



**QUIZ 8**

Ad, Soyad: **SOLUTION**

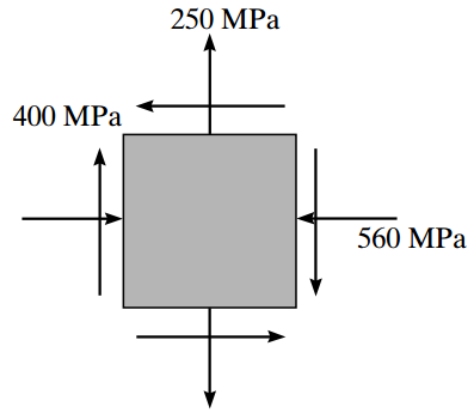
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**Problem:** By drawing mohr circle of the shown element,

- a) Determine the principal stresses,
- b) Determine the maximum in plane shear stress,
- c) Determine the average normal stress,
- d) Specify the orientation angle,
- e) Determine the equivalent state of stress for an element oriented  $60^\circ$  counterclockwise from the element shown.



a)

The coordinate of reference points *A* and *B* are

$$A(-560, -400) \quad B(250, 400)$$

$$\sigma_{avg} = \frac{\sigma_x + \sigma_y}{2} = \frac{-560 + 250}{2} = -155 \text{ MPa} \Rightarrow C(-155, 0)$$

The radius of the circle is

$$R = CA = \sqrt{[-560 - (-155)]^2 + (-400)^2} = 569.23 \text{ MPa}$$

$$\sigma_1 = -155 - 569.23 = -724.23 \text{ MPa}$$

$$\sigma_2 = -155 + 569.23 = 414.23 \text{ MPa}$$

b)

$$\tau_{max} = R = 569.23 \text{ MPa}$$

c)

$$\sigma_{avg} = -155 \text{ MPa}$$

d)

$$\alpha = \tan^{-1}\left(\frac{400}{560 - 155}\right) = 44.64^\circ$$

$$\frac{\alpha}{2} = 22.32^\circ$$

e)

$$\beta = 120^\circ - 44.64^\circ = 75.36^\circ$$

$$\sigma_{x'} = -155 - 569.23 \cos 75.36^\circ = -299 \text{ MPa}$$

$$\tau_{x'y'} = 569.23 \sin 75.36^\circ = 551 \text{ MPa}$$

$$\sigma_{y'} = -155 + 569.23 \cos 75.36^\circ = -11.1 \text{ MPa}$$

