PROBLEM ____, pg ____

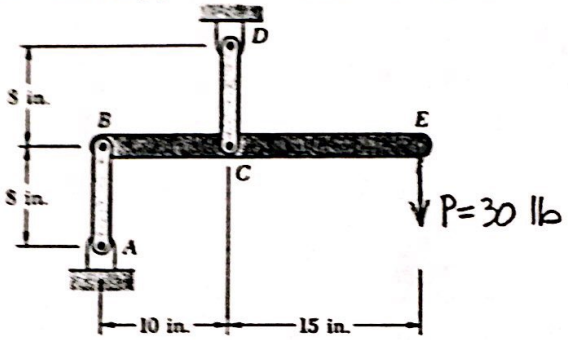
GIVEN: THE FRAME SHOWN BELOW. LINKS AB & CD HAVE UNIFORM RECTANGULAR CROSS-SECTION OF $\frac{1}{4}$" X 1"; THE CONNECTIONS ARE $\frac{1}{2}$" ⌀ PINS.

FIND: a) MAXIMUM VALUE OF THE AVERAGE NORMAL STRESS IN CD

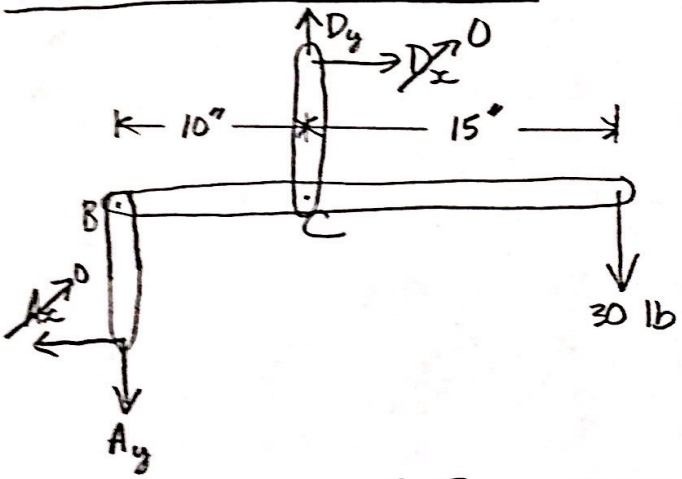
b) MAXIMUM VALUE OF THE AVERAGE NORMAL STRESS IN CD IF 30 lb IS VERTICALLY UPWARD

c) AVERAGE SHEAR STRESS IN THE PIN AT C

d) BEARING STRESS IN THE PIN AT C



SOL'N: a) FBD OF ENTIRE FRAME



SINCE AB & CD ARE 2-FORCE MEMBERS THE FORCES @ A, B, C, D ARE DIRECTED ALONG THE AXIS OF THE MEMBER $\Rightarrow A_x = D_x = 0$

$\circlearrowleft + \Sigma M_B = 0;$

$(D_y)(10) - (30)(25) = 0$

$D_y = 75$ lb

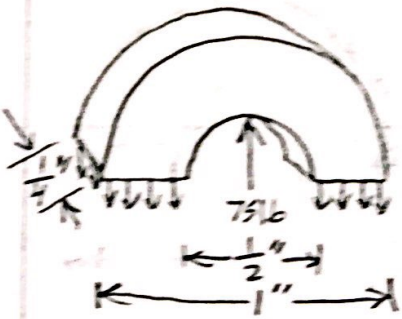
$\uparrow + \Sigma F_y = 0;$

$-A_y + 75 - 30 = 0$

$A_y = 45$ lb

FBD OF MEMBER CD

MEMBER CD IS IN TENSION WITH AN INTERNAL AXIAL FORCE OF 75 lb.



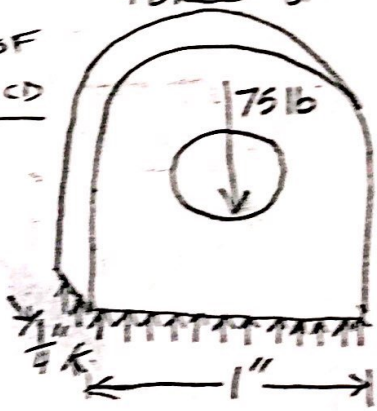
$$\sigma_{CD} = \frac{P}{A}$$

$$\sigma_{CD} = \frac{75\text{ lb}}{(1" - \frac{1}{2}")(\frac{1}{4}")} = 600 \frac{\text{lb}}{\text{in}^2} = 600 \text{ psi}$$

$$\boxed{\sigma_{CD} = 600 \text{ psi}}$$

b) WITH THE LOAD OF 30 lb BEING VERTICALLY UPWARD, MEMBER CD WILL BE IN COMPRESSION WITH AN AXIAL FORCE OF -75 lb.

FBD OF MEMBER CD

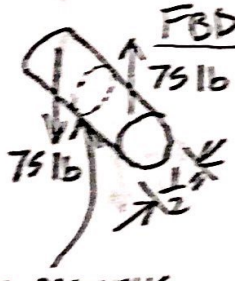


$$\sigma_{CD} = \frac{P}{A}$$

$$\sigma_{CD} = \frac{-75\text{ lb}}{(1")(\frac{1}{4}")} = -300 \text{ psi}$$

$$\boxed{\sigma_{CD} = -300 \text{ psi}}$$

c) FBD OF PIN AT C FROM SCENARIO A



$$\tau_{AVG} = \frac{P}{A}$$

$$\tau_{AVE} = \frac{75\text{ lb}}{\frac{\pi(\frac{1}{2}")^2}{4}} = \frac{(75\text{ lb})(4)}{\pi(\frac{1}{2}")^2}$$

$$\boxed{\tau_{AVG} = 382 \text{ psi}}$$

d) BEARING STRESS IS CAUSED BY CONTACT BETWEEN THE PIN AT C & MEMBER CD AS WELL AS MEMBER BC

$$\sigma_b = \frac{P}{A} = \frac{P}{td} \Rightarrow \sigma_b = \frac{75\text{ lb}}{(\frac{1}{2}")(\frac{1}{2}")} = 600 \text{ psi} \Rightarrow \boxed{\sigma_b = 600 \text{ ps}}$$