MECH 234 + 235

PROB. 6.10
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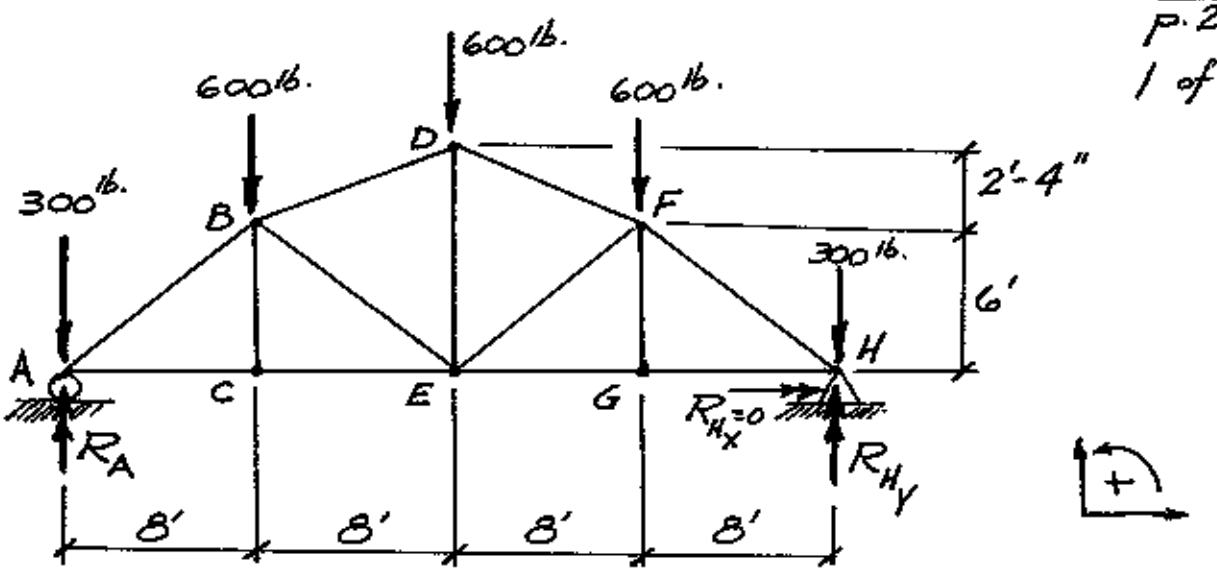


I. EXTERNAL FORCES: APPLIED LOADS + REACTIONS AT SUPPORTS. ASSUME DIR. FOR REACTIONS.

$\Sigma F_x = 0 = R_{H_x}$ ∴ NO EXTERNAL HORIZ. FORCE COMP.

$\Sigma F_Y = 0 = -300 - 600 - 600 - 600 - 300 + R_A + R_{H_Y}$

$2400\,\text{lb.} = R_A + R_H$

$\Sigma M_H = 0 = -R_A(32') + 300^{\#}(32') + 600^{\#}(24') + 600^{\#}(16') + 600^{\#}(8')$

$R_A = \dfrac{9600'^{\#} + 14{,}400'^{\#} + 9600'^{\#} + 4800'^{\#}}{32'} = \boxed{1200^{\#} = R_A \uparrow}$

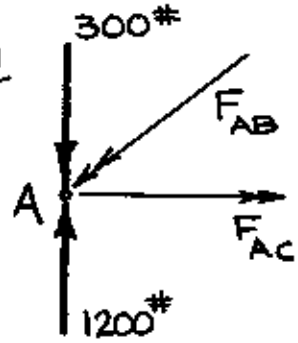
$\therefore \boxed{R_H = 1200^{\#} \uparrow}$

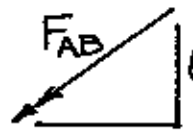
CONSIDERING SYMMETRY,
APPLIED LOADS = $2400^{\#} \downarrow$
2 REACTIVE FORCES EQUI-DIST. FROM CENTER
ACTION = REACTION
$2400^{\#} \downarrow = 2R \uparrow$ ∴ EACH REACTION = $1200^{\#} \uparrow$

II. INTERNAL FORCES IN EACH MEMBER OF THE TRUSS.
JOINT ANALYSIS: - ISOLATE EACH JT., ITS MEMBERS, AND ANY EXTERNAL FORCES.

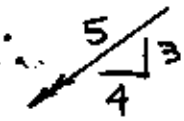
- ASSUME UPPER MEMBERS IN COMPRESSION, LOWER MEMBERS IN TENSION.
- APPLY EQUILIBRIUM EQUATIONS, $\Sigma F_x = 0$ $\Sigma F_Y = 0$
- SYMMETRICAL TRUSS, SOLVE ONLY HALF.
- USE DISTANCES GIVEN FOR 'SLOPES' OF INCLINED MEMBERS TO DETERMINE HORIZ. + VERT. COMPONENTS OF EACH MEMBER.

JT. A





$\sqrt{6^2+8^2} = 10$

$\therefore$ 

$F_{AB_X} = \frac{4}{5} F_{AB}$

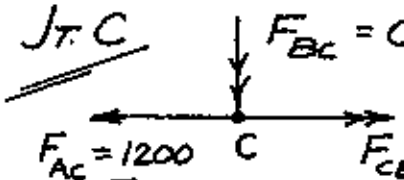
$F_{AB_Y} = \frac{3}{5} F_{AB}$

$\Sigma F_x = 0 = -\frac{4}{5} F_{AB} + F_{AC}$

$\Sigma F_Y = 0 = -300 + 1200 - \frac{3}{5} F_{AB} \quad \therefore F_{AB} = 900\left(\frac{5}{3}\right) = 1500^{\#}$ COMPRESSION.

$\therefore F_{AC} = \frac{4}{5} F_{AB} = \frac{4}{5}(1500^{\#}), \quad F_{AC} = 1200^{\#}$ TENSION.

JT. C

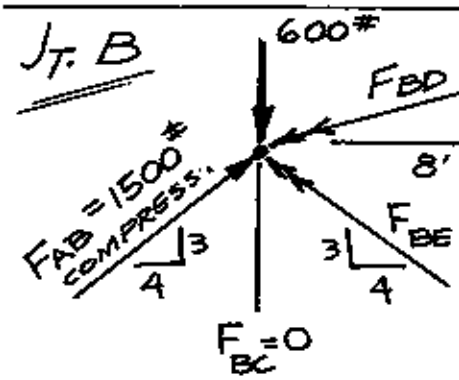


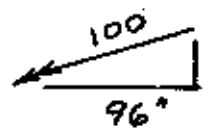
$F_{BC} = 0$, BY OBSERVATION & $\Sigma F_Y = 0 = F_{BC}$

MEMBERS BC and FG are 'ZERO-LOAD' MEMBERS.

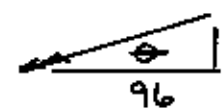
$\Sigma F_x = 0 = -F_{AC} + F_{CE} \quad \therefore F_{CE} = F_{AC} = 1200^{\#}$ TENSION.

JT. B





$\sqrt{28^2+96^2} = 100$

OR 

$\theta = \tan^{-1}\frac{28}{96} = 16.26°$

$\Sigma F_x = 0 = \frac{4}{5}(1500^{\#}) - \frac{4}{5} F_{BE} - \frac{96}{100} F_{BD}$

$\Sigma F_Y = 0 = -600 + \frac{3}{5}(1500) - \frac{28}{100} F_{BD} + \frac{3}{5} F_{BE}$

$300 + \frac{3}{5} F_{BE} = \frac{28}{100} F_{BD}$ } SOLVE SIMULT.

and $900 - \frac{4}{5} F_{BE} = \frac{96}{100} F_{BD}$ } $\times \frac{3}{4}$

$300 + \frac{3}{5} F_{BE} = \frac{28}{100} F_{BD}$

$675 - \frac{3}{5} F_{BE} = \frac{72}{100} F_{BD}$

$975 \times \frac{100}{100} = F_{BD}$

$\therefore F_{BD} = 975^{\#}$ COMP.

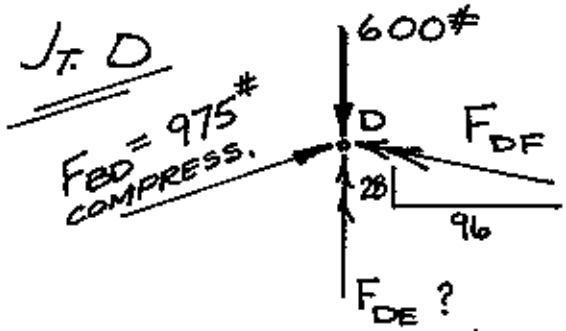
then

$F_{BE} = \frac{5}{3}\left[\frac{28}{100}(975^{\#}) - 300^{\#}\right]$

$F_{BE} = -45^{\#} = 45^{\#}$ TENSION.

ASSUMED WRONG DIR.!

JT. D



F_{DF} has same 'slope' as F_{BD}

$F_{DF_x} = \frac{96}{100} F_{DF}$

$F_{DF_y} = \frac{28}{100} F_{DF}$

COULD BE A 'ZERO-LOAD' MEMBER.

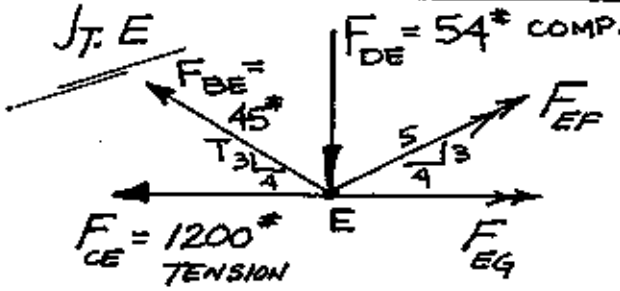
$\Sigma F_x = + \frac{96}{100}(975^{\#}) - \frac{96}{100} F_{DF} = 0 \quad \therefore F_{DF} = 975^{\#}$ COMP.

$\Sigma F_y = 0 = -600^{\#} + \frac{28}{100}(975^{\#}) + \frac{28}{100} F_{DF} + F_{DE}$

$-600 + 273 + 273 = -F_{DE}$

$-54 = -F_{DE} \quad \therefore F_{DE} = 54^{lb.}$ COMPRESSION

JT. E



DUE TO SYMMETRY YOU CAN ASSUME

$F_{EF} = F_{BE} = 45^{\#}$ TENSION

$F_{EG} = F_{CE} = 1200^{\#}$ TENSION.

CHECK ✓

$\Sigma F_x = 0 \quad -1200^{\#} - \frac{4}{5}(45^{\#}) + \frac{4}{5} F_{EF} + F_{EG}$

$\Sigma F_y = 0 = \frac{3}{5}(45^{\#}) - 54^{\#} + \frac{3}{5} F_{EF}$

$27 - 54 = -\frac{3}{5} F_{EF} \quad \therefore F_{EF} = +45^{\#}$ TENSION ✓

$\therefore -1200 - 36 + \frac{4}{5}(45^{\#}) = -F_{EG} \quad \therefore F_{EG} = +1200^{\#}$ TENSION ✓

SUMMARY

MEMBER	INTERNAL FORCE	MEMBER	INTERNAL FORCE
AB	1500 lb. C	HF	1500 lb. C
AC	1200 lb. T	HG	1200 lb. T
BC	0	FG	0
BD	975 lb. C	FD	975 lb. C
BE	45 lb. T	FE	45 lb. T
CE	1200 lb. T	EG	1200 lb. T
DE	54 lb. C	DE	