3.

$$\sigma_x = \sigma_L = \frac{pd}{4t} = \frac{2.4\times10^6 \times 0.12}{4\times 0.0025} = 28.8\times10^6 \ N/m^2$$

$$\sigma_x = \underline{28.8 \text{ MPa}}.$$

$$\sigma_y = \sigma_\theta = \frac{pd}{2t} = \underline{57.6 \text{ MPa}}.$$

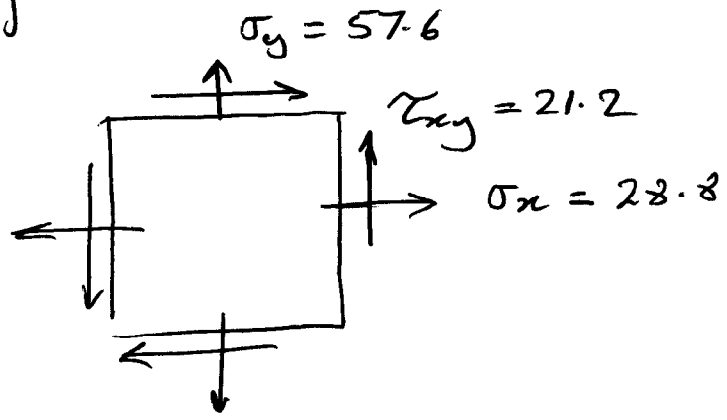
Torsional shear stress τ_{xy} given by:

$$\tau . \ \pi D t . \frac{D}{2} = M_T$$

$$\therefore \ \tau = \frac{2M_T}{\pi D^2 t} = \frac{2\times 1.2\times 10^3}{\pi \times 0.12^2 \times 0.0025}$$

$$\tau_{xy} = \underline{21.2 \text{ MPa}}.$$

Components of Stress (MPa)



Principal planes defined by ϕ given by:

$$\tan 2\phi = \frac{2\tau_{xy}}{\sigma_x - \sigma_y}$$