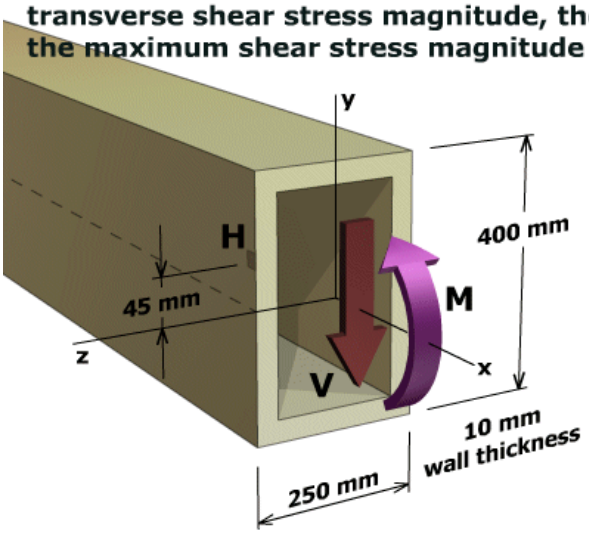
IDE 110 – Summer 2006 Quiz 23 **Name:** _____

The rectangular tube is subjected to a transverse shear force of V = 100 kN and a bending moment of M = 220 kN-m, each acting in the directions shown. Determine the bending stress, the transverse shear stress magnitude, the principal stresses, and the maximum shear stress magnitude acting at location H.



Q_H = 828,250 mm^3

σ_H (MPa)

$|\tau_H|$ (MPa)

σ_1 (MPa)

σ_2 (MPa)

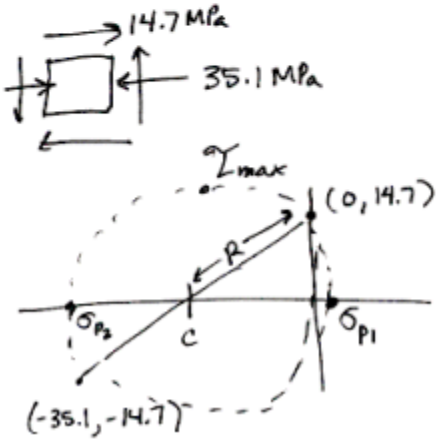
$|\tau_{max}|$(MPa)

$I = \frac{1}{12}(.25)(.4^3) - \frac{1}{12}(.25-2(.01))(.4-2(.01))^3 = 2.82(10^{-4})\ m^4$

$y_H = .045\ m$

$\sigma_{bending} = \sigma_H = \frac{My}{I} = \frac{220\,(10^3)(.045)}{2.82(10^{-4})} = 35.1$ MPa (C)

$\tau = \frac{VQ}{Ib} = \frac{(100\times10^3)(828{,}250\times10^{-9})}{(2.82\times10^{-4})(.01\times2)} = 14.7$ MPa



$C = \frac{-35.1}{2} = -17.55$

$R = \sqrt{17.55^2 + 14.7^2}$

$R = 22.89$

$\sigma_{P_1} = C + R = 5.34$ MPa

$\sigma_{P_2} = C - R = -40.44$ MPa

$\tau_{max} = 22.89$ MPa

σ_H (MPa) **-35.15**

$|\tau_H|$ (MPa) **14.71**

σ_1 (MPa) **5.34**

σ_2 (MPa) **-40.49**

$|\tau_{max}|$(MPa) **22.92**