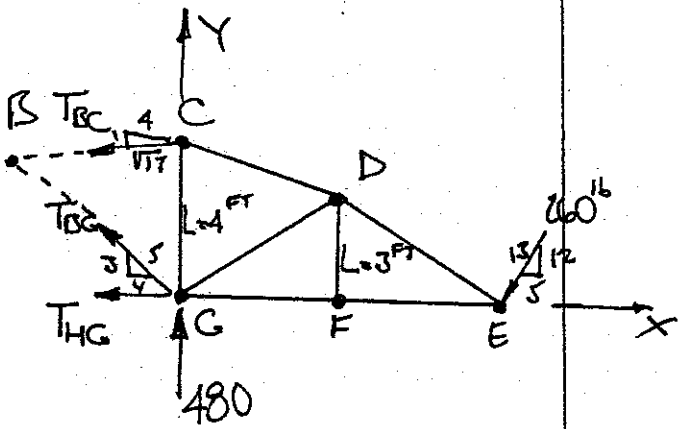
$3 + 13 = 2 \times 8 = 16$

⟶ STRUCTURE DETERMINATE & STABLE

(2-) REACTION R_{GY}:

$\Sigma M_A = 0, \quad 8R_{GY} = 16\left(260 * \frac{12}{13}\right) \longrightarrow \underline{R_{GY} = 480^{lb} \uparrow}$

(3-) MEMBERS BC, BG, HG



$\Sigma M_C = 0, \quad \left(T_{BC} * \frac{4}{\sqrt{17}}\right)^{lb} * 4^{FT} = \left(260 * \frac{12}{13}\right)^{lb} * 8^{FT}$

$\underline{T_{BC} = 494.8^{lb}\,(T)}$

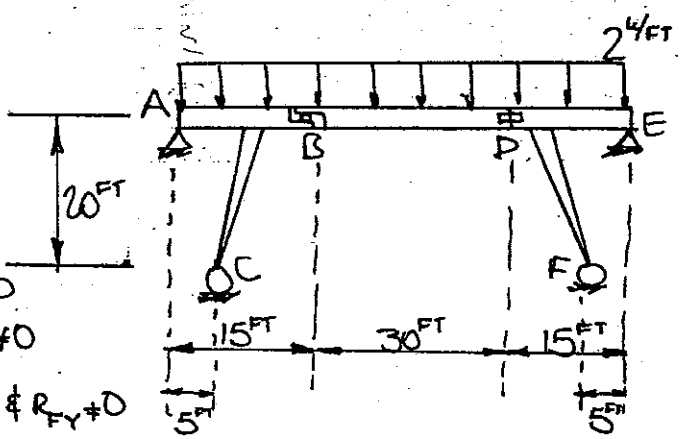
$\Sigma F_Y = 0, \quad \left(T_{BG} * \frac{3}{5}\right) = \left(T_{BC} * \frac{1}{\sqrt{17}}\right)$

$\underline{T_{BG} = 200^{lb}\,(T)}$

$\Sigma M_B = 0, \quad T_{HG}^{lb}(3)^{FT} + \left(260 * \frac{12}{13}\right)^{lb} * 12 + \left(260 * \frac{5}{13}\right)^{lb} * 3^{FT} = 480^{lb} * 4^{FT}$

$\underline{T_{HG} = -420^{lb} = 420^{lb}\,(C)}$

PROBLEM 6-78

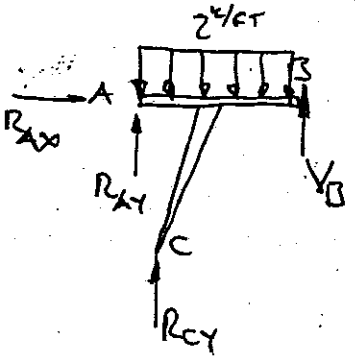


PINNED AT A, D, E → $R_{AX} \neq 0$, $R_{AY} \neq 0$, $P_D \neq 0$ & $V_D \neq 0$, $R_{EX} \neq 0$ & $R_{EY} \neq 0$

ROCKER SUPPORT AT C & F $\xrightarrow{\text{ONLY}}$ $R_{CY} \neq 0$ & $R_{FY} \neq 0$

ROLLER AT B → ONLY $V_B \neq 0$ & $P_B = 0$

CONSIDER SUBSYSTEM ABC:



$\Sigma F_x = 0 \rightarrow R_{AX} = 0$

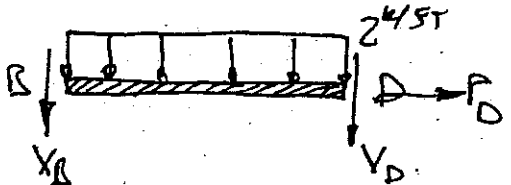
$\Sigma M_A = 0 \rightarrow 5R_{CY} + 15V_B - 2\left(\frac{15^2}{2}\right) = 0$

$R_{CY} = -3V_B + 45$ ①

$\Sigma F_y = 0 \rightarrow R_{AY} = 2 \cdot 15 - R_{CY} - V_B$

$R_{AY} = 30 - R_{CY} - V_B = 30 + 2V_B - 45 = -15 + 2V_B = R_{AY}$ ②

CONSIDER SUBSYSTEM BD:



$\Sigma M_D = 0$, $30V_B = 2 \cdot \frac{30^2}{2}$ $V_B = 30^K$

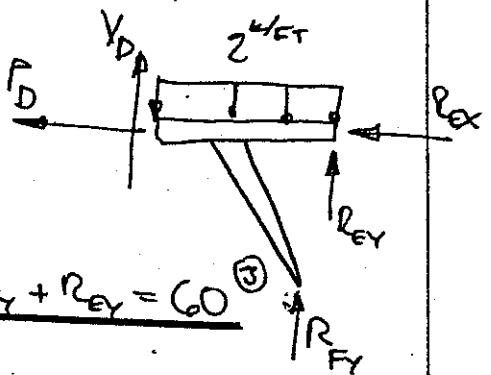
① → $R_{CY} = 135^K$ ↑

② $R_{AY} = -75 = 75^K$ ↓

$\Sigma F_y = 0$ $V_D = V_B = -30^K$

$\Sigma F_x = 0$ $P_D = 0$

CONSIDER SUBSYSTEM DEF:



$\Sigma F_x = 0$, $R_{EX} = P_D = 0 = R_{EX}$

$\Sigma F_y = 0$, $V_D + R_{FY} + R_{EY} = 2 \cdot 15 = 30 \Rightarrow R_{FY} + R_{EY} = 60$ ③

$\Sigma M_E = 0$, $15V_D + \left(-2 \cdot \frac{15^2}{2}\right) + 5R_{FY} = 0$

$R_{FY} = 135^K$ ↑

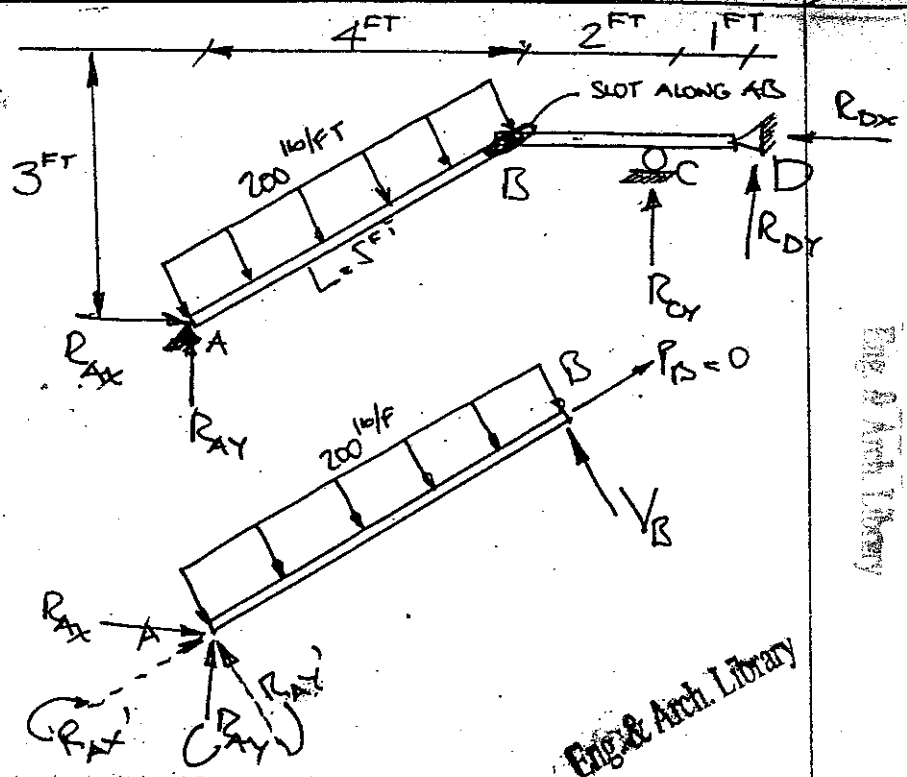
③ → $R_{EY} = 75^K$ ↑

} CHECKS W/ SYMMETRY

PROBLEM 6-91

SLOT ALONG AB →

$P_B = 0$



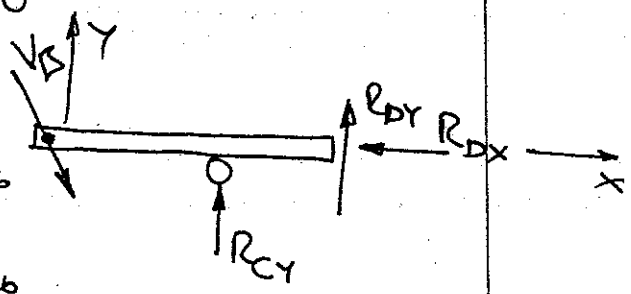
CONSIDER SUBSYSTEM AB:

$\Sigma M_B = 0, \quad (200)\left(\frac{5}{2}\right) = 5R_{AY}' \qquad \underline{R_{AY}' = 500^{lb}}$

$\Sigma F_X' = 0 \rightarrow \qquad R_{AX}' = P_B = 0, \quad \underline{R_{AX}' = 0}$

$\Sigma F_Y' = 0 \rightarrow \qquad V_B + 200 * 5 - 500 = 0$

CONSIDER SUBSYSTEM BCD:



$V_B = \left(200^{lb/FT} * 5\right) - 500, \quad V_B = 500^{lb}$

$\Sigma F_X = 0 \rightarrow \qquad V_B * \frac{3}{5} = \underline{R_{DX} = 300^{lb} \leftarrow}$

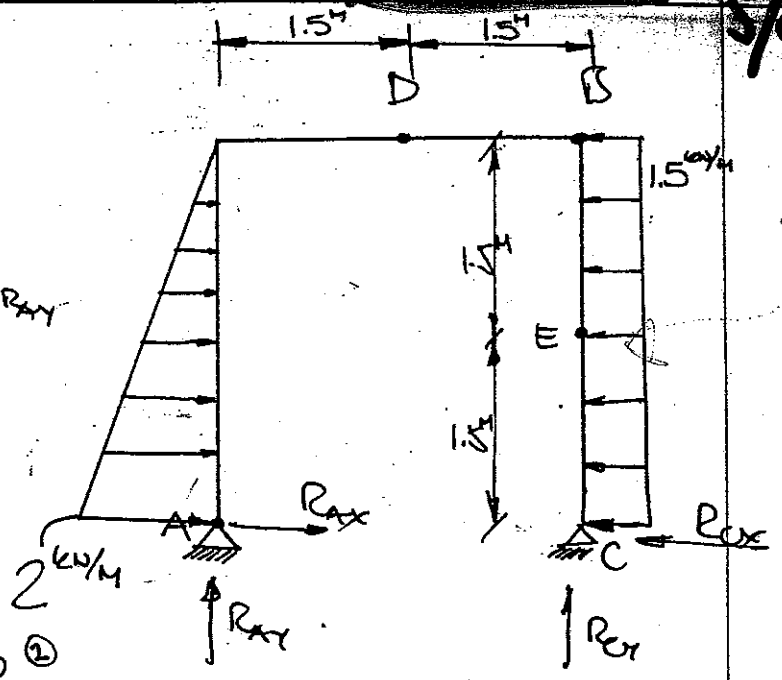
$\Sigma M_B = 0 \rightarrow \qquad 2R_{CY} + 3R_{DY} = 0$

$\Sigma F_Y = 0 \rightarrow \qquad \frac{4}{5}V_B = R_{CY} + R_{DY} = (-1.5 + 1)R_{DY}$

$R_{DY} = -\frac{8}{5}V_B = -800 = \underline{800^{lb} \downarrow = R_{DY}}$

$\underline{1200^{lb} \uparrow = R_{CY}}$

PROBLEM 7-18



PIN AT B $\longrightarrow M_B = 0$

$\Sigma M_B = 0$, $3R_{AX} + 2 \times \frac{3}{2} \times \frac{2}{3}(3) = 3R_{AY}$

$R_{AY} = (3R_{AX} + 6)/3$.

$R_{AY} = R_{AX} + 2$ ①

$\Sigma F_Y = 0 \longrightarrow R_{AY} + R_{CY} = 0$ ②

$\Sigma M_B = 0 \longrightarrow 3R_{CX} + \frac{3}{2} \times 1.5 = 0$

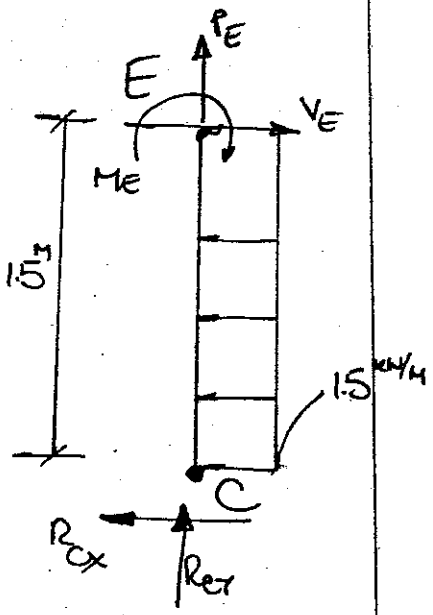
$R_{CX} = -2.25^{kN} \Rightarrow \underline{R_{CX} = 2.25^{kN} \longrightarrow}$

$\Sigma F_X = 0 \longrightarrow R_{AX} + 2 \times \frac{3}{2} = R_{CX} + 1.5 \times 3$

$R_{AX} = -2.25 + 4.5 - 3 = -0.75 \Rightarrow \underline{R_{AX} = 0.75 \longleftarrow}$

INTERNAL FORCES AT E

① $\underline{R_{AY} = 1.25^{kN} \uparrow}$ ② $\underline{R_{CY} = -2.75 = 2.75^{kN} \downarrow}$



$\Sigma F_X = 0$, $V_E = (1.5)(1.5) + R_{CX} = 2.25 + R_{CX} = 0$

$\underline{V_E = 0}$

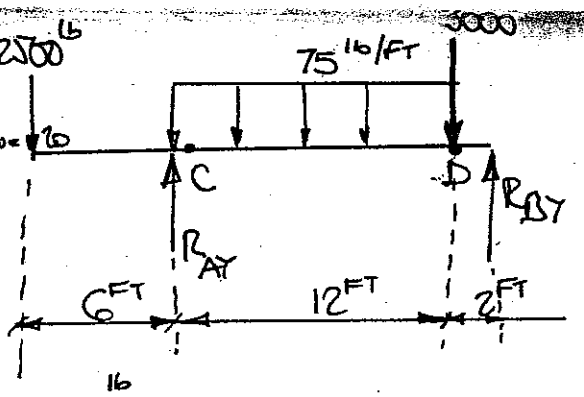
$\Sigma F_Y = 0$ $P_E + R_{CY} = 0$, $\underline{P_E = 1.25 \ (T.)}$

$\Sigma M_E = 0$ $M_E = -\left(R_{CX} \times 1.5 + 1.5 \times \frac{1.5^2}{2}\right)$

$= 1.6875$

$\underline{M_E \approx 1.69^{kN\text{-}M}}$ ↻

PROBLEM 7-23

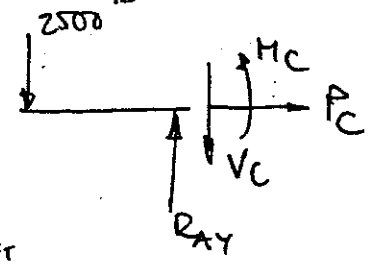


$\Sigma M_B = 0$, $14R_{AY} = 2 \times 3000 + 12 \times 75(6+2) + 2500 \times 20$

$R_{AY} = 4514.3^{lb}\uparrow$

$\Sigma F_Y = 0$, $R_{BY} = 1885.7^{lb}\uparrow$

INTERNAL FORCES AT C:



$\Sigma F_X = 0$ $\quad P_C = 0$

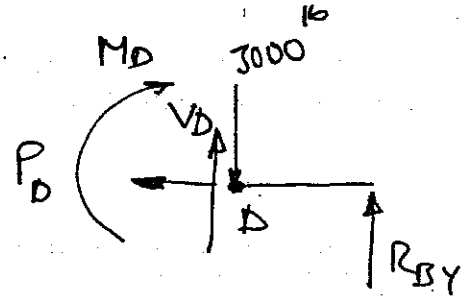
$\Sigma F_Y = 0$ $\quad V_C = 4514.29 - 2500$

$V_C = 2014^{lb}\downarrow$ OR $\uparrow$

$\Sigma M_C = 0$ $\quad M_C = -2500 \times 6 = -15000^{lb\text{-}FT}$

$M_C = 15000^{lb\text{-}FT}\circlearrowright$ OR $\circlearrowleft$

INTERNAL FORCES AT D:



$\Sigma F_X = 0$ $\quad P_D = 0$

$\Sigma M_Y = 0$ $\quad V_D + R_{BY} = 3000$, $V_D = 1114.3^{lb}\uparrow$ OR $\uparrow$

$\Sigma M_D = 0$ $\quad M_D + 2R_{BY} = 0$, $M_D = 3771.4^{lb\text{-}FT}\circlearrowleft$ OR $\circlearrowright$

PROBLEM 7-81: PIN @ B & E

FBD AGB:

$\Sigma M_B = 0,\ 5R_{AY} = 30 - 8$

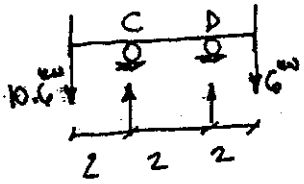
$R_{AY} = 4.4^{KN}\uparrow$

FBD EF:

$\Sigma M_E = 0,\ 4R_{FY} = 3 \cdot 4^2/2$

$R_{FY} = 6^{KN}\uparrow$

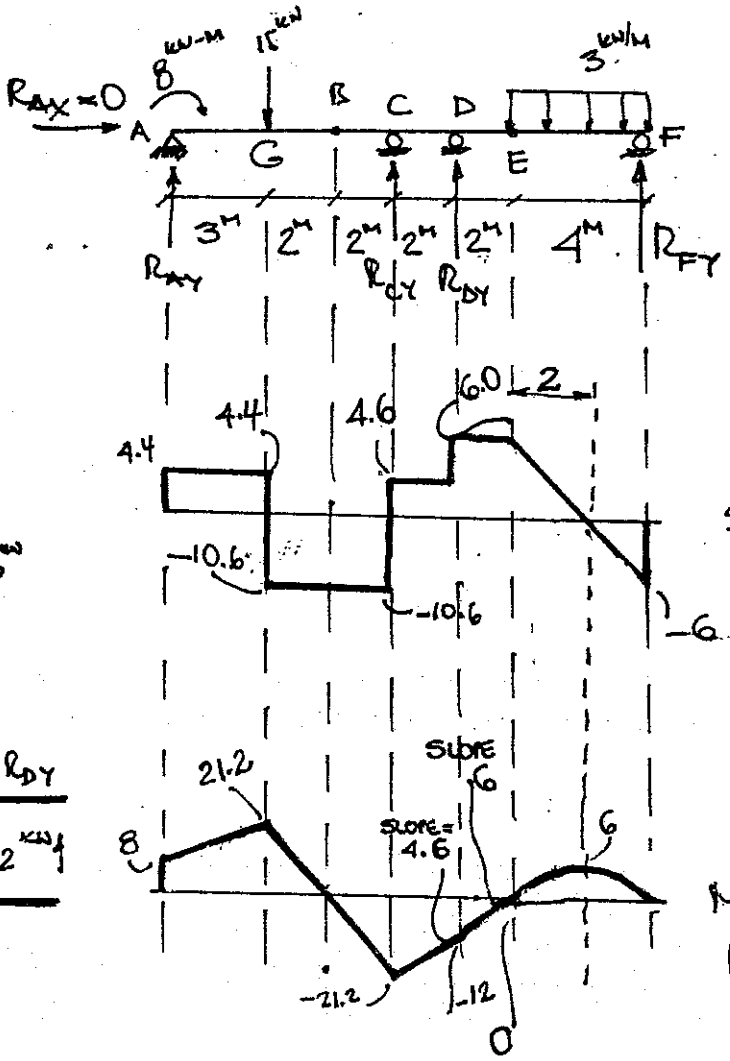
FBD BCDE:



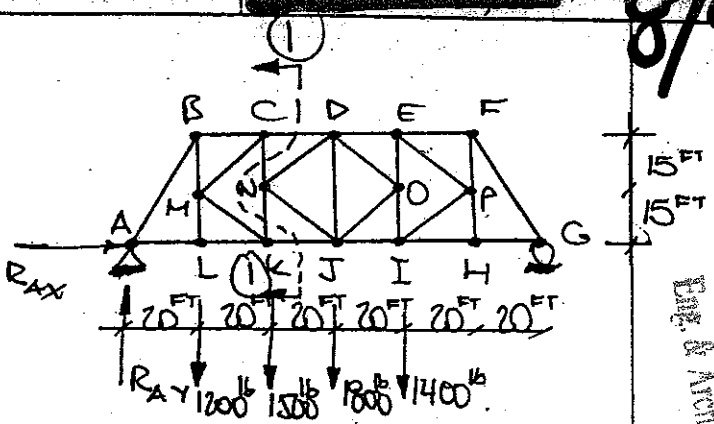
$\Sigma M_C = 0,\ 21.2 = 2R_{DY} + 24$

$R_{DY} = +1.4 = 1.4^{KN}\uparrow = R_{DY}$

$\Sigma F_Y = 0,\ 16.6 - 1.4 = R_{CY} = 15.2^{KN}\uparrow$



PROBLEM 6-54:



(1.) DETERMINANCY & STABILITY

3 EXTERNAL REACTIONS = # GLOBAL EQUATIONS

1 REACTION IN X-DIRECTION
2 REACTION IN Y-DIRECTION

$3 + 29 = 2 \times 16 = 32$ OK (REACTIONS, MEMBERS, JOINTS)

DETERMINATE & STABLE

(2.) TAKE CUT 1-1 AS SHOWN

GLOBAL SYSTEM: $\Sigma F_x = 0 \rightarrow R_{AX} = 0$

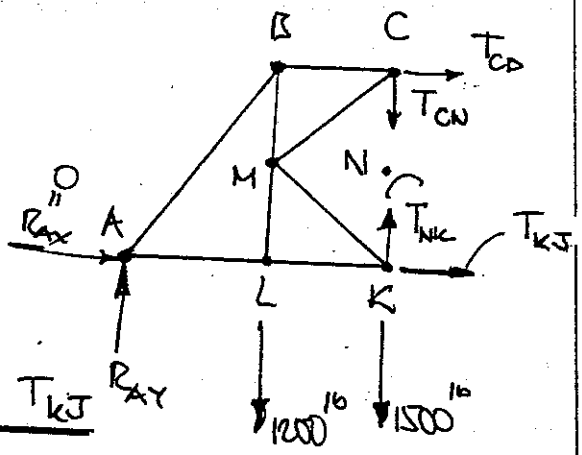
$\Sigma M_G = 0 \rightarrow R_{AY}(6 \times 20) = 1200(100) + 1500(80) + 1800(60) + 1400(40) \Rightarrow$

$R_{AY} = 3366.67^{lb}$

$\Sigma M_K = 0,\ 30 T_{CD} + 40 R_{AY} = 1200^{lb}(20)^{FT}$

$T_{CD} = -3688.9^{lb}$

$T_{CD} = 3.69^{KIP}\ (C)$

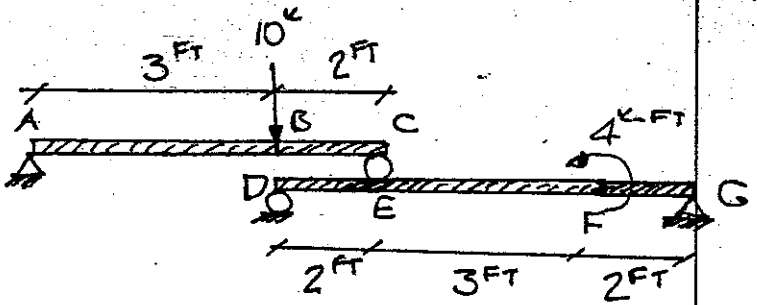


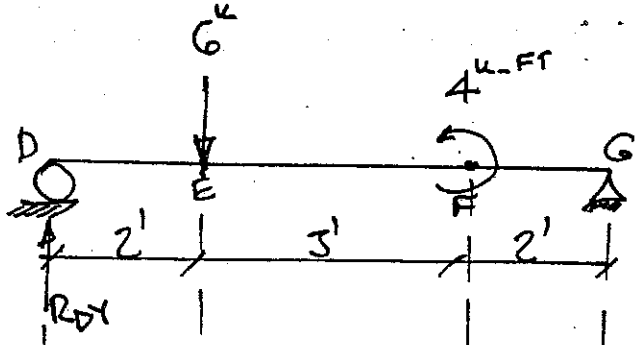
$\Sigma M_C = 0$ OR SIMPLY $\Sigma F_x = 0$

$T_{CD} + T_{KJ} = 0$

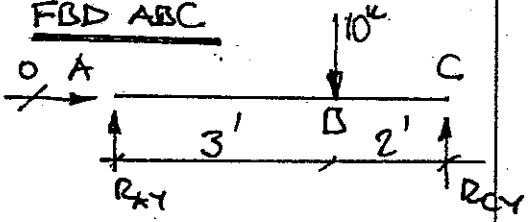
$T_{KJ} = -T_{CD} = 3688.9^{lb}\ (T) = T_{KJ}$

PROBLEM # 7-118





FBD ABC



$\Sigma M_A = 0, \quad 5R_{CY} = 3 \times 10^{K-FT}$

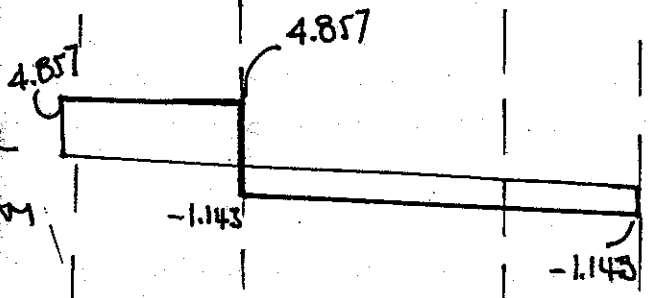
$R_{CY} = 6^{K} \uparrow$

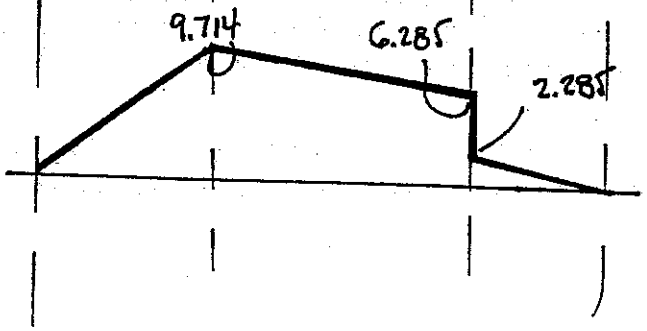
FBD DEG

$\Sigma M_G = 0, \quad 7R_{DY} = 5 \times 6 + 4 = 34$

$R_{DY} = 4.857 \uparrow$

SHEAR DIAGRAM (K)





MOMENT DIAGRAM (K-FT)