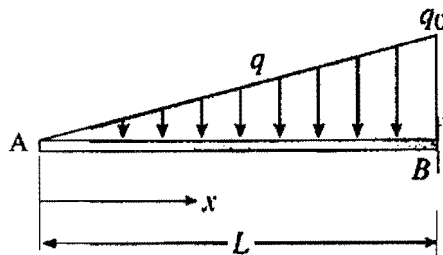1. (10%) A cantilever beam that is free at end A and fixed at end B is subjected to a tribute load q as shown below. Find the shear force and bending moment at distance x from the free end of the beam.



2. (20%) A cylindrical rod with a diameter d and length L is fixed at one end and subjected to load P at the axial direction, torsion T about the x-axis and moment $M_b$ about the y-axis. Determine the stresses located at points A and B on the root of the rod. On each point, also draw the stress directions on the simple cubic as shown below.



Cross section at root
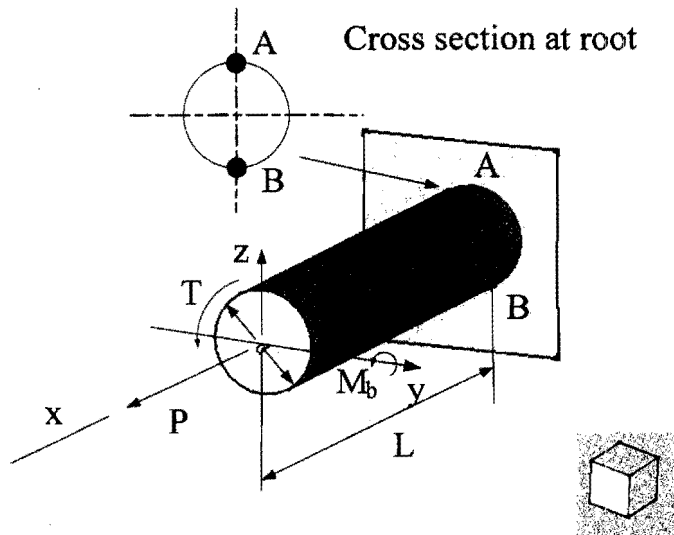
3. (20%) A solid steel cylinder S is placed inside a copper tube C having the same length. The coefficient of thermal expansion $\alpha_c$ of copper is larger than the coefficient $\alpha_s$ of the steel. The assembly is under a compression force P. Obtain the formula for the increase in temperature $\Delta T$ that will cause all the load to be carried by the copper tube.

Cross section area: $A_s$ and $A_c$ for steel and copper

Young's modulus: $E_s$ and $E_c$ for steel and copper
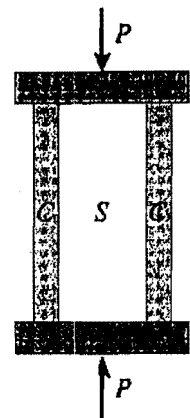


(背面仍有題目,請繼續作答)

4. (25%) The beam shown is subjected to a uniformly distributed load. The flexural rigidity $EI$ of the beam is constant; $E$ is Young's modulus of material, and $I$ is the second moment of inertia. Find (a) the equation of the deflection curve for the beam; and (b) all the support reactions. Do NOT use the method of superposition
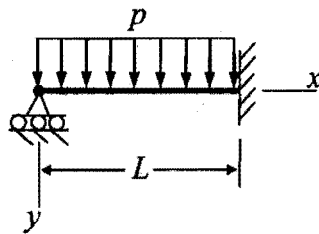


5. (25%) By solving the differential equation of the deflection curve, determine the critical load $P_{cr}$ and the equation of buckled mode shape for the ideal column shown