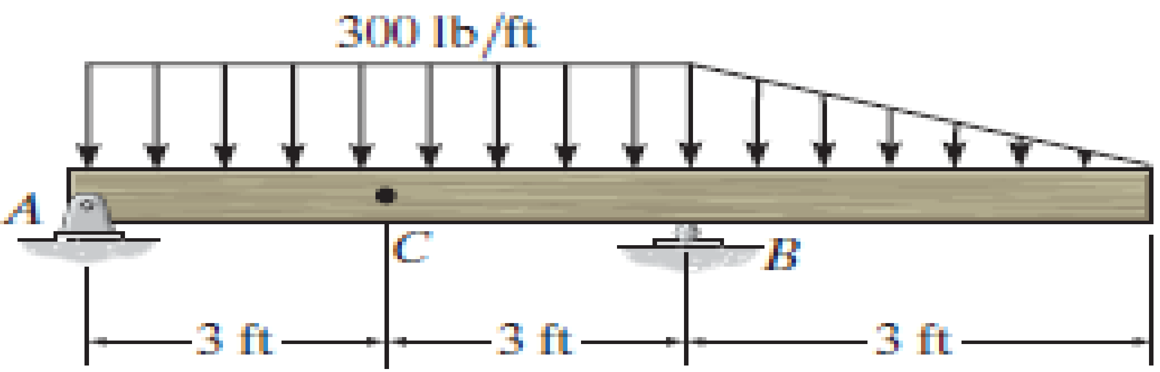
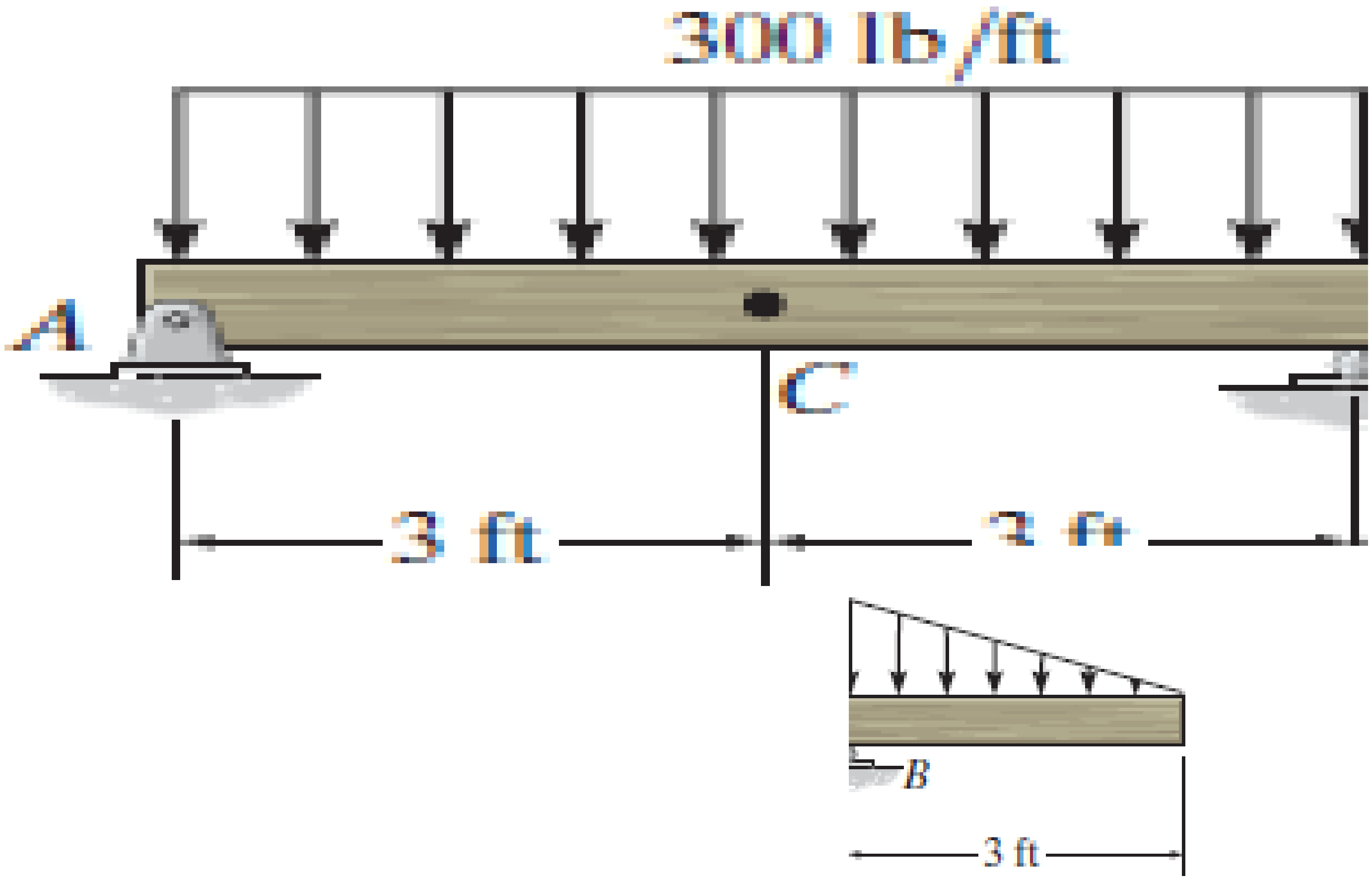
Strength of Materials 1

Presented by : Alhareth Muthanna .A

F1–5. Determine the internal normal force, shear force, and bending moment at point *C* in the beam.

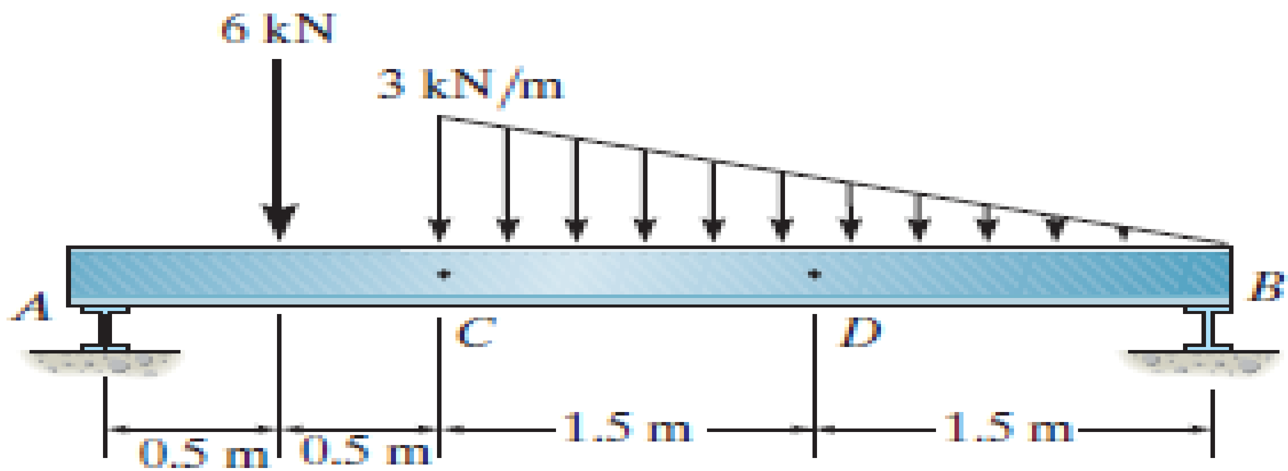


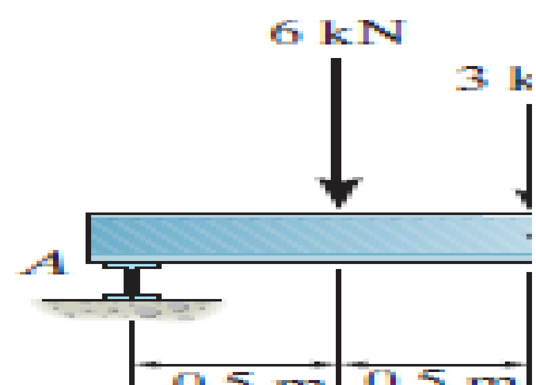
F1–5


300 lb/ft
A
C
3 ft
B
3 ft

- B_y=1425 ft
- A_y= 825ft
- V_c=75ft
- M_c=1125

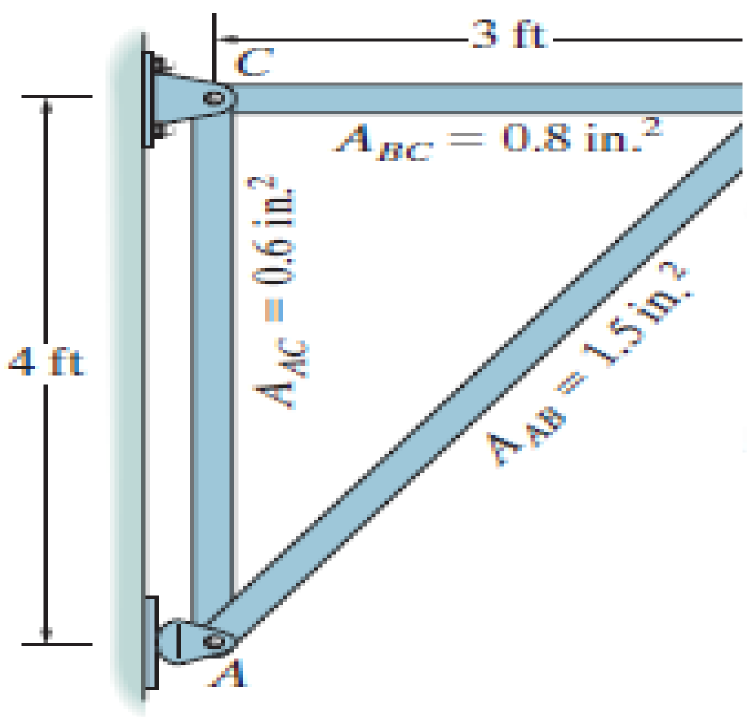
*1–8. Determine the resultant internal loadings on the cross section through point C. Assume the reactions at the supports A and B are vertical.

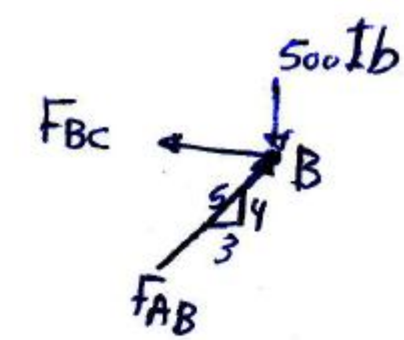


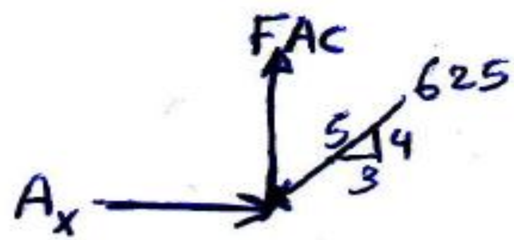


- $A_{y=7.5\ K_N}$
- N_c=0
- V_c=1.5 K_N
- M_c=4.5 $K_{N.m}$

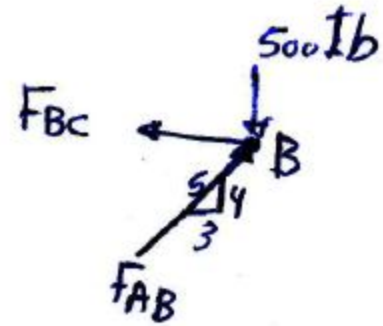
•1–45. The truss is made from three pin-connected members having the cross-sectional areas shown in the figure. Determine the average normal stress developed in each member when the truss is subjected to the load shown. State whether the stress is tensile or compressive.







- **Find average normal stress in each member?**
- **State whether the stress is tensile or compressive?**
- Joint B
- $\sum f_y=0$
- $-500+F_{AB}*\frac{4}{5}=0$
- $F_{AB}=625$ Ib C
- $\sum f_x=0$
- $-F_{BC}+625*\frac{3}{5}=0$
- $F_{BC}=375$ Ib T

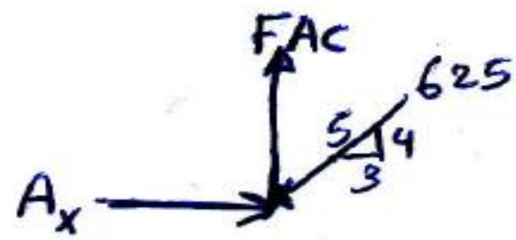


Joint A

$\sum f_y=0$

F_{AC}-625*$\frac{4}{5}$

F_{AC}=500 Ib T



$\sigma_{AB}=\frac{F}{A}$

$=\frac{625}{1.5}$

= 416.67 psi C

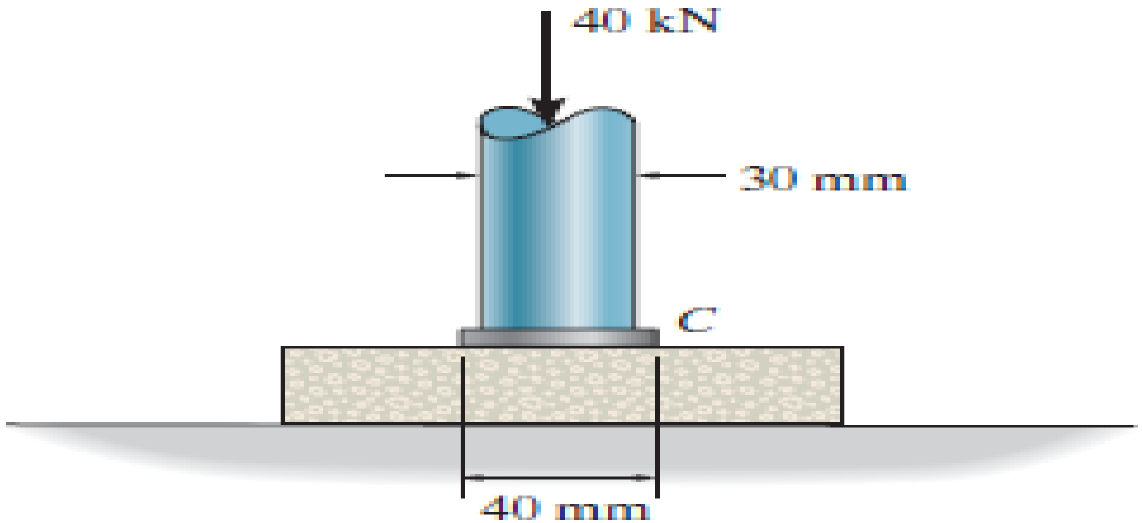
$\sigma_{BC}=\frac{375}{0.8}$

= 468.75 Psi T

$\sigma_{AC}=\frac{500}{0.6}$

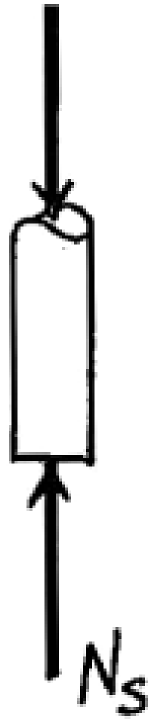
= 833.34 psi T

1–54. The shaft is subjected to the axial force of 40 kN. Determine the average bearing stress acting on the collar C and the normal stress in the shaft.

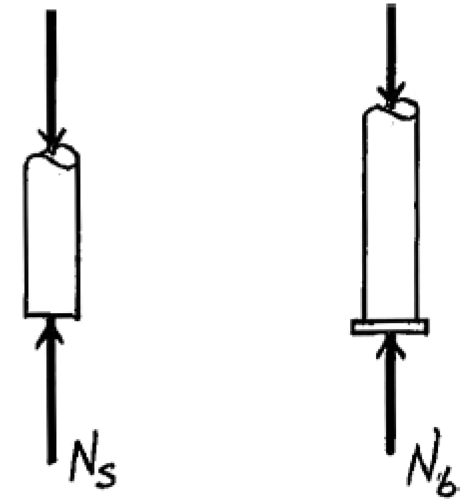


Prob. 1–54

- Axial force = 40 K_N
- Average bearing stress =?
- Normal stress in shaft =?
- $\sigma_{avg}=\frac{P}{A}$
- $\sum F_y=0$
- P_s-40 =0
- P_s=40 K_N
- $\sum f_y=0$
- P_b -40=0
- $P_b=40\, K_N$



- $\sigma_{avg} = \frac{P_s}{As}$
- $A_s = \frac{\pi}{4} * d^2$
- $= \frac{\pi}{4} * (\frac{30}{1000})^2$
- $= 7.06*10^{-4}\ m^2$
- $A_b = \frac{\pi}{4} * (\frac{40}{1000})^2$
- $\sigma_{avg\ s} = \frac{P_s}{A_s}$
- $= \frac{40*10^3}{7.06*10^{-4}}$
- $= 56.65 *10^6$ Pa



- $\sigma_{avg\ b} = \frac{P_b}{A_b}$
- $= \frac{40*10^3}{1.25*10^{-3}}$
- $= 32 * 10^6$ Pa

F1–15. Determine the maximum average shear stress developed in each 3/4-in.-diameter bolt.

$$T = \frac{V}{A}$$

$$\Sigma f_x = 0$$

$$4 * V - 10 = 0$$

$$V = 2.5\ kip$$

$$A = \frac{\pi}{4} * d^2$$

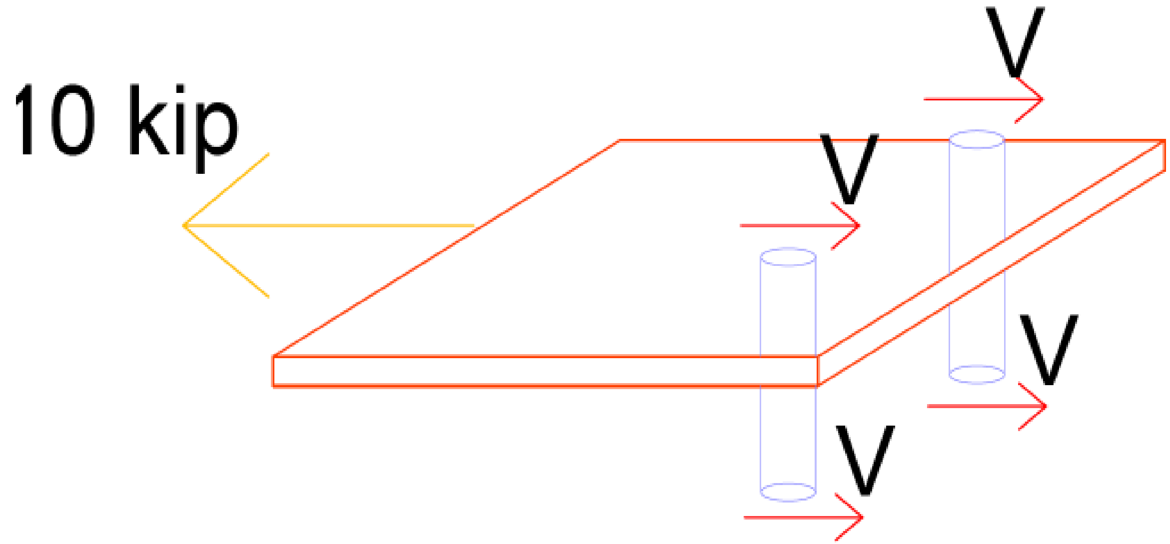
$$= \frac{\pi}{4} * (\frac{3}{4})^2$$

$$= 0.4415\ in^2$$

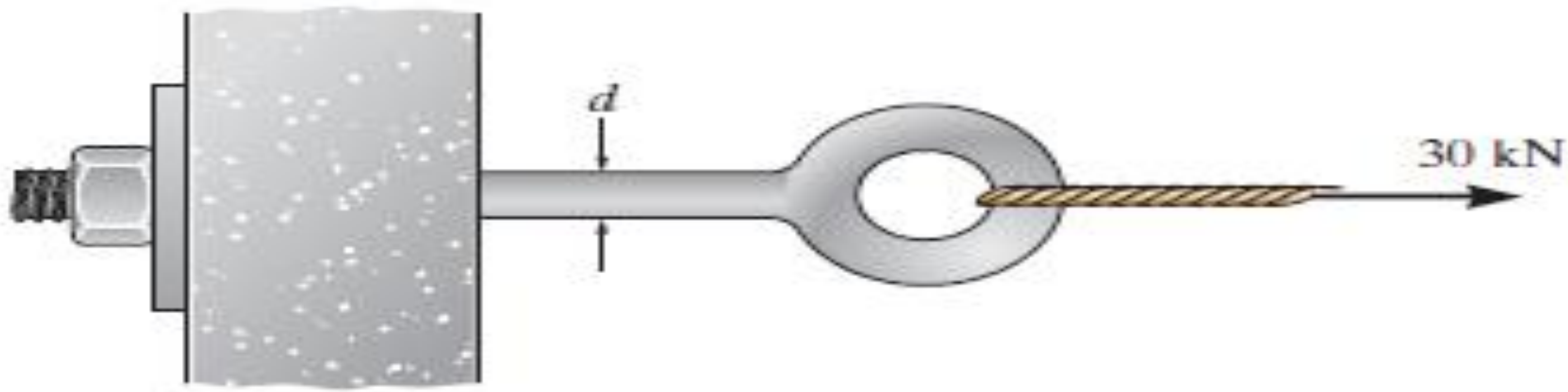
$$T = \frac{V}{A}$$

$$= \frac{2.5}{0.4415}$$

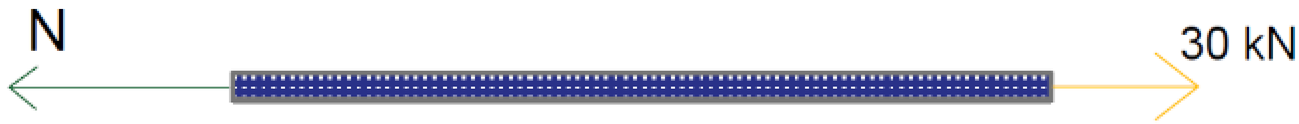
$$= 5.66\ Ksi$$



F1–19. If the eyebolt is made of a material having a yield stress of $\sigma_Y = 250$ MPa, determine the minimum required diameter d of its shank. Apply a factor of safety F.S. = 1.5 against yielding.



F1–19



$$F.S = \frac{\sigma_{fill}}{\sigma_{allow}}$$

$$\sigma_{allow} = \frac{\sigma_{fill}}{F.S}$$

$$= \frac{250}{1.5}$$

$$= 166.67\ Mpa$$

$$\sum f_x = 0$$

$$N - 30 = 0$$

$$N = 30\ K_N$$

- $A=\frac{\pi}{4}*d^2$
- $\sigma_{allow}=\frac{F}{A}$
- $166.67*10^6=\frac{30*10^3}{\frac{\pi}{4}*d^2}$
- $D=15.14\ mm$