ME 3300 TEAM QUIZ #1 S.09 (Open Book)

Names: [illegible]

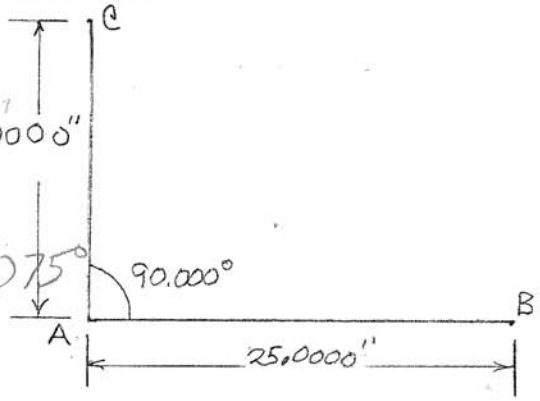
A steel plate 2 ft by 3 ft by ¼ inch thick, while unstressed, has etched on its surface the lines shown (assume that it is possible to make such accurate length and angle measurements). A state of plane stress, with σ_x = 30,000 psi σ_y = - 20,000 psi and τ_{xy} = - 15,000 psi,.is then uniformly applied to the plate. If E = 30X10^6 psi and ν = 0.30. Determine:

The final dimension of line AB 25.03in

The final dimensions of line AC 14.985 in

The final plate thickness 0.2499 in

The final angle between the line AB and AC 90.075°



$\epsilon_x = \frac{10^3}{30\times10^6}[30 - .3(20)] = .0012$ in

$\delta_x = \epsilon_x(25) = (.03) \rightarrow (AB)_f = 25+.03$

$\epsilon_y = \frac{10^3}{30\times10^6}[-20 - .3(30)] = -0.000966667$

$\delta_y = \epsilon_y(15) = -.0145$ $(AC)_{final} = 15+(-.0145) = 14.985$

$\epsilon_z = \frac{10^3}{30\times10^6}[-.3(30-20)] = -0.0001$

$(t)_{final} = .25(1-0.0001) = 0.2499$

$\gamma = \frac{\tau}{G}$ $G = \frac{E}{2(1+\nu)} = \frac{30\times10^6}{2.6} = 11.5385\times10^6$

$\gamma = \frac{-15{,}000}{11.5385\times10^6} = -0.0013$ rad $= 0.0748°$

So $(\theta)_{final} = 90.0748°$