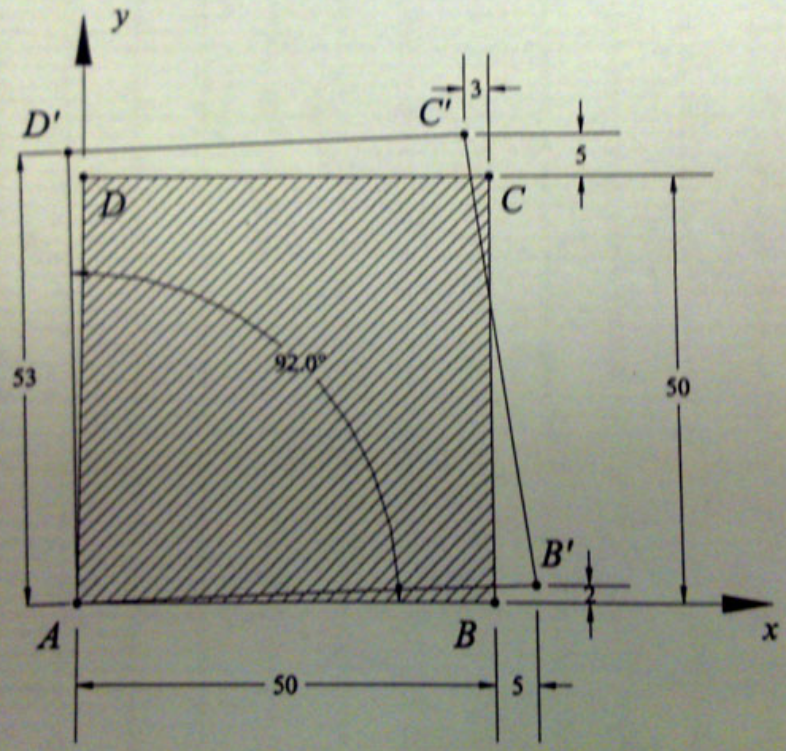
PROBLEM 1: **(20 points)**

The piece of rubber ***ABCD*** is originally square. After deformation its shape is defined by the polygon line ***AB'C'D'***.

Determine the average shear strain γ_{xy} at point ***A***.

Determine the average normal strain along the diagonals ***AC*** and ***BD***.



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Showing your points and construction on graphs and the assoc
quantities

1. Proportional Limit,
2. Modulus of Elasticity,
3. Yield Stress at 0.2% Offset,
4. The permanent strain in the bar when it is loaded in ter
   the load is removed.
5. If the bar is reloaded, what is the <u>new proportional limit</u>

1- The proportional limit

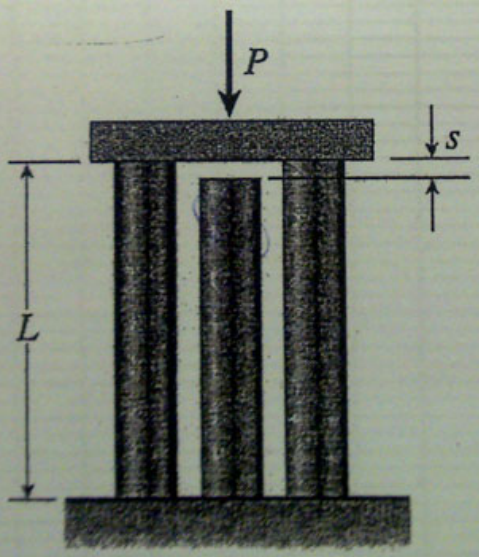
2- $E = \frac{9.0 \times 10^6}{} = 4.5 \times 10^{1}$

PROBLEM 3: **(25 points)**

A compressive load P is transmitted through a rigid plate to three magnesium-alloy bars that are identic and symmetrically disposed about the middle bar, except that initially the middle bar is slightly short than the two others (see figure). The dimensions and properties of the assembly are as follows:

Length $L = 1.0$ m, cross-sectional area of each bar $A = 3000$ mm^2, modulus of elasticity $E = 45000$ MPa, and the gap $s = 1.0$ mm.

a) Calculate the load P_1 required to close the gap.
b) Calculate the downward displacement δ of the rigid plate when $P = 400$ kN.



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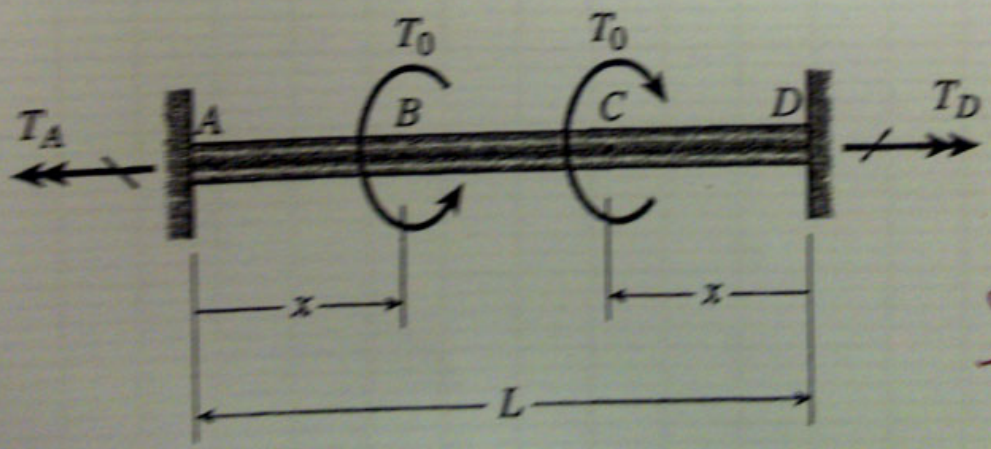
PROBLEM 4: **(20 points)**

A solid circular shaft ***ABCD*** with fixed supports at ends ***A*** and ***D*** is acted upon by two equal and o directed torques T_0, as shown in the figure. The torques are applied at points ***B*** and ***C***, each of located at distance x from one end of the shaft. (The distance x may vary from zero to $L/2$)

a) Determine the reactive torques T_A and T_D in terms of T_0, x and L.
b) For what distance x will the angle of twist ϕ at points ***B*** and ***C*** be a maximum?
c) What is the corresponding angle of twist ϕ_{max}?



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a) $\sum T_x = 0 \Rightarrow \sum T_x = 0$