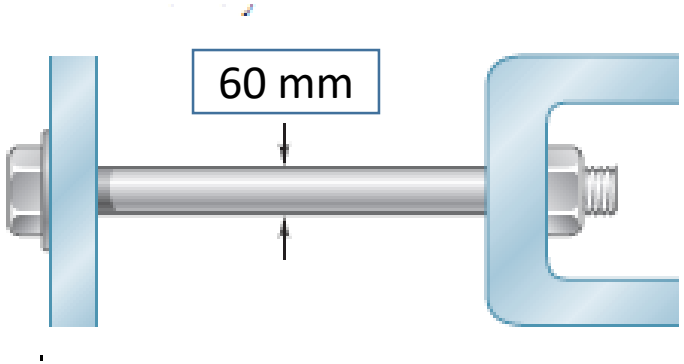
Question 1

Tutorial 7

The change in diameter of a large steel bolt is carefully measured as the nut is tightened.

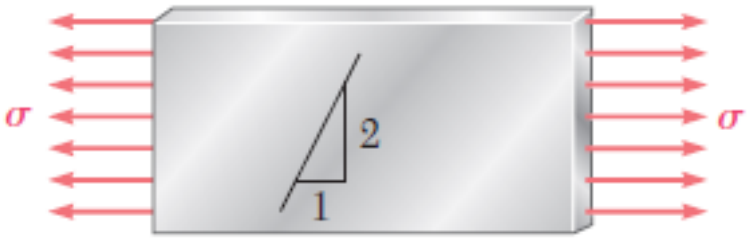
E = 200 GPa and $\boldsymbol{\nu}$ = 0.30



Determine the internal force in the bolt, if the diameter is observed to decrease by 0.013 mm.

Question 2

An aluminum plate (E = 74 GPa, $\boldsymbol{\nu}$ = 0.33) is subjected to a centric axial load that causes a normal stress σ.



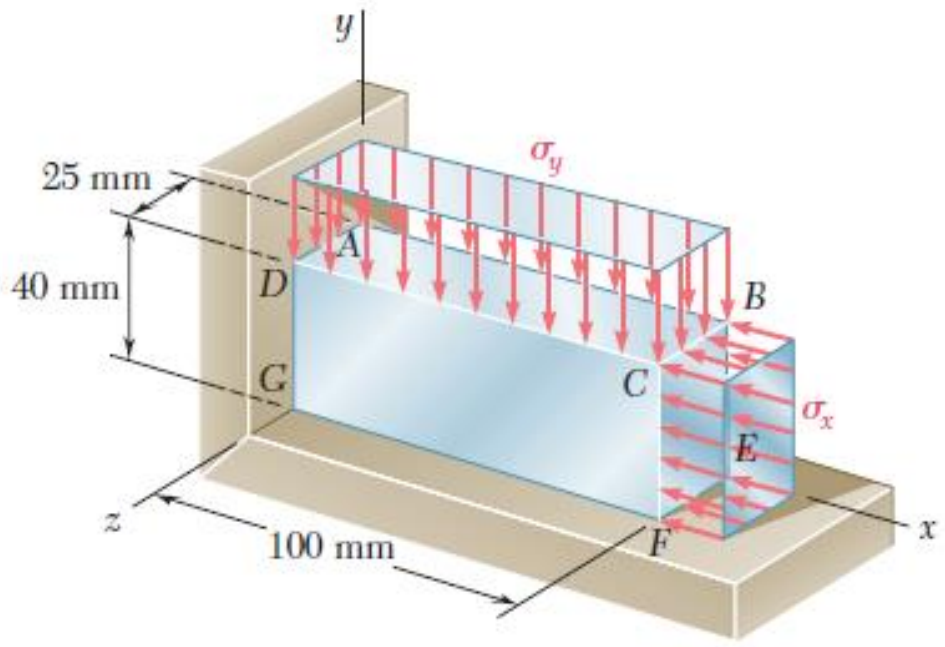
Before loading, a line of slope 2:1 was scribed on the plate Determine the slope of the line when $\boldsymbol{\sigma}$ =125 MPa.

Question 3

The block shown is made of a magnesium alloy for which E = 45 GPa and $\boldsymbol{\nu}$ = 0.35.

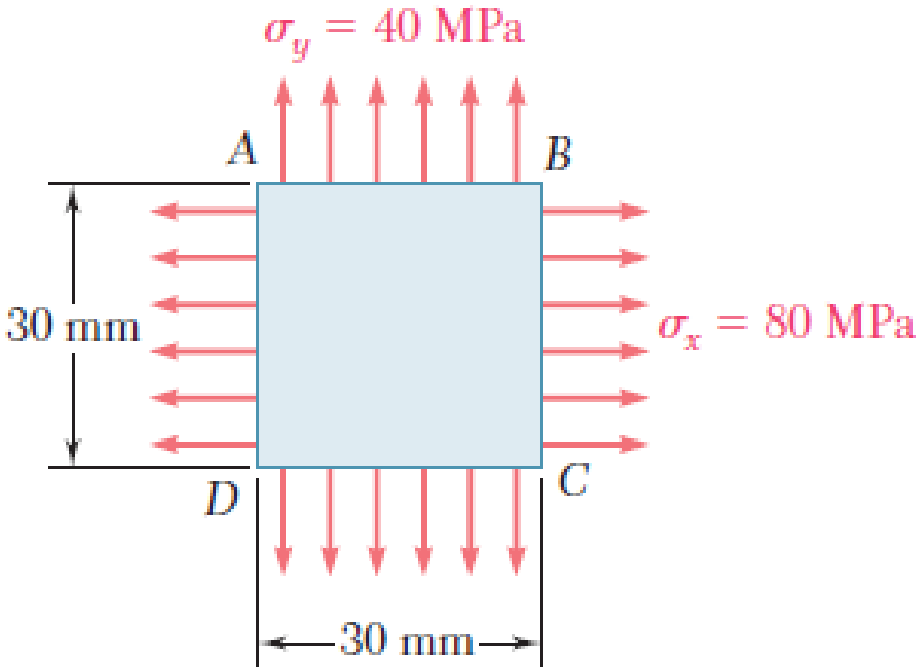
$\boldsymbol{\sigma}_x$ = -180 Mpa

Determine (*a*) the magnitude of $\boldsymbol{\sigma}_y$ for which the change in the height of the block will be zero, (*b*) the corresponding change in the area of the face *ABCD*, (*c*) the corresponding change in the volume of the block.



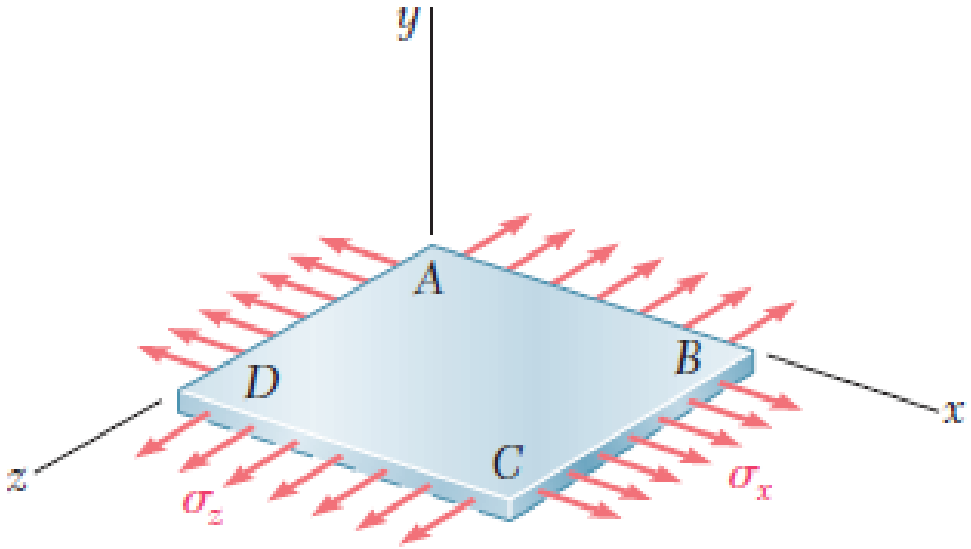
Question 4

A 30-mm square was scribed on the side of a large steel pressure vessel. After pressurization the biaxial stress condition at the square is as shown. For E = 200 GPa and ν = 0.30 , determine the change in length of (*a*) side *AB*, (*b*) side *BC*, (*c*) diagonal *AC*.



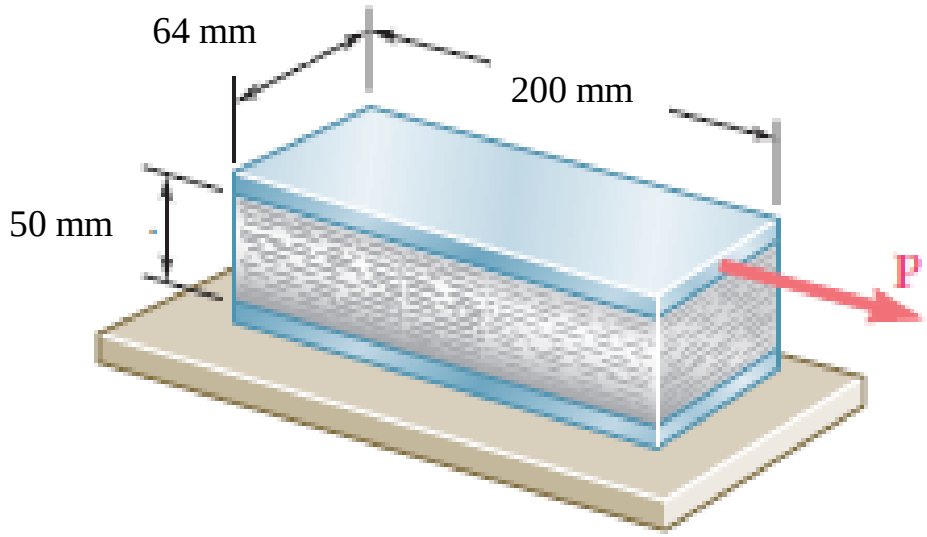
Question 5

The homogeneous plate *ABCD* is subjected to a biaxial loading as shown. It is known that $\boldsymbol{\sigma}_z = \boldsymbol{\sigma}_0$ and that the change in length of the plate in the *x* direction must be zero, that is, $\boldsymbol{\epsilon}_x = 0$. Denoting by *E* the modulus of elasticity and by $\boldsymbol{\nu}$ Poisson's ratio, determine (*a*) the required magnitude of $\boldsymbol{\sigma}_x$, (*b*) the ratio $\boldsymbol{\sigma}_0 / \boldsymbol{\epsilon}_z$

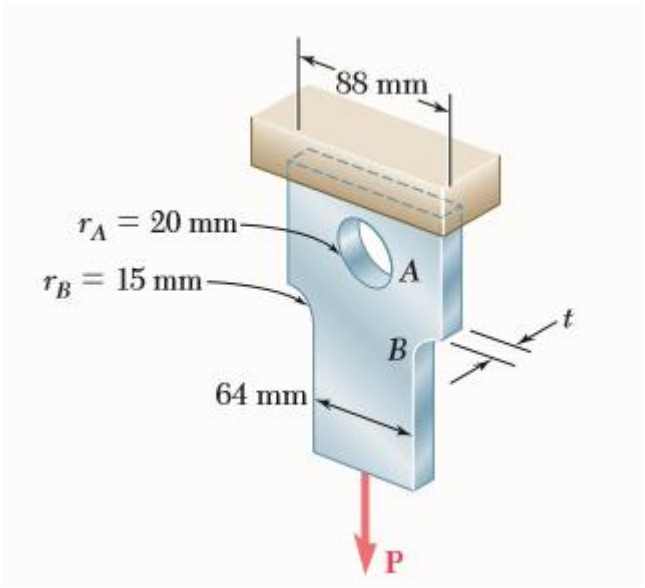


Question 6

A rectangular block of a material with a modulus of rigidity G = 620 MPa is bonded to two rigid horizontal plates. The lower plate is fixed, while the upper plate is subjected to a horizontal force **P.** Knowing that the upper plate moves through 1 mm. under the action of the force, determine (*a*) the average shearing strain in the material, (*b*) the force **P** exerted on the upper plate.



Question 7



P = 100 kN

Determine the minimum plate thickness t required if the allowable stress is 125 MPa.