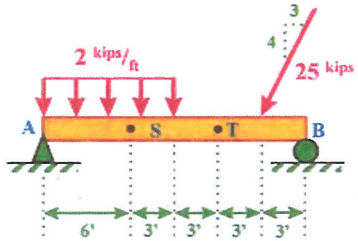
Worksheet 1A
Internal Forces

Given: Beam with applied loads as shown.

Determine the internal forces on a transverse cross-section through points "S" and "T."



External - Entire FBD

$\circlearrowleft \sum M_A = 0 = (-2 \cdot 9)(4.5) - \left(\frac{4}{5} \cdot 25\right)(15) + 18B_y$

$B_y = 21.16\text{k} \uparrow$

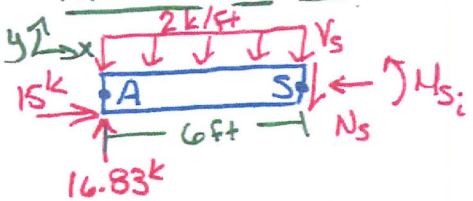
$\uparrow \sum F_y = 0 = A_y - (2 \cdot 9) - \left(\frac{4}{5} \cdot 25\right) + 21.16$

$A_y = 16.83\text{k} \uparrow$

$\rightarrow \sum F_x = 0 = A_x - \left(\frac{3}{5} \cdot 25\right)$

$A_x = 15\text{k} \rightarrow$

Internal @ "S"



$\rightarrow \sum F_x = 0 = 15 - N_S$

$N_S = 15\text{k} \leftarrow$ on AS

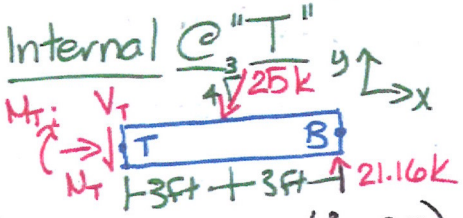
$\uparrow \sum F_y = 0 = 16.83 - (2 \cdot 6) - V_S$

$V_S = 4.83\text{k} \downarrow$ on AS

$\circlearrowleft \sum M_S = 0 = M_{Si} + (2 \cdot 6)(3) - (16.83)(6)$

$M_{Si} = 65.0\text{ kft} \curvearrowleft$ on AS

Internal @ "T"



$\rightarrow \sum F_x = 0 = N_T - \left(\frac{3}{5} \cdot 25\right)$

$N_T = 15\text{k} \rightarrow$ on TB

$\uparrow \sum F_y = 0 = -V_T - \left(\frac{4}{5} \cdot 25\right) + 21.16$

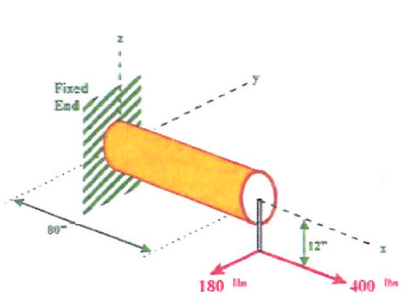
$V_T = 1.167\text{k} \downarrow$ on TB

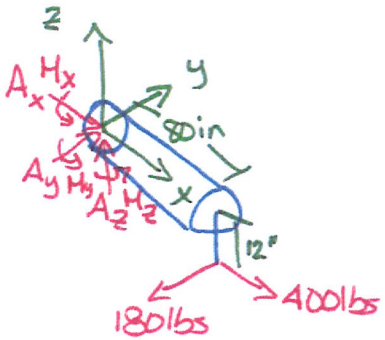
$\circlearrowleft \sum M_T = 0 = -M_{Ti} - \left(\frac{4}{5} \cdot 25\right)(3) + (21.16)(6)$

$M_{Ti} = 67.0\text{ kft} \curvearrowright$ on TB

Worksheet 1B
Internal Forces

Find the external reactions at the fixed end of the structure shown.





RHR

$\sum F_x = 0 = A_x + 400$ $\quad A_x = -400$ lbs

$\sum F_y = 0 = A_y - 180$ $\quad A_y = 180$ lbs

$\sum F_z = 0 = A_z$ $\quad A_z = 0$ lbs

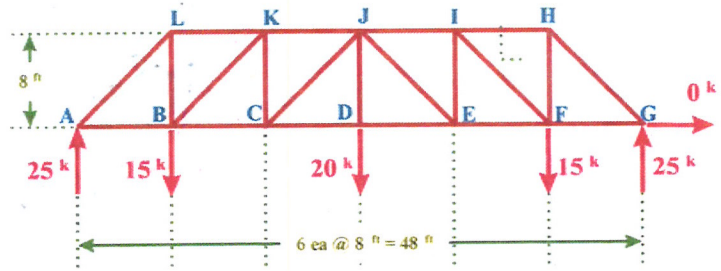
$\sum M_x = 0 = M_x - (180)(12)$ $\quad M_x = 2160$ lb·in

$\sum M_y = 0 = M_y - (400)(12)$ $\quad M_y = 4800$ lb·in

$\sum M_z = 0 = M_z - (180)(80)$ $\quad M_z = 14{,}400$ lb·in

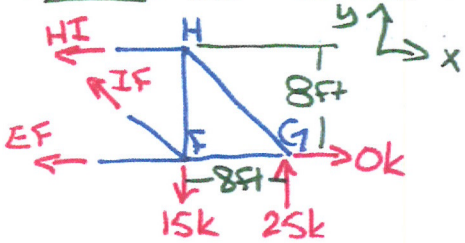
Worksheet 1C
Internal Normal Forces/Stresses

Given: The cross-sectional area of all truss members below is 4 in^2. For the loads and reactions shown:



Determine the normal stress on a transverse plane in member IH.

Method of sections



$\circlearrowleft \sum M_F = 0 = -(HI)(8) - (25)(8)$

$HI = -25k = \underline{25k\ (c)}$

Stress

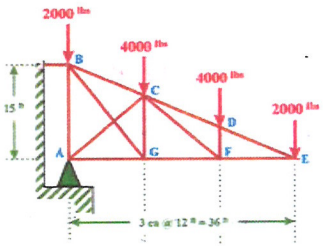
$A = 4\ in^2$

$\sigma = \frac{P}{A} = \frac{25}{4} = \underline{6.25\ ksi\ (c)}$

Worksheet 1D
Internal Normal Forces/Stresses

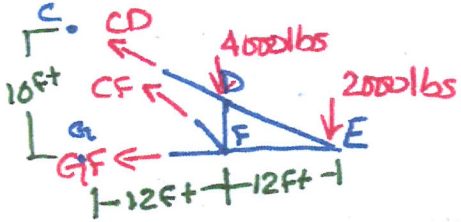
Given: Member GF of the pin-connected truss has a cross-sectional area of 7.4 in^2

Determine the maximum normal stress in GF.



Do we need external? NO!

Method of sections



$\circlearrowleft \sum M_C = 0 = (4000)(12) + (2000)(24) + (GF)(10)$

$GF = -9600\ lbs = \underline{9600\ lbs\ (c)}$

Stress

$A = 7.4\ in^2$

$\sigma = \frac{P}{A} = \frac{9600}{7.4} = 1297\ psi$

$= \underline{1.297\ ksi\ (c)}$