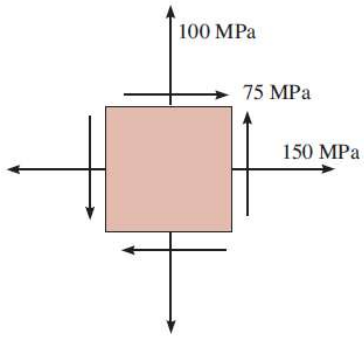
.. Plane Stress Transformation *question solution using* STRESS TRANSFORMATION EQUATIONS

***9–12.** Determine the equivalent state of stress on an element at the same point oriented 60° counterclockwise with respect to the element shown. Sketch the results on the element.

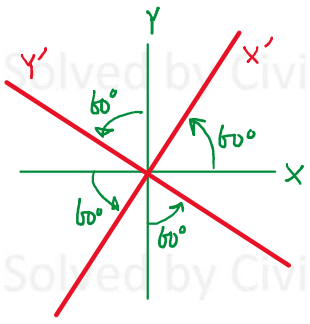


Prob. 9–12

Mechanics of Materials, R.C. Hibbeler 1oth Ed. Pearson

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

$\theta = 60°$



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

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

$$90+\theta = 90+60° = 150°$$

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

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