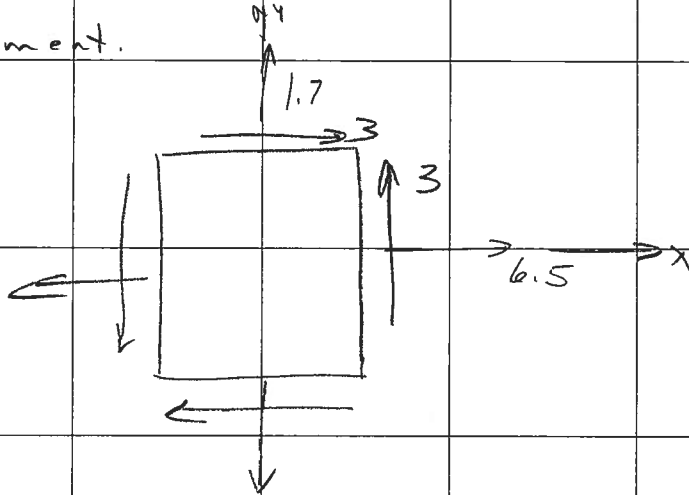
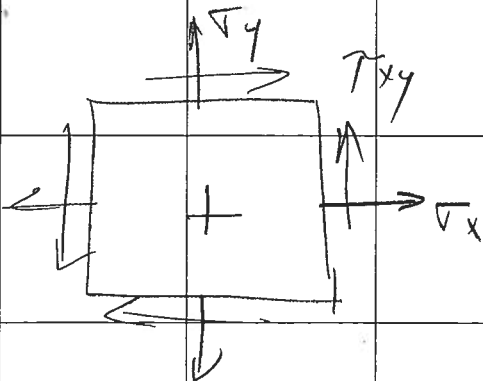


An element in plane stress is subjected to the stresses shown. Determine the stresses acting on an element oriented 60° clockwise from the element position shown. Show these stresses on a sketch of a properly oriented element.



Determine the proper signs of σ_x , σ_y , and τ_{xy}

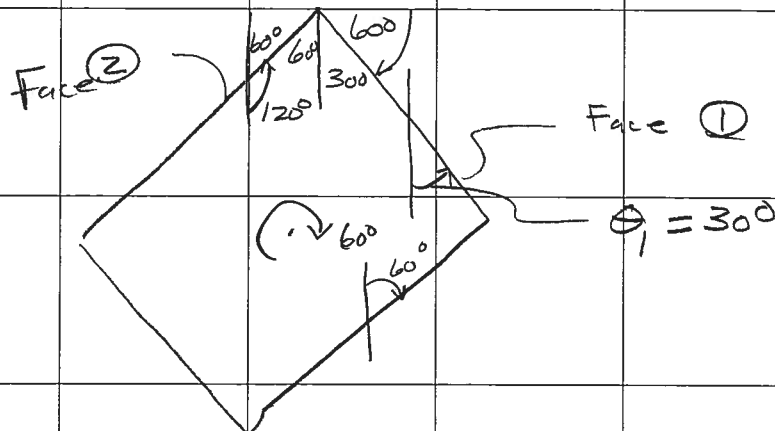


$$\sigma_x = 6.5$$

$$\sigma_y = 1.7$$

$$\tau_{xy} = 3$$

Make a sketch of the rotated element



Analyze Face ①

The angle θ for face ① is $\theta_1 = 30^\circ$

$$(1) \quad \sigma_\theta = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$$

$$(2) \quad \sigma_{30^\circ} = \frac{6.5 + 1.7}{2} + \frac{6.5 - 1.7}{2} \cos 60^\circ + 3 \sin 60^\circ$$

$$(3) \quad \sigma_{30^\circ} = 4.100 + 1.200 + 2.598$$

$$(4) \quad \sigma_{30^\circ} = +7.898$$

$$(5) \quad \tau_\theta = - \left(\frac{\sigma_x - \sigma_y}{2} \right) \sin 2\theta + \tau_{xy} \cos 2\theta$$

$$(6) \quad \tau_{30^\circ} = - \left(\frac{6.5 - 1.7}{2} \right) \sin 60^\circ + 3 \cos 60^\circ$$

$$(7) \quad \tau_{30^\circ} = -2.078 + 1.5$$

$$(8) \quad \underline{\tau_{30^\circ} = -.578}$$

Analyze Face (2)

The angle θ for face (2) is $\theta_2 = 120^\circ$

$$(9) \quad \sigma_{120^\circ} = \left(\frac{6.5 + 1.7}{2} \right) + \left(\frac{6.5 - 1.7}{2} \right) \cos 240^\circ + 3 \sin 240^\circ$$

$$(10) \quad \sigma_{120^\circ} = 4.100 - 1.20 - 2.598$$

$$(11) \quad \underline{\sigma_{120^\circ} = +.302}$$

$$(12) \quad \tau_{120^\circ} = - \left(\frac{6.5 - 1.7}{2} \right) \sin 240^\circ + 3 \cos 240^\circ$$

$$(13) \quad \tau_{120^\circ} = +2.078 - 1.5$$

$$14 \quad \underline{\tau_{120^\circ} = +.578}$$

Show results on a properly oriented sketch

