(1) Knowing that a 10mm-diameter hole has been drilled through each of the shafts AB, BC, and CD, determine (a) the shaft in which the maximum shearing stress occurs, (b) the magnitude of that stress. (15%)
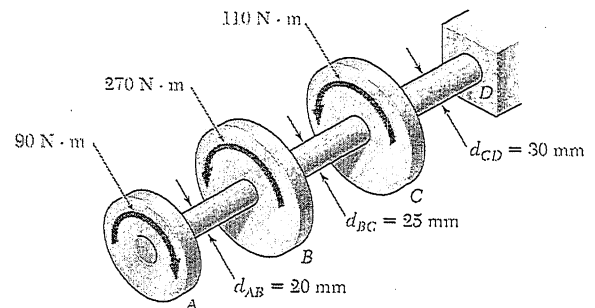
(2) A 56 Nm couple is applied to the steel bar shown, (a) assuming that the couple is applied about the z axis as shown, determine the maximum stress and radius of curvature of the bar. (b) Solve part a, assuming that the couple is applied about the y axis. Use E=200GPa. (15%)
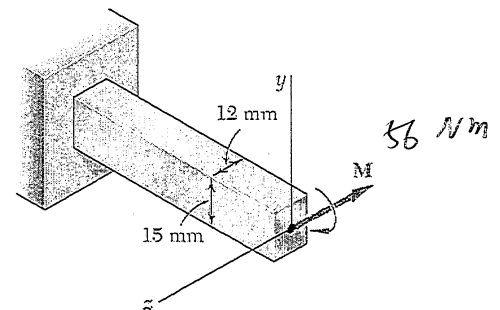
(3) A closed-end thin walled pressure vessel of 0.5" wall thickness and 20" outer diameter is subjected to an internal pressure of 1000 psi. and an end torgue of 1.457×10^6 in-lb. The yield strength of the material is 30,000 psi. What is the factor of safety against yielding by the von Mises criterion. (15%)

(4) An element in a stressed body has the static of stress shown. Determine the magnitude of the principal stresses and the maximum shearing stress. Also find the plane on which theses stresses act(with respect to the X-plane) (15%)

$\sigma_x = 5000$

$\tau_{xy} = 1000 \ psi$

$\sigma_y = 3000$
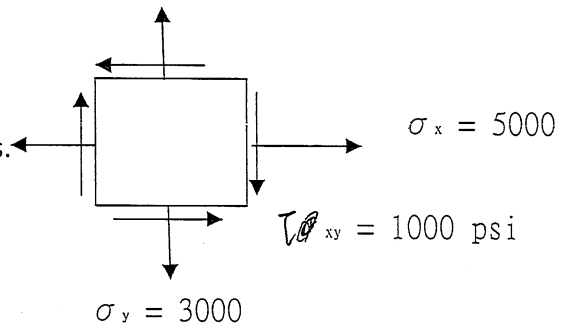
(5) For the beam and loading shown, (a) draw the shear and bending moment diagrams, (b) design the cross section of the beam. Knowing that the grade of the timber used has an allowable normal stress of 15MPa. (20%)
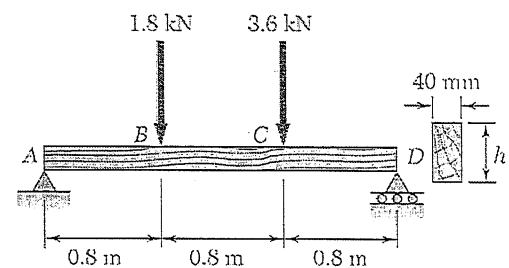
(6) For the cantilever beam and loading shown, determine the slope and deflection at the free end C. (15%)
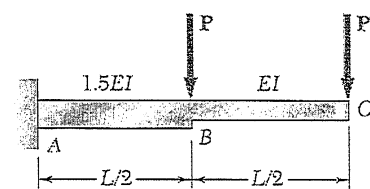
(7) For the beam and loading shown in the figure, explain
   (a) definition of statically indeterminate structure,
   (b) method for determining the reactions at the supports.
   （5%）