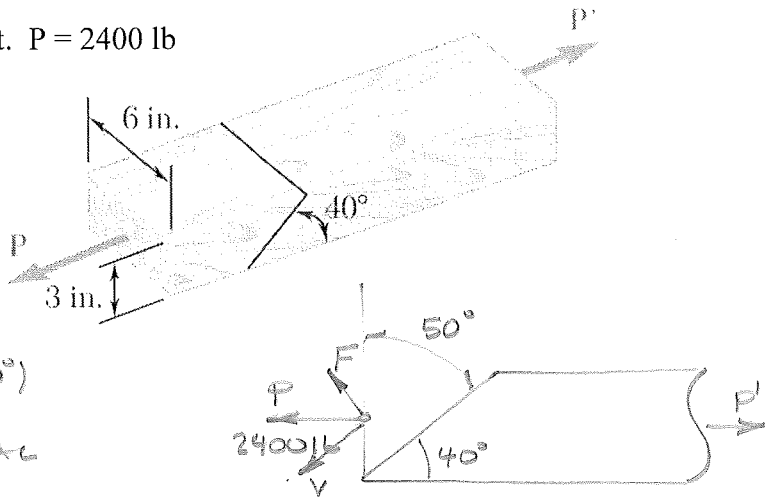
1) GIVEN: Wooden member under tension with scarf joint. P = 2400 lb
REQ'D: Shear and normal stresses in joint.



$\theta = 90° - 40° = 50°$

NORMAL AREA:

$A_o = 6\,in(3\,in) = 18\,in^2$

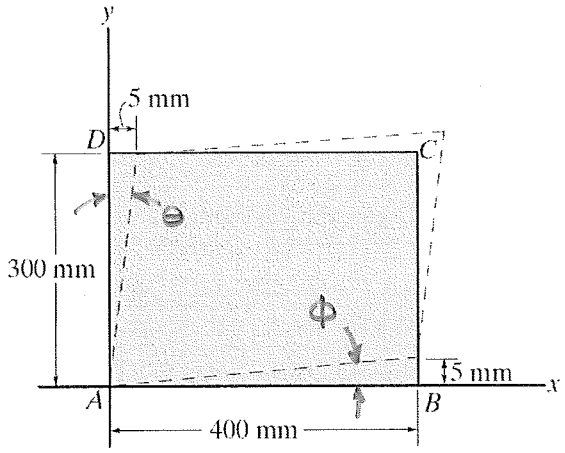
$\sigma_\theta = \frac{P}{A_o}\cos^2\theta = \frac{2400\,lb}{18\,in^2}\cos^2(50°)$

$= \underline{55.1\ psi}$ NORMAL

$\tau_\theta = \frac{P}{A_o}\cos\theta\sin\theta = \frac{2400\,lb}{18\,in^2}\cos(50°)\sin(50°)$

$= \underline{65.7\ psi}$ SHEAR

2) GIVEN: The rectangular plate is deformed into the shape of a parallelogram as shown.
REQ'D: Shear strain at corners A and B.



$\gamma_{A(xy)} = \theta + \phi$

$\theta = \frac{5}{300} = 0.01667\ rad$

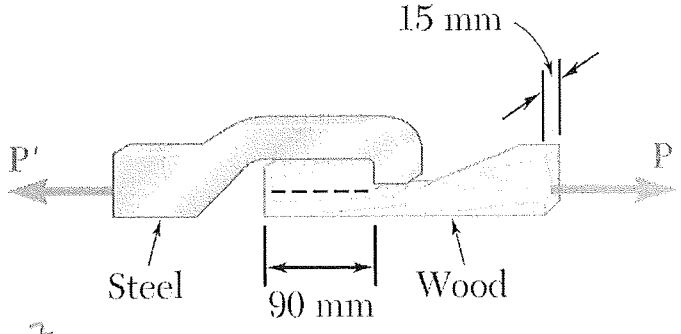
$\phi = \frac{5}{400} = 0.01250\ rad$

$\gamma_A = 0.01667\,rad + 0.01250\,rad$

$= \underline{0.0292\ rad}$

$\gamma_B = \theta + \phi = \gamma_A = \underline{0.0292\ rad}$

3) GIVEN: Wooden hook failed in shear along the dashed line when P = 8 kN.
REQ'D: Average shearing stress at failure.



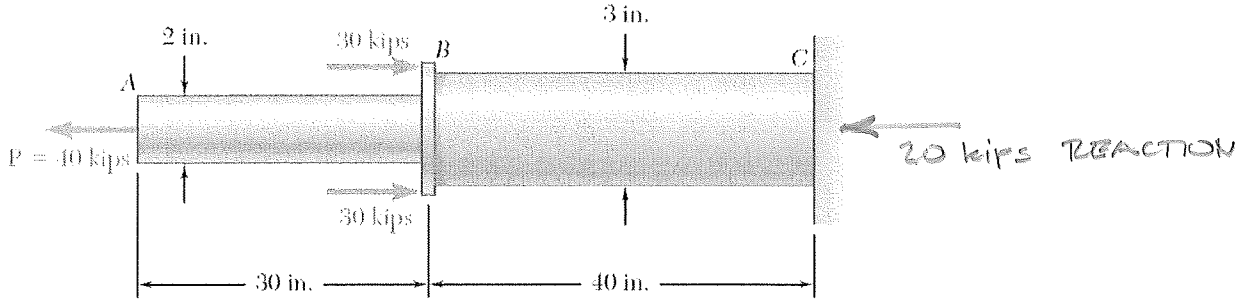
AREA IN SHEAR

$A_s = 90mm(15mm) = 1.35\times10^3\ mm^2$

SHEARING STRESS

$\tau_{AVG} = \frac{P}{A_s} = \frac{8000\,N}{1.35\times10^3\,mm^2} = 5.93\ N/mm^2 \Rightarrow \underline{5.93\ MPa}$ SHEAR

4) GIVEN: Cylindrical rods AB and BC are welded together at B and loaded as shown.



REQ'D: A) Average normal stress in section AB.

$$A_{AB} = \frac{\pi}{4} D^2 = \frac{\pi}{4}(2\text{in})^2 = 3.142\ \text{in}^2$$

$$\sigma_{AB} = \frac{P}{A} = \frac{40\ \text{kips}}{3.142\ \text{in}^2} = \underline{12.73\ \text{ksi}\ (T)}\ \text{IN SECTION AB}$$

B) Average normal stress in section BC.

$$\text{LOAD IN BC}: \underline{40\text{kips}} - \underline{2(30\text{kips})} = \underline{-20\ \text{kips}}\ \text{COMPRESSION}$$

$$A_{BC} = \frac{\pi}{4} D^2 = \frac{\pi}{4}(3\text{in})^2 = 7.069\ \text{in}^2$$

$$\sigma_{BC} = \frac{P_{BC}}{A_{BC}} = \frac{-20\ \text{kips}}{7.069\ \text{in}^2} = \underline{-2.83\ \text{ksi}\ (C)}\ \text{IN SECTION BC}$$

C) Also, find the axial strain in each segment if $\Delta L_{AB} = 0.0127$ in and $\Delta L_{BC} = 0.00377$ in.

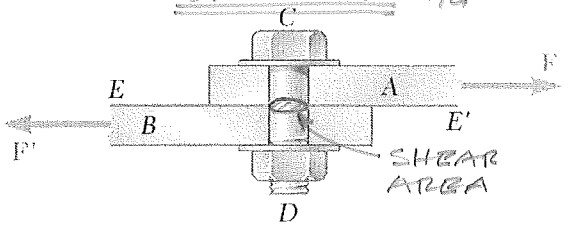
$$\epsilon = \frac{\Delta L}{L}$$

$$\epsilon_{AB} = \frac{\Delta L_{AB}}{L_{AB}} = \frac{0.0127\ \text{in}}{30\ \text{in}} = \underline{0.000423\ \text{in/in}}$$

$$\epsilon_{BC} = \frac{\Delta L_{BC}}{L_{BC}} = \frac{-0.00377\ \text{in}}{40\ \text{in}} = \underline{-0.0000943\ \text{in/in}}\ \text{COMP.}$$

(COMPRESSION)

5) GIVEN: Ø 0.5 in bolt connecting two 0.5 in thick plates.
REQ'D: Bearing and shear stresses if F = 1000 lbs.



$$\sigma_B = \frac{F}{A_B} = \frac{1000\ \text{lb}}{0.5\text{in}(0.5\text{in})} = \underline{4000\ \text{psi}}$$

Ø OF BOLT; THICKNESS OF PLATE

$$\tau = \frac{F}{A_S} = \frac{1000\ \text{lb}}{\frac{\pi}{4}(0.5\text{in})^2 \times 1 \times 1} = \underline{5093\ \text{psi}}\ \text{SHEAR IN BOLT}$$

SINGLE SHEAR; ONE BOLT