

3.2 Sketch a free-body diagram of each element of the figure. Determine the magnitude and direction of each force acting on each member.

3.3 Find the reactions at the supports and sketch the shear-force and bending moment diagrams of the beams shown. Label the diagram properly.





(b) $\sigma_x = 16 \text{ ksi}$, $\sigma_y = 9 \text{ ksi}$, $\tau_{xy} = 5 \text{ ksi ccw}$ (c) $\sigma_x = 10 \text{ ksi}$, $\sigma_y = 24 \text{ ksi}$, $\tau_{xy} = 6 \text{ ksi ccw}$ (d) $\sigma_x = 9 \text{ ksi}$, $\sigma_y = 19 \text{ ksi}$, $\tau_{xy} = 8 \text{ ksi cw}$ **3.9** Repeat 3.8 for the following: (a) $\sigma_x = -4$ ksi, $\sigma_y = 12$ ksi, $\tau_{xy} = 7$ ksi ccw (c) $\sigma_x = -8$ ksi, $\sigma_y = 7$ ksi, $\tau_{xy} = 6$ ksi cw

13 A ¹/₂-in diameter steel tension rod is 72 in long and carries a load of 2000 lb. Find the tensile stress, the total deformation, the unit tension and the change in the rod diameter.

23. Find the second moment of area, the location of the neutral axis and the distances from the neutral surface to the top and bottom surfaces. If a positive bending moment of 10 kip-in is applied to the beam, find the resulting stresses at the top and bottom surfaces.

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25 For the beams shown, find the locations and magnitudes of the maximum tensile stress and the maximum shear stress due to V.



39. A 15-mm diameter steel bar is to be used as a torsion spring. If the torsional stress in the bar is not to exceed 110 MPa when one end is twisted through an angle of 30° , what must be the length of the bar?

40. A 3-in diameter solid steel shaft, used as a torque transmitter, is replaced with a 3-in hollow shaft having a ¹/₄-in wall thickness. If both materials have the same strength, what is the percentage reduction in torque transmission? What is the percentage reduction in shaft weight?