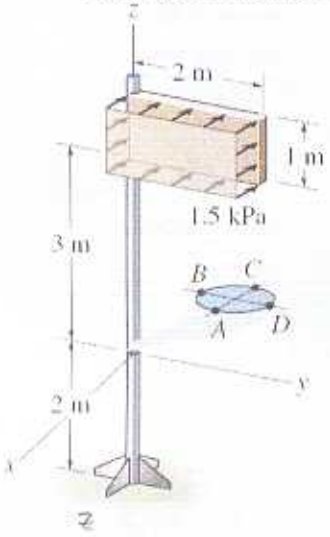
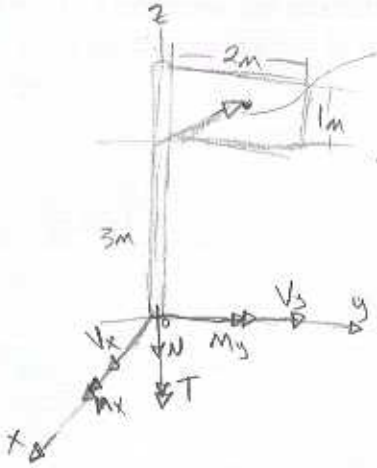
4. The sign is subjected to the uniform wind loading. a) Determine the stress components at points A and B on the 80mm diameter supporting post. b) Show the results on a volume element located at each of these points.





$P = (1.5\times10^3 N/m^2)(2m)(1m) = 3000N$

$\vec{P} = -3000N\,\hat{k}$

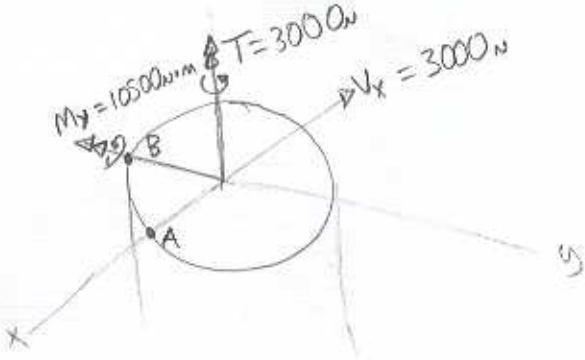
$\Sigma\vec{F} = V_x\hat{i} + V_y\hat{j} - N\hat{k} - 3000N\,\hat{k} = 0$

$\boxed{V_x = 3000N}$ $\boxed{V_y = N = 0}$

$\Sigma M_o = M_x\hat{i} + M_y\hat{j} - T\hat{k} + (1m\,\hat{j} + 3.5m\,\hat{k}) \times (-3000\hat{i})$

$= M_x\hat{i} + M_y\hat{j} - T\hat{k} + 3000N\cdot m\,\hat{k} - 10500N\cdot m\,\hat{j} = 0$

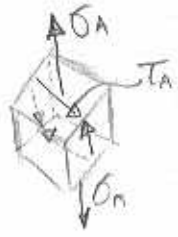
$M_x = 0$ $\boxed{M_y = 10500N\cdot m}$ $\boxed{T = 3000N\cdot m}$



Point A

$\tau_A = \tau_T = \frac{TP}{J} = \frac{T(.04m)}{\frac{\pi}{2}(.04)^4} = 29.84MPa$; $\tau_{Vx} = \frac{V_x Q}{I_y t} = 0$

$\sigma_A = \sigma_{my} = -\frac{M_y x}{I} = -\frac{M_y(-r)}{\frac{\pi}{4}r^4} = 208.89\,MPa$



Point B

$\tau_T = \frac{TP}{J} = \frac{T(.04)}{\frac{\pi}{2}(.04)^4} = 29.84\,MPa$

$\tau_{Vx} = \frac{VQ}{I_y t} = \frac{V(\frac{\pi}{2}r^2)(\frac{4r}{3\pi})}{(\frac{\pi}{4}r^4)(2r)} = 0.796\,MPa$

$\sigma_{my} = -\frac{M_y x = 0}{I_y} = 0$

$\tau_B = \tau_T - \tau_{Vx} = 29.044\,MPa$

$\sigma_B = 0$