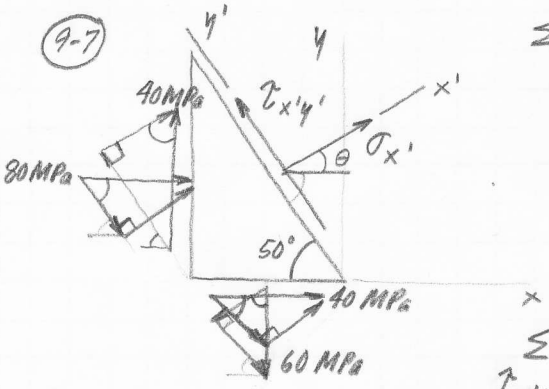
K. Dennehy Ch. 9, Pgs. 462-468: 9-7, 9-8, 9-31, 9-32 HW

(9-7)



$\Sigma F_{x'} = 0$

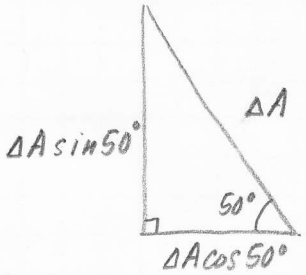
$\sigma_{x'} \Delta A + 40\,MPa \sin 50° \Delta A \cos 50° - 60\,MPa \cos 50° \Delta A \cos 50°$
$+ 40\,MPa \cos 50° \Delta A \sin 50° + 80\,MPa \sin 50° \Delta A \sin 50° = 0$

$\sigma_{x'} = 60\,MPa \cos^2 50° - 80\,MPa \sin^2 50°$
$- (2)\,40\,MPa \cos 50° \sin 50° = \boxed{-61.5\,MPa}$

$\Sigma F_{y'} = 0$

$\tau_{x'y'} \Delta A - 40\,MPa \cos 50° \Delta A \cos 50° - 60\,MPa \sin 50° \Delta A \cos 50°$
$+ 40\,MPa \sin 50° \Delta A \sin 50° - 80\,MPa \cos 50° \Delta A \sin 50° = 0$

$\tau_{x'y'} = 40\,MPa \cos^2 50° - 40\,MPa \sin^2 50°$
$+ (60\,MPa + 80\,MPa) \cos 50° \sin 50° = \boxed{62.0\,MPa}$



(9-8)

$\sigma_x = -80\,MPa$
$\sigma_y = 60\,MPa$
$\tau_{xy} = -40\,MPa$
$\theta = 40°$

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

$= \frac{-80+60}{2} + \frac{-80-60}{2} \cos 80° + (-40) \sin 80°$

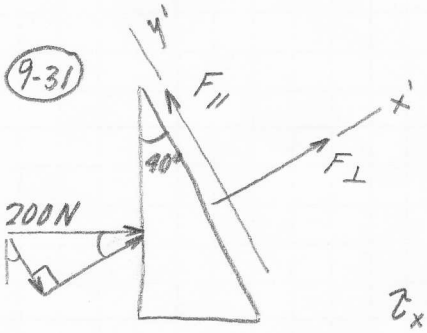
$= \boxed{-61.5\,MPa}$

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

$= -\frac{(-80)-60}{2} \sin 80° + (-40) \cos 80°$

$= \boxed{62.0\,MPa}$

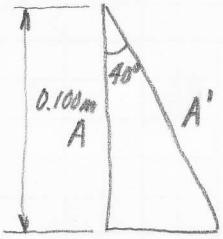
(9-31)



$\Sigma F_{x'} = 0, \quad F_{\perp} + 200\,N \cos 40° = 0$
$F_{\perp} = -153.21\,N$

$\Sigma F_{y'} = 0, \quad F_{\parallel} - 200\,N \sin 40° = 0$
$F_{\parallel} = 128.56\,N$

$\tau_{x'y'} = \frac{F_{\parallel}}{A'} = \frac{128.56\,N}{8.038 \times 10^{-4} m^2}$
$= 159{,}935.7 \frac{N}{m^2}$ or $\boxed{160\,kPa}$



wall thickness = 0.002 m

$A = \pi (r_o^2 - r_i^2)$
$= \pi ((0.050\,m)^2 - (0.048\,m)^2)$
$= 6.1575 \times 10^{-4} m^2$

$A' \cos 40° = A$

$A' = \frac{6.1575 \times 10^{-4} m^2}{\cos 40°} = 8.038 \times 10^{-4} m^2$

(9-32)

$\sigma_{x'} = \frac{F_{\perp}}{A'} = \frac{-153.21\,N}{8.038 \times 10^{-4} m^2}$
$= -190{,}605.7 \frac{N}{m^2}$ or $\boxed{-191\,kPa}$