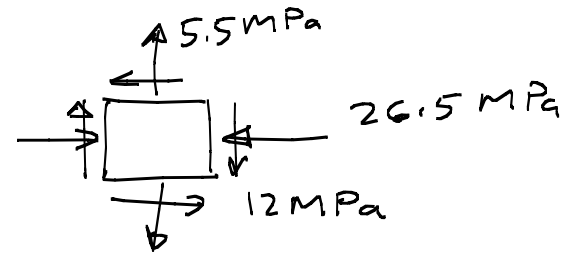


Problem 2

Determine :- Principal Stresses
- Max Shear Stress



$$\sigma_{1,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$
$$= \frac{-26.5 + 5.5}{2} \pm \sqrt{\left(\frac{-26.5 - 5.5}{2}\right)^2 + (-12)^2}$$

$$\sigma_{1,2} = -10.5 \pm 20$$

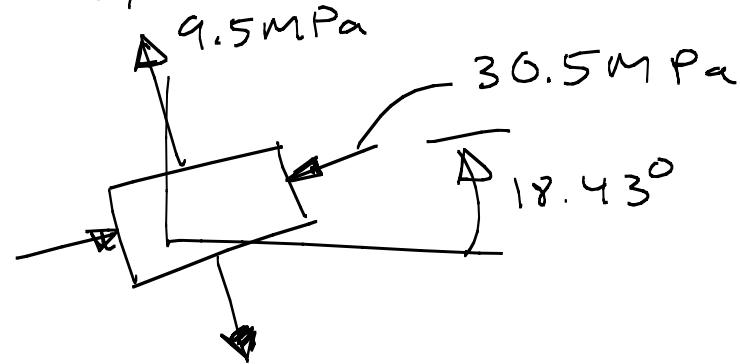
$$\boxed{\sigma_1 = 9.5 \text{ MPa}, \sigma_2 = -30.5 \text{ MPa}}$$

$$\tan 2\theta_p = \frac{2\tau_{xy}}{\sigma_x - \sigma_y} = \frac{2(-12)}{-26.5 - 5.5}$$

$$\boxed{\theta_p = 18.43^\circ}$$

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

If $\Theta = 18.43^\circ$, $\sigma_{x_1} = -30.5 \text{ MPa}$



$$\tau_{\max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$= \sqrt{\left(\frac{-26.5 - 5.5}{2}\right)^2 + (-12)^2}$$

$$\tau_{\max} = 20 \text{ MPa}$$

$$\sigma_{x_1} = \sigma_{y_1} = \sigma_{\text{aver}} = \frac{\sigma_x + \sigma_y}{2} = \frac{-26.5 + 5.5}{2} = \boxed{-10.5 \text{ MPa}}$$

$$\Theta_s = \Theta_P - 45^\circ$$

$$= (18.43^\circ + 90^\circ) - 45^\circ = \boxed{63.43^\circ}$$

