SOLUTION:

USING TRANSFORMATION EQUATIONS THE STRESSES ON THE ELEMENT
ROTATED 15° ABOUT THE z AXIS ARE

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

$$= (40\,mPa)\cdot\cos^2(15°) + (10\,mPa)\sin^2(15°) + 2(0)\cdot\cos(15°)\sin(15°)$$

$$= \boxed{38.0\,mPa}$$

$$\sigma_{y'} = \sigma_x\cdot\sin^2\theta + \sigma_y\cdot\cos^2\theta - 2\cdot\tau_{xy}\cdot\sin\theta\cdot\cos\theta$$

$$= (40\,mPa)\cdot\sin^2(15°) + (10\,mPa)\cdot\cos^2(15°) - 2\cdot(0)\cdot\sin(15)\cos(15)$$

$$= \boxed{12.0\,mPa}$$

$$\tau_{x'y'} = -(\sigma_x-\sigma_y)\cdot\sin\theta\cdot\cos\theta + \tau_{xy}\cdot(\cos^2\theta-\sin^2\theta)$$

$$= -(40\,mPa-15\,mPa)\cdot\sin(15°)\cos(15) + (0)\cdot(\cos^2(15°)-\sin^2(15°))$$

$$= \boxed{7.5\,mPa}$$

THE PRINCIPAL STRESSES, CALCULATED USING EQUATIONS, ARE

$$\sigma_{1,2} = \frac{\sigma_x+\sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x-\sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$= \frac{(40\,mPa + 10\,mPa)}{2} \pm \sqrt{\left(\frac{40\,mPa-10\,mPa}{2}\right)^2 + (0)^2} =$$

$$= 25\,mPa \pm 15\,mPa$$

$$\boxed{\begin{array}{l}\sigma_1 = 40\,mPa \\ \sigma_2 = 15\,mPa\end{array}}$$

$$\tau_{max} = \pm\sqrt{\left(\frac{40\,mPa-10\,mPa}{2}\right)^2 + (0)^2} = \boxed{\pm15\,mPa}$$