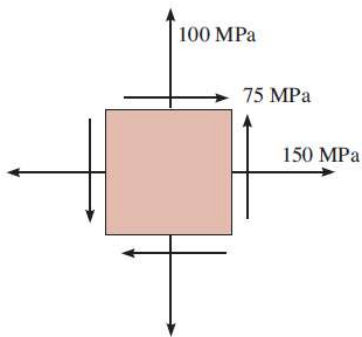


.. Plane Stress Transformation question solution using **STRESS TRANSFORMATION EQUATIONS**

**\*9-12.** Determine the equivalent state of stress on an element at the same point oriented  $60^\circ$  counterclockwise with respect to the element shown. Sketch the results on the element.

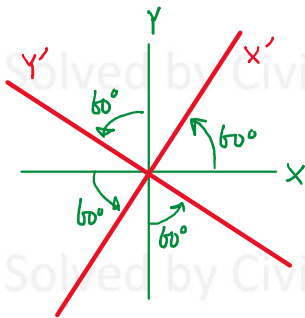


**Prob. 9-12**

Mechanics of Materials, R.C. Hibbeler 10th Ed. Pearson

$$\sigma_x = 150 \text{ MPa}, \sigma_y = 100 \text{ MPa}, \tau_{xy} = 75 \text{ MPa}$$

$$\theta = 60^\circ$$



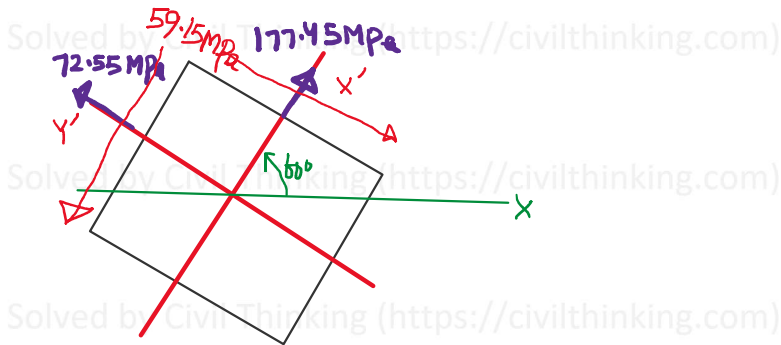
$$\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta = 177.45 \text{ MPa}$$

$$\sigma_{y'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2(90^\circ + \theta) + \tau_{xy} \sin 2(90^\circ + \theta)$$

$$90^\circ + \theta = 90^\circ + 60^\circ = 150^\circ$$

$$\Rightarrow \sigma_{y'} = 72.55 \text{ MPa}$$

$$\tau_{x'y'} = -\frac{\sigma_x - \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta = -59.15 \text{ MPa}$$



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