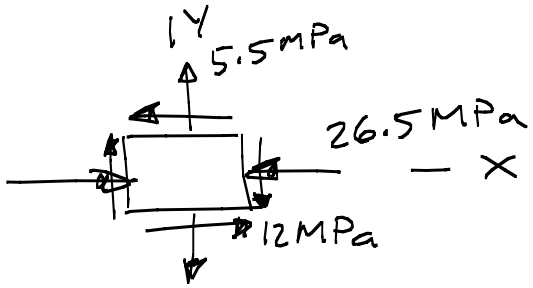
Problem 1



Determine: The stresses at an angle 40° below the x-axis

$\sigma_x = -26.5\ MPa \quad \sigma_y = 5.5 MPa \quad \tau_{xy} = -12\ MPa \quad \theta = -40°$

$$\sigma_{x_1} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2}\cos 2\theta + \tau_{xy}\sin 2\theta$$

$$\sigma_{x_1} = \frac{-25.5 + 5.5}{2} + \frac{-26.5 - 5.5}{2}\cos(-80) + (-12)\sin(-80°)$$

$$\sigma_{x_1} = -10.5 - 2.78 + 11.8$$

$$\boxed{\sigma_{x_1} = -1.46\ MPa}$$

$$\sigma_{y_1} = -10.5 + 2.78 - 11.8$$

$$\boxed{\sigma_{y_1} = -19.52\ MPa}$$

$$\tau_{x_1y_1} = -\frac{\sigma_x - \sigma_y}{2}\sin 2\theta + \tau_{xy}\cos 2\theta$$

$$= -\left(\frac{-26.5 - 5.5}{2}\right)\sin(-80^\circ) + (-12)\cos(-80^\circ)$$

$$\boxed{\tau_{x_1y_1} = -17.84 \text{ MPa}}$$