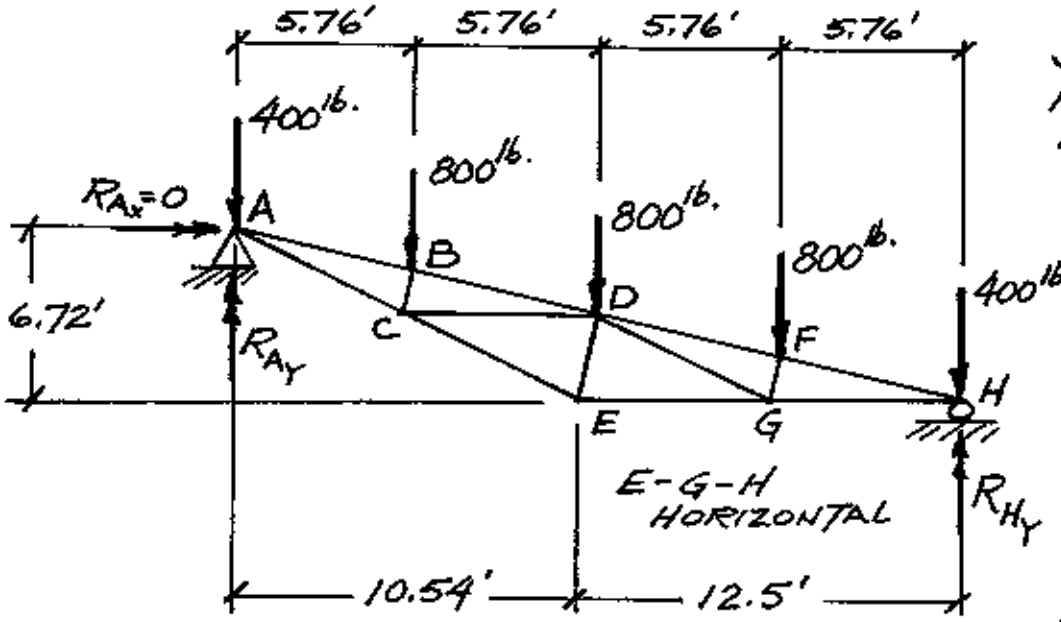
MILANO MECH 234 + 235 PROB. 6-17

INVERTED HOWE ROOF TRUSS. P. 289



SOLVE for FORCE in each MEMBER to the left of DE including MEMBER DE.

I. EXTERNAL: SOLVE for REACTIONS:

$\Sigma F_Y = 0 = -400 - 800 - 800 - 800 - 400 + R_{AY} + R_{HY}$

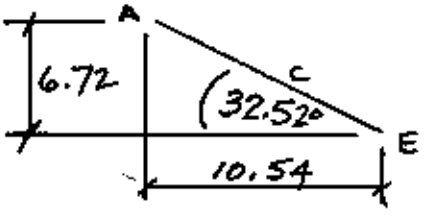
$3200^{lb} = R_A + R_H$ IS THIS SYMMETRICAL?

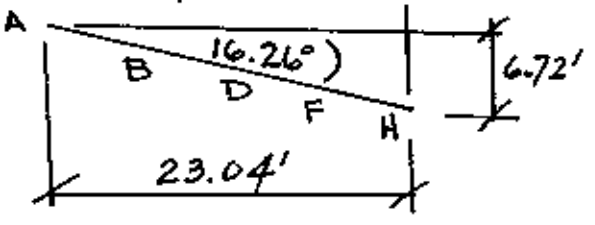
$\circlearrowleft \Sigma M_A = 0 = -800(5.76') - 800(11.52') - 800(17.28') - 400(23.04') + R_H(23.04')$

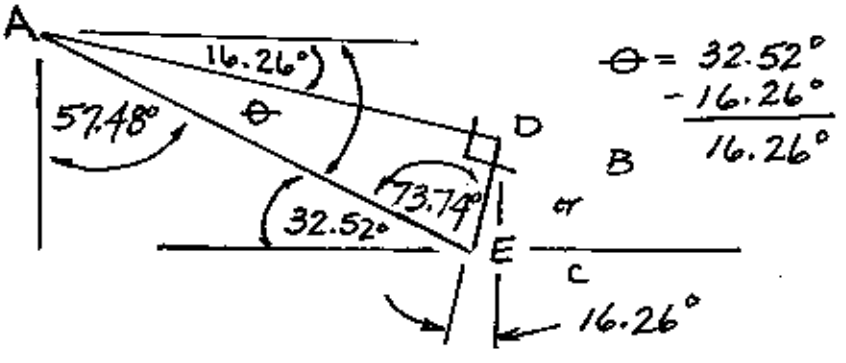
$\therefore R_H = 1600^{lb} \uparrow = R_A$

II. INTERNAL FORCES, JOINT ANALYSIS:

- DETERMINE GEOMETRY FIRST.

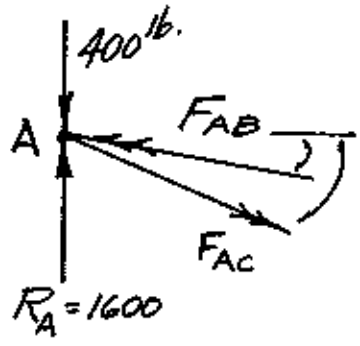






$\theta = 32.52° - 16.26° = 16.26°$

JT. A



$\Sigma F_x = 0 = -F_{AB}\cos 16.26° + F_{AC}\cos 32.52°$

$0.96\,F_{AB} = 0.843\,F_{AC}$

$F_{AB} = 0.878\,F_{AC}$

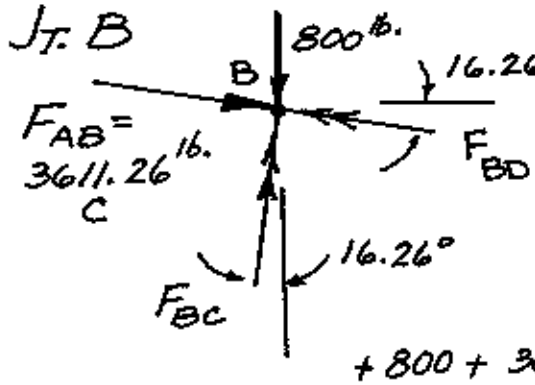
$\Sigma F_y = 0 = -400 + 1600 + F_{AB}\sin 16.26° - F_{AC}\sin 32.52°$

$1200 = -[.878\,F_{AC}]\cdot .28 + .54\,F_{AC}$

$= 0.292\,F_{AC}$ $\therefore F_{AC} = 4113.05$ lb ✓ TENSION.

$\therefore F_{AB} = 3611.26$ lb ✓ COMPRESSION.

JT. B



$\Sigma F_x = 0 = F_{AB}\cos 16.26° + F_{BC}\sin 16.26° - F_{BD}\cos 16.26°$

$0.96[3611.26] + 0.28F_{BC} = 0.96\,F_{BD}$

$\Sigma F_y = 0 = -800 - F_{AB}\sin 16.26° + F_{BD}\sin 16.26° + F_{BC}\cos 16.26°$

$+800 + 3611.26\sin 16.26° = 0.28\,F_{BD} + 0.96\,F_{BC}$

SOLVE SIMULT., ADD

$1811.14 = 0.28F_{BD} + 0.96F_{BC}$

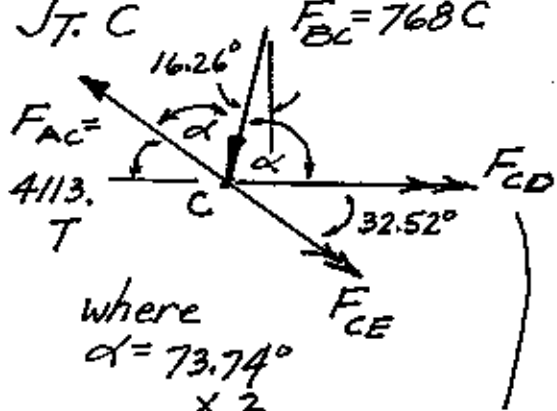
$[3466.81 = 0.96\,F_{BD} - 0.28F_{BC}] \times \frac{.96}{.28}$

$13{,}697.36 = 3.57\,F_{BD}$

$\therefore F_{BD} = 3835.26$ lb. ✓ COMPRESS.

Then, $1811.14 = 0.28[3835.26] + 0.96F_{BC}$ $\therefore F_{BC} = 767.99 \doteq 768$ lb. ✓ COMPRESS.

JT. C



where $\alpha = 73.74°$

$\times 2$

$147.48° + 32.52° = 180°$

$\Sigma F_x = 0 = -F_{AC}\cos 32.52° - F_{BC}\sin 16.26° + F_{CD} + F_{CE}\cos 32.52°$

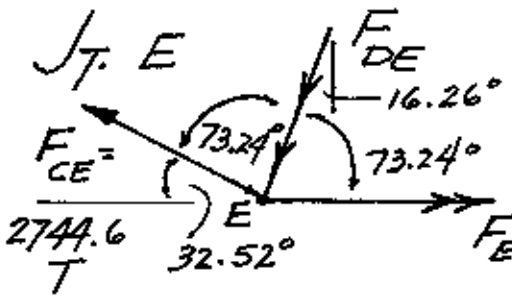
$3468.1 + 215.04 = F_{CD} + 0.84\,F_{CE}$

$\Sigma F_y = 0 = 4113\sin 32.52° - 768\cos 16.26° - F_{CE}\sin 32.52°$

$2211.12 - 737.28 = 0.537\,F_{CE}$

$\therefore F_{CE} = 2744.58$ lb. ✓ TENSION

$\therefore F_{CD} = 1377.7$ lb. TENS. ✓



$\Sigma F_x = 0 = -F_{CE}\cos 32.52° - F_{DE}\sin 16.26° + F_{EG}$

$2314.24 = -0.28\,F_{DE} + F_{EG}$

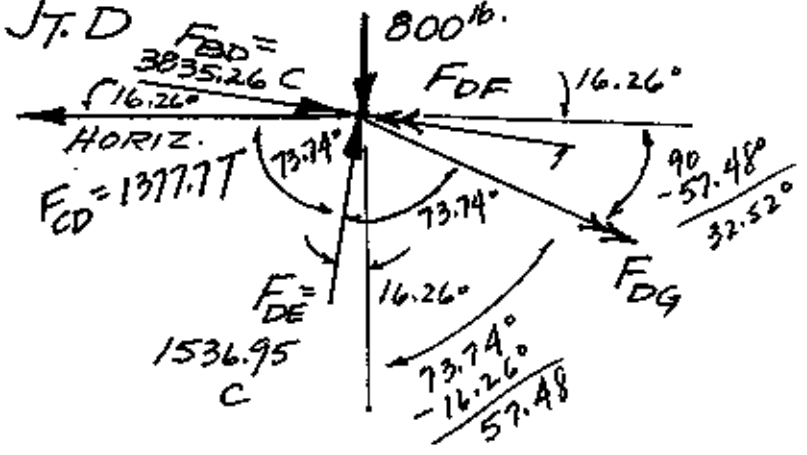
$\Sigma F_y = 0 = F_{CE}\sin 32.52° - F_{DE}\cos 16.26°$

$1475.47 = 0.96\,F_{DE}$ $\quad\therefore F_{DE} = 1536.95^{lb.}$ COMPRESS. ✓

$\therefore 2314.24 + 0.28[1536.95] = F_{EG}$ $\quad\therefore F_{EG} = 2744.58^{lb.}$ TENSION ✓

SAME AS F_{CE}

CURIOUS ABOUT SYMMETRY ?



$\Sigma F_x = 0 = -F_{CD} + F_{BD}\cos 16.26° + F_{DE}\sin 16.26° + F_{DG}\cos 32.52° - F_{DF}\cos 16.26°$

$1377.7 - 3835.26(0.96) - 1536.95(0.28) = +0.84\,F_{DG} - 0.96\,F_{DF}$

$-2734.5 = -.96\,F_{DF} + .84\,F_{DG}$

$\Sigma F_y = 0 = -800 - F_{BD}\sin 16.26° + F_{DE}\cos 16.26° + F_{DF}\sin 16.26° - F_{DG}\sin 32.52°$

$800 + 3835.26(0.28) - 1536.95(0.96) = 0.28\,F_{DF} - 0.54\,F_{DG}$

SOLVE SIMULT. SUBTRACT

$-[398.4 = .28\,F_{DF} - .54\,F_{DG}] \times \frac{.84}{.54}$

$+2734.5 = .96\,F_{DF} - .84\,F_{DG}$

$2114.8 = .52\,F_{DF}$ $\quad\therefore F_{DF} = 4066.9^{lb.}$ COMPRESS.

Then, $398.4 = .28[4067] - .54\,F_{DG}$ $\quad\therefore F_{DG} = 1371^{lb.}$ TENSION.