1. An element of material is subjected to the following state of plane stress: F_x = 12 MPa, F_y = -8 MPa, and J_{xy} = -4 MPa. Determine the principal stresses and show them on a sketch of a properly oriented element, and determine the maximum in-plane shear stress and the average normal stress and show them on a sketch of a properly oriented element.

2. An element of material is subjected to the following state of plane strain: $\epsilon_x = 300\mu$, $\epsilon_y = 750\mu$, and $\gamma_{xy} = 450\mu$. Determine the strain components $\epsilon_{x'}$, $\epsilon_{y'}$, and $\gamma_{x'y'}$ for an element rotated (counterclockwise) by an angle of $\theta = 30°$. Use the calculated strains to produce a sketch of the deformed x'y' element.
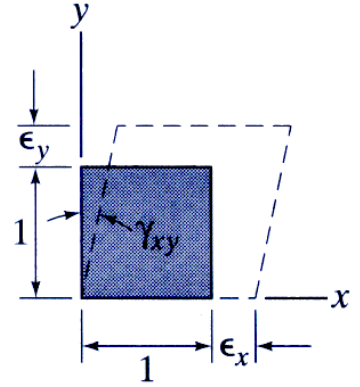
3. At a point on the surface of a steel machine component, the strain rosette measured the following strains: $\varepsilon_a = 700\mu$, $\varepsilon_b = 560\mu$, and $\varepsilon_c = -280\mu$. Letting $E = 30\times10^6$ psi and $\nu = 0.30$, determine the stress components σ_x, σ_y, and τ_{xy} at the rosette location.

Gage b, y, 135°, Gage a, 90°, 135°, Gage c, x
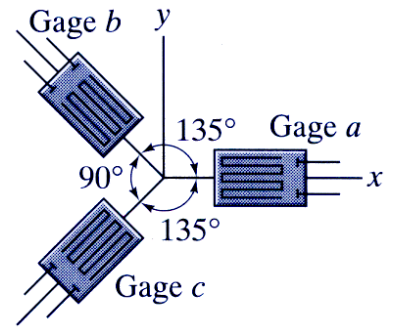
4. Hemispherical end caps are attached to a cylindrical main body to form a propane storage tank. The tank has an inside diameter of $d_i = 40$ in. and is to be subjected to a maximum internal gage pressure of $p = 120$ psi. The allowable tensile stress F in the wall of the tank is 12 ksi. Determine the minimum wall thickness t_c of the cylindrical part of the tank, and determine the minimum wall thickness t_s of the spherical part of the tank.