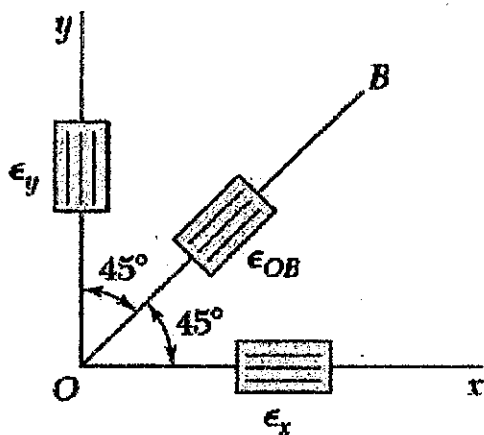


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

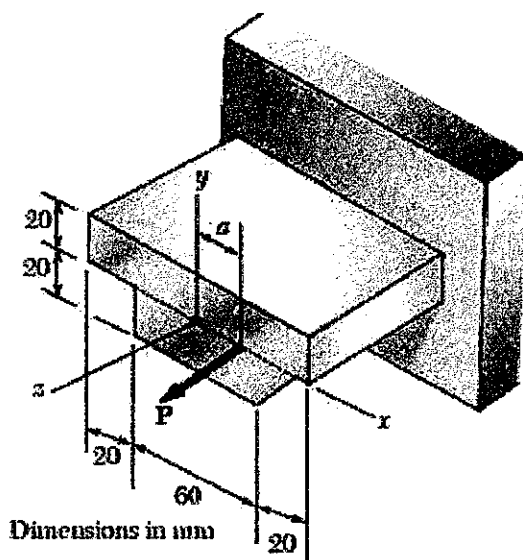
1. (20pts) Explain the following terms:

(a) true strain, (b) strain hardening, (c) brittle material, (d) factor of safety, (e) shear strain, (f) shear center, (g) idealized elastoplastic material, (h) elastic section modulus, (i) unsymmetric bending, (j) Castigliano's theorem.

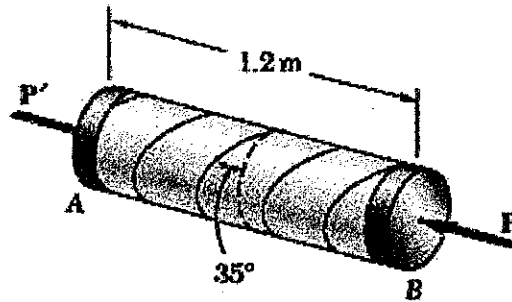
2. (10pts) The following figure is a strain rosette. How to use these three strain gages to determine the shear strain  $\gamma_{xy}$ ?



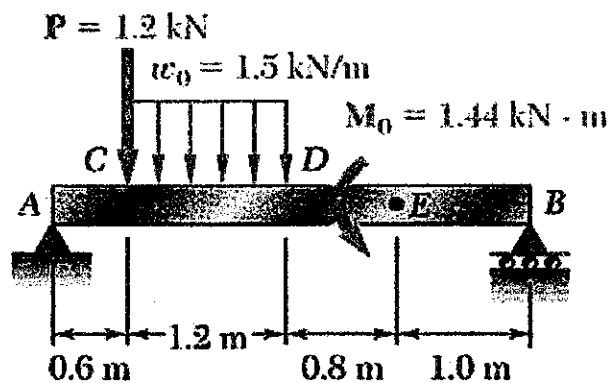
3. (20pts) A horizontal load  $P$  of magnitude of 100 kN is applied to the beam shown. Determine the largest distance  $a$  for which the maximum tensile stress in the beam does not exceed 75 MPa.



4. (20pts) A pressure vessel of 250-mm inner diameter and 6-mm wall thickness is fabricated from a 1.2-m section of spirally welded pipe  $AB$  and is equipped with two rigid end plates. The gage pressure inside the vessel is 2 MPa and 45-kN centric axial forces  $P$  and  $P'$  are applied to the end plates. Determine (a) the normal stress perpendicular to the weld, (b) the shear stress parallel to the weld ( $\sin 35^\circ = 0.57$ ,  $\cos 35^\circ = 0.82$ ,  $\sin 70^\circ = 0.94$  and  $\cos 70^\circ = 0.34$ ).



5. (10pts) Draw the shear and bending moment diagrams for the beam and loading shown.



6. (20pts) Also use the figure above, determine the deflection at the midpoint  $D$  ( $E = 200$  GPa and  $I = 6.87 \times 10^{-6}$  m<sup>4</sup>).