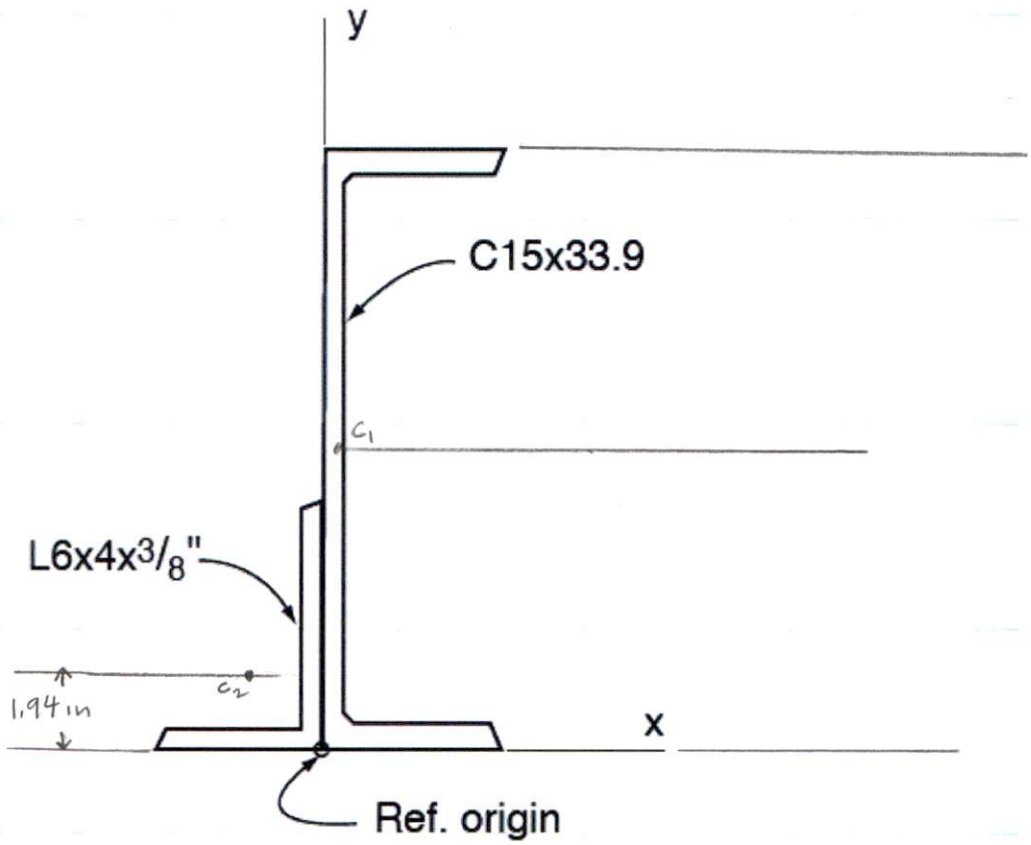
CMGT350	Exam #2	Fall 2022

One page of notes, front and back handwritten by you. Handout of Tables. Algebra and Trig Cheat Sheets
SHOW ALL WORK FOR FULL CREDIT

Name Solution

1. Determine the centroid of the built-up cross-section shown, for the reference origin shown. Determine the moment of inertia about the centroidal X axis.



Solution.

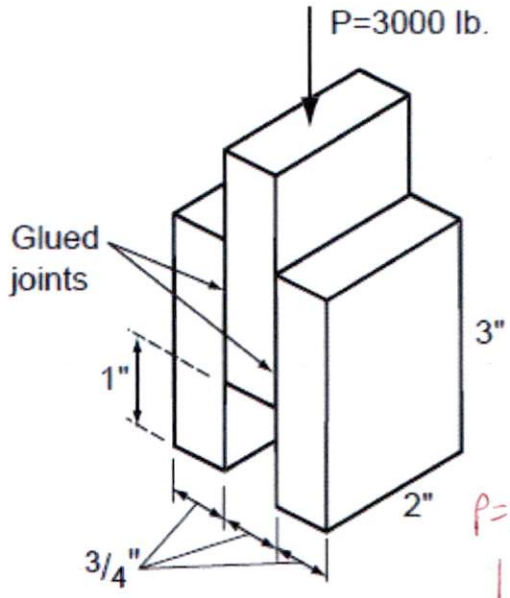
(1) Part	(2) A (in.^{2})	(3) y (in.)	(4) Ay (in.^{3})	(5) $\bar{y} - y$ (in.)	(6) $A(\bar{y} - y)^2$ (in.^{4})	(7) I (in.^{4})
C15x33.9	9.96	7.5	74.7	-1.5	22.41	315
L6x4x3/8"	3.61	1.94	7.0034	-4.06	59.5	13.5
	Σ 13.54		Σ 81.7034		81.9	328.5

$$\bar{y} = \frac{\Sigma Ay}{\Sigma A} = \frac{81.7034 \text{ in}^3}{13.54 \text{ in}^2} = 6 \text{ in}$$

$$\bar{I}_x = \Sigma I + A(\bar{y} - y)^2 = 81.9 \text{ in}^4 + 328.5 \text{ in}^4$$

$$= 410.4 \text{ in}^4$$

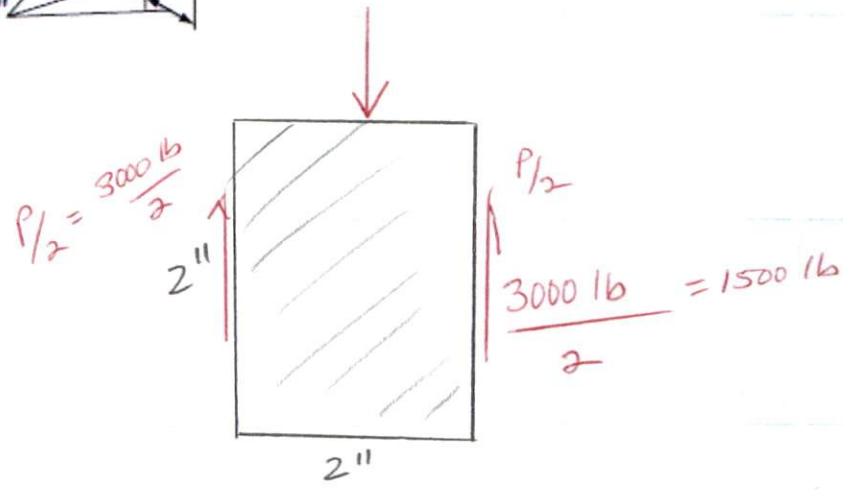
2. The plywood blocks shown have been arranged to determine the shear strength of a glued joint. If P = 3000 lb at failure, what is the shearing stress that develops between the plywood pieces?



Solution.

$$\tau = \frac{P}{A} = \frac{1500\ lb}{2in \times 2in}$$

$$= 375\ psi$$



3. A circular tube has an outside diameter of 2" and an inside diameter of 1.25" is compressed under a load of 22.5 kips. (a) Calculate the compression stress in the tube. (b) Calculate the deformation of the circular tube if the tube is made of aluminum and has an original length of 24 inches. E = 10 x 10^3 ksi

$$\text{Area} = \frac{\pi(2\text{in})^2}{4} - \frac{\pi(1.25\text{in})^2}{4}$$

$$= 3.14\,\text{in}^2 - 1.23\,\text{in}^2$$

$$= 1.91\,\text{in}^2$$

a) $\sigma = \frac{P}{A} = \frac{22.5\,\text{kip}}{1.91\,\text{in}^2} = 11.78\,\text{ksi}$

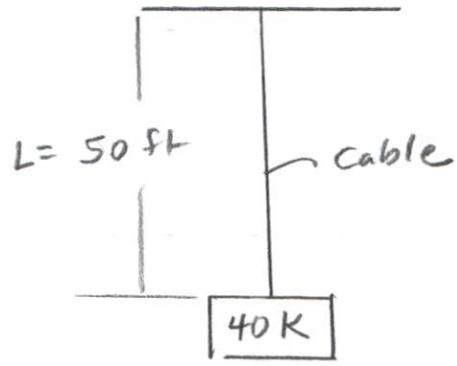
b) AL $\quad E = 10 \times 10^3\,\text{ksi}$ (Given)

$L = 24\,\text{in.}$

$$\delta = \frac{PL}{AE} = \frac{22.5\,\text{kips} \times 24\,\text{in}}{1.91\,\text{in}^2 \times 10{,}000\,\text{ksi}}$$

$$= 0.0283\,\text{in.}$$

4. A circular cable that is 50 ft long is made from steel and has to hold a total of 40,000 lb. The cable can elongate no more than 0.34 in. Determine the diameter of the cable to the nearest 1/8th inch to meet this requirement. $E = 30 \times 10^6$ psi



$\delta = 0.34$ in

$L = 50 \text{ ft} \times \frac{12 \text{ in}}{\text{ft}} = 600$ in

$P = 40$ kips

$E = 30 \times 10^3$ ksi

$$\delta = \frac{PL}{AE}$$

$$A = \frac{PL}{\delta E} = \frac{40 \text{ k } (600 \text{ in})}{0.34 \text{ in} \times 30{,}000 \text{ ksi}}$$

$$= 2.353 \text{ in}$$

$$\frac{\pi d^2}{4} = 2.353 \text{ in}$$

$$d = \sqrt{\frac{4}{\pi}(2.353 \text{ in})} = 1.73 \text{ in}$$

$0.73 \times 8 = 5.847$

use, $1\ 6/8$ in

so, $d = 1\text{-}3/4$ in