Solutions

2.1

- $\sigma_{avg} = (80 + 20)/2 = \mathbf{50.0}$ MPa.
- $R = \sqrt{30^2 + 30^2} = \sqrt{1800} = \mathbf{42.4}$ MPa.

2.2

- $\sigma_1 = 50 + 42.4 = \mathbf{92.4}$ MPa.
- $\sigma_2 = 50 - 42.4 = \mathbf{7.6}$ MPa.
- $\theta_p = \tan^{-1}(2 \times 30/60)/2 = 45/2 = \mathbf{22.5}^\circ$.

2.3

- Both principals positive, so the absolute-maximum shear is $\sigma_1/2 = \mathbf{46.2}$ MPa.

2.4

- The principals would straddle zero, so the absolute-maximum shear becomes the in-plane radius itself.
- $R' = \sqrt{50^2 + 30^2} = \sqrt{3400} = \mathbf{58.3}$ MPa.

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