SOLUTION (1.2)

Normal stress is

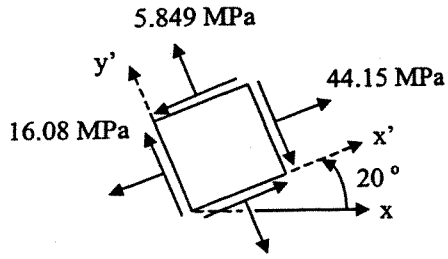
$$\sigma_x = \frac{P}{A} = \frac{125(10^3)}{0.05 \times 0.05} = 50 \ MPa$$

(a) Equations (1.8), with $\theta = 20^o$:

$$\sigma_{x'} = 50\cos^2 20^o = 44.15 \ MPa$$

$$\tau_{x'y'} = -50\sin 20^o \cos 20^o = -16.08 \ MPa$$

$$\sigma_{y'} = 50\cos^2(20^o + 90^o) = 5.849 \ MPa$$

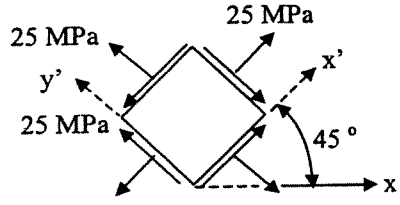


(b) Equations (1.8), with $\theta = 45^o$:

$$\sigma_{x'} = 50\cos^2 45^o = 25 \ MPa$$

$$\tau_{x'y'} = -50\sin 45^o \cos 45^o = -25 \ MPa$$

$$\sigma_{y'} = 50\cos^2(45^o + 90^o) = 25 \ MPa$$



SOLUTION (1.3)

From Eq. (1.8a),

$$\sigma_x = \frac{\sigma_{x'}}{\cos^2\theta} = \frac{-75}{\cos^2 30^o} = -100 \ MPa$$

For $\theta = 50^o$, Eqs. (1.8) give then

$$\sigma_{x'} = -100\cos^2 50^o = -41.32 \ MPa$$

$$\tau_{x'y'} = -(-100)\sin 50^o \cos 50^o$$

$$= 49.24 \ MPa$$

Similarly, for $\theta = 140^o$:

$$\sigma_{x'} = -100\cos^2 140^o = -58.68 \ MPa$$

$$\tau_{x'y'} = -49.24 \ MPa$$

