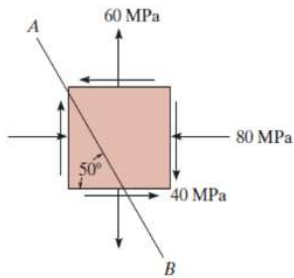


# Plane Stress Transformation question solution using

## STRESS TRANSFORMATION EQUATIONS

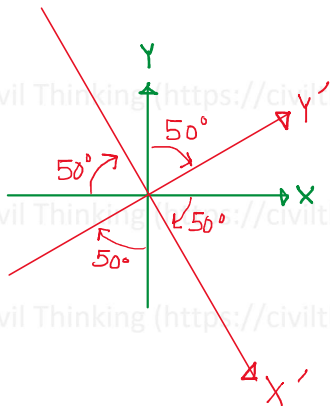
Determine the stress components acting on the inclined plane AB. Solve the problem using the method of **STRESS TRANSFORMATION EQUATIONS**. Draw the sketch.



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

$$\theta = -50^\circ \Rightarrow 2\theta = -100^\circ$$

$$\sigma_x = -80 \text{ MPa}; \sigma_y = 60 \text{ MPa}; \tau_{xy} = -40 \text{ MPa}.$$



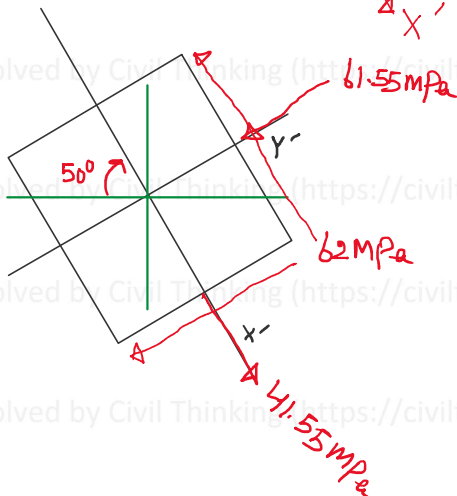
$$\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta = 41.55 \text{ MPa}$$

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

$$90^\circ + \theta = 90^\circ - 50^\circ = 40^\circ \Rightarrow 2(90^\circ + \theta) = 2 \times 40^\circ = 80^\circ$$

$$\Rightarrow \sigma_{y'} = -61.55 \text{ MPa}$$

$$\tau_{x'y'} = -\frac{\sigma_x - \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta = -62 \text{ MPa}$$



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