

Worksheet:

For the simple model of the engineering structure shown, the bar BE is a 50 mm diameter round steel bar. You may neglect the weight of the individual members and the wheel in your analysis.

- For a transverse cut of the bar, find the normal stress in member BE
- For a non-transverse cut of the bar at an angle of 30 degrees, find the normal stress and the shear stress in member BE

SOLUTIONTRANSVERSE CUT

$$P = 167 \text{ N}$$

$$\sigma = \frac{N}{A} = \frac{167}{1963} = 0.085 \frac{\text{kN}}{\text{mm}^2} (\text{T})$$

$$= 85 \text{ MPa (T)}$$

ANSNON-TRANSVERSE CUT

$$P = 167 \text{ N}$$

$$\sigma = \frac{P}{A_t} \cos^2 \theta = \frac{167}{1963} \cos^2 30^\circ$$

$$\sigma = 0.0637 \frac{\text{kN}}{\text{mm}^2} (\text{T}) = 63.7 \text{ MPa (T)}$$

ANSTRANSVERSE AREA

$$A_t = \pi r^2$$

$$= \pi (25)^2$$

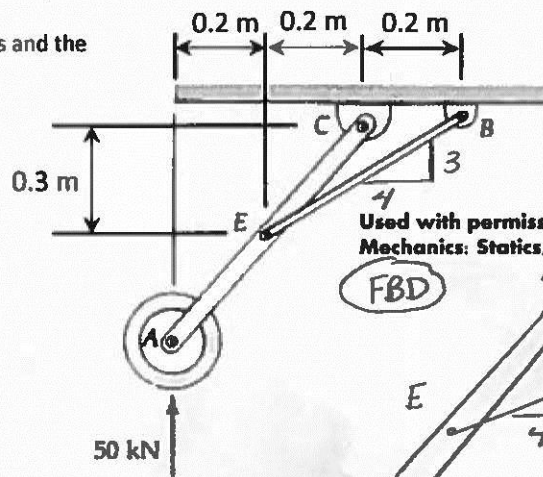
$$A_t = 1963 \text{ mm}^2$$

$$\tau = \frac{P}{2A_t} \sin 2\theta$$

$$\tau = \frac{167}{2(1963)} \sin [2(30^\circ)]$$

$$\tau = 0.0368 \frac{\text{kN}}{\text{mm}^2}$$

$$= 36.8 \text{ MPa}$$

ANS.

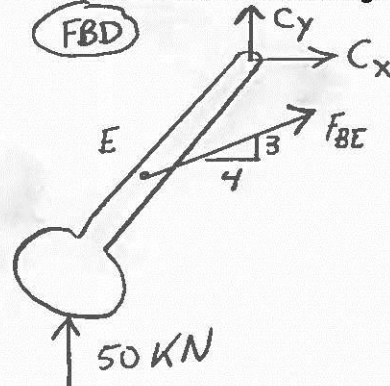
MEMBER BE

IS A

2 FORCE MEMBER

Used with permission from "Engineering Mechanics: Statics," McGill/King, 4th Ed, 2003

FBD



$$\sum M_C = 0$$

$$-50(0.4) + \left(\frac{4}{5}\right) F_{BE}(0.3) - \left(\frac{3}{5}\right) F_{BE}(0.2) = 0$$

$$F_{BE} = 167$$

$$\vec{F}_{BE} = 167 \text{ kN (T)}$$