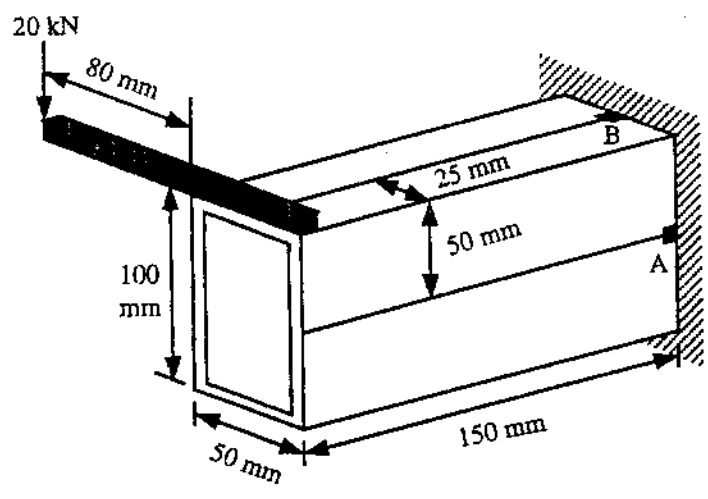
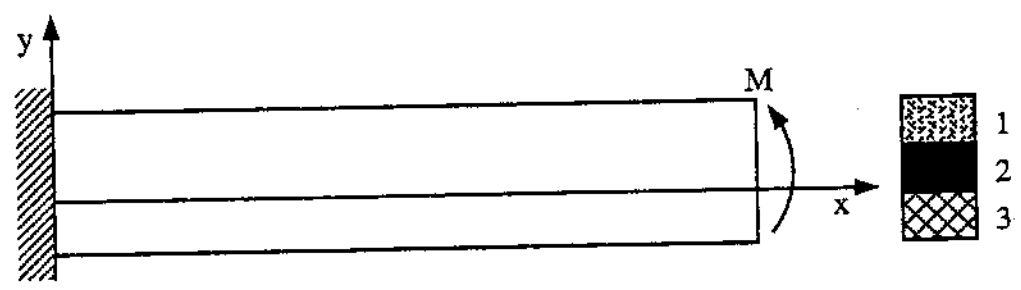


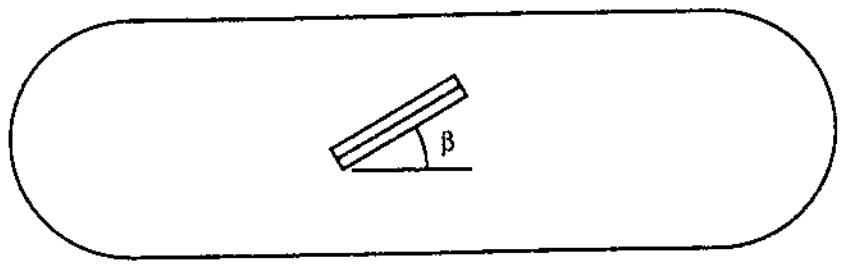
1. A vertical 20 kN force is applied to a rigid rod, which is welded to a cantilever tube. Knowing that the tube has a uniform wall thickness of 6 mm, determine the shear stress at points A and B on the tube. (20%)



2. A composite cantilever beam is made up of three materials and is subjected to a moment M at the free end. Assume that the moduli of elasticity for these materials are E_1 , E_2 and E_3 , respectively. (i) Derive equation to locate the neutral axis of the beam. (ii) Derive equations to calculate the normal stresses in the three materials. (20%)

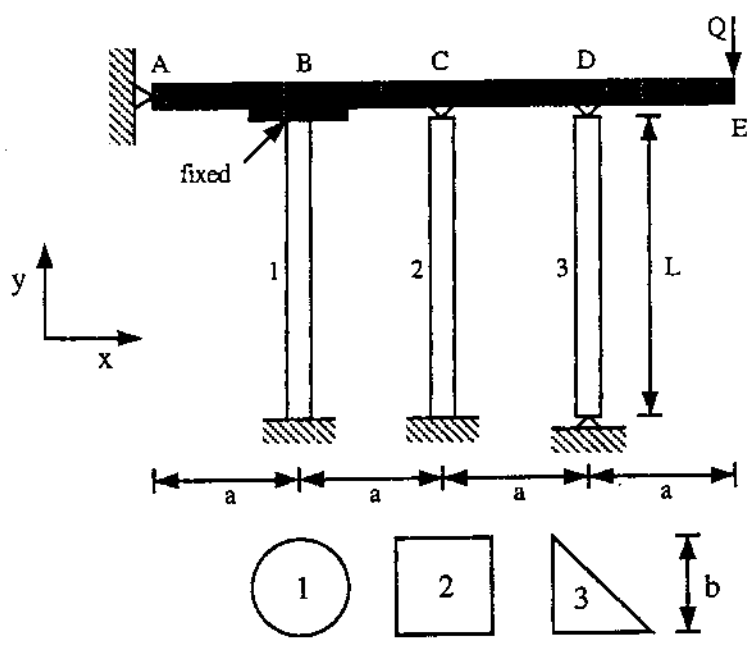


3. A strain gage forming an angle $\beta = 30^\circ$ with the horizontal axis is used to determine the pressure p in the cylindrical tank. The tank is made up of steel with $E = 29 \text{ Msi}$ and $\nu = 0.3$. The inner diameter and thickness of the tank are 36 in. and $3/8$ in., respectively. Determine the pressure p in the tank if the gage reading is $220 \times 10^{-6} \text{ in./in.}$? (20%)



(背面仍有題目,請繼續作答)

4. A rigid bar AE is subjected to a concentrated load Q at E and is supported by three solid columns at points B, C and D. The cross sections of these columns are circle, square and right isosceles triangle, respectively (their dimensions are shown below). These columns are made up of the same material (with modulus of elasticity E) and free to deform in any direction (not restricted to xy plane). At what load Q_{CR} does the system collapse by buckling of all the columns? (20%)



5. The bar has cross-sectional area A , modulus of elasticity E , and coefficient of thermal expansion α . The length of the bar at initial temperature T_0 is L and there is no initial axial force in the bar. The temperature of the bar is then increased such that the final temperatures at ends A and B are T_a and T_b ($T_b > T_a$), respectively. Assume that the final temperature in the bar varies linearly from end A to end B. Determine the axial force it exerts on the rigid walls after the temperature changes. (20%)

