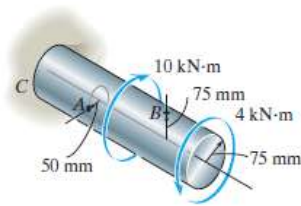


5-3. The solid shaft is fixed to the support at C and subjected to the torsional loadings shown. Determine the shear stress at points A and B and sketch the shear stress on volume elements located at these points.



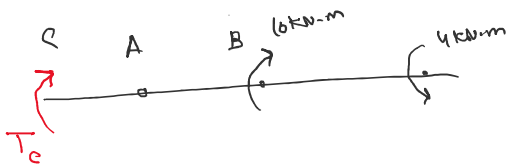
To find: τ_A, τ_B

We know

$$\frac{\tau}{R} = \frac{T}{J} \Rightarrow \tau = \frac{JR}{J} \quad \text{--- (1)}$$

\Rightarrow We need T (internal torques) to find τ

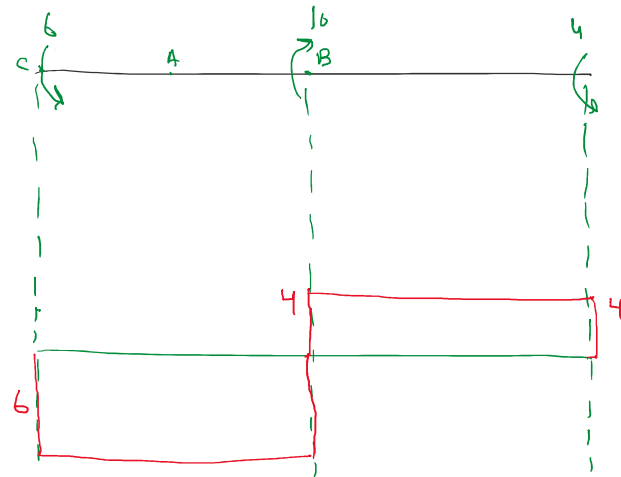
Internal torques are found using equation of equilibrium of torque:



$$\sum T = 0$$

$$\Rightarrow T_c + 10 - 4 = 0$$

$$\Rightarrow T_c = 4 - 10 = -6 \text{ kN}\cdot\text{m} = 6 \text{ kN}\cdot\text{m} (\curvearrowright)$$



$$\Rightarrow T_A = -6 \text{ kN}\cdot\text{m}; T_B = 4 \text{ kN}\cdot\text{m}$$

From (1):

$$\Rightarrow \tau_c = \frac{4 \times 0.075}{\pi} = 6.04 \text{ MPa}$$

$$\Rightarrow \tau_B = \frac{4 \times 0.075}{\frac{\pi}{2} \times 0.075^4} = 6.04 \text{ MPa}$$

$$\tau_A = \frac{-6 \times 0.05}{\frac{\pi}{2} \times 0.075^4} = -6.04 \text{ MPa}$$

Volume Elements :-

