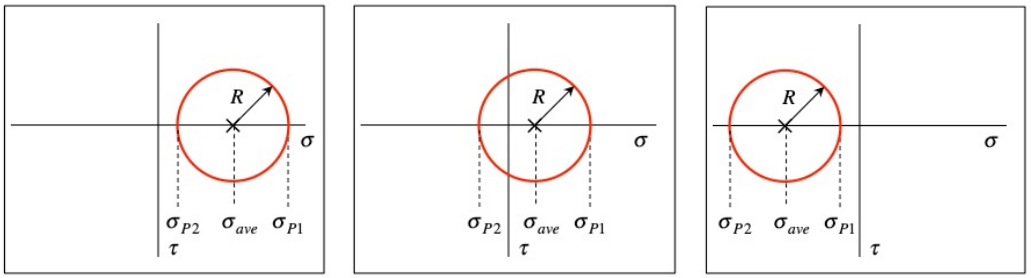
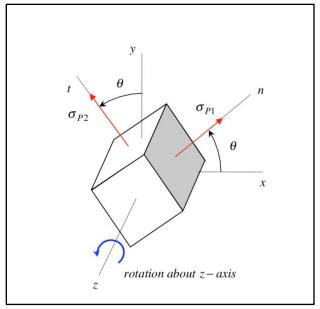
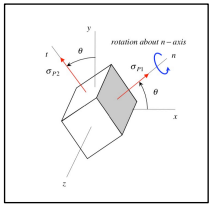
Summary: Absolute maximum shear stress

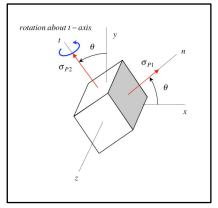
PROBLEM: For plane stress, the stress transformation equations produces a Mohr's circle of radius R and center at $(\sigma, \tau) = (\sigma_{ave}, 0)$. Depending on the relative sizes of R and σ_{ave}, we have three possibilities of Mohr's circle shown below. Here we rotate about z to where n is a principal axis, as shown below.



$\sigma_{ave} \geq R > 0$ $\quad R \geq |\sigma_{ave}|$ $\quad -R \geq \sigma_{ave}$

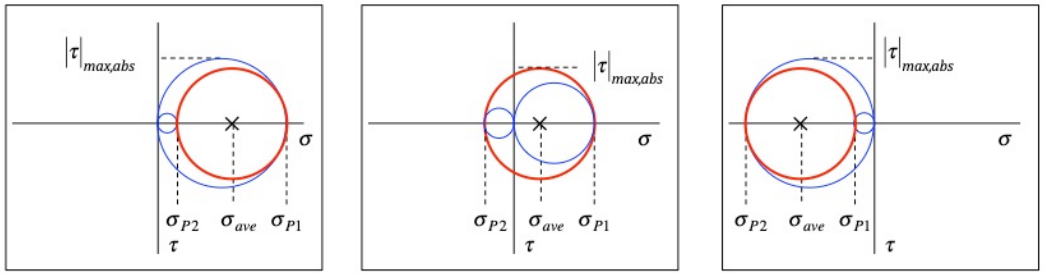






Subsequent rotation about the n-axis produces a Mohr's circle between 0 and σ_{P2} on the σ-axis. Similarly, an alternate rotation about the t-axis produces a Mohr's circle between 0 and σ_{P1} on the σ-axis.

CONCLUSION: The absolute maximum shear stress, $|\tau|_{max,abs}$,for each of the three cases is shown below. *Do not memorize these results* - simply draw your three Mohr's circles, and your figure gives you the answer!



$|\tau|_{max,abs} = \sigma_{P1}/2$ $\quad |\tau|_{max,abs} = R$ $\quad |\tau|_{max,abs} = |\sigma_{P2}|/2$