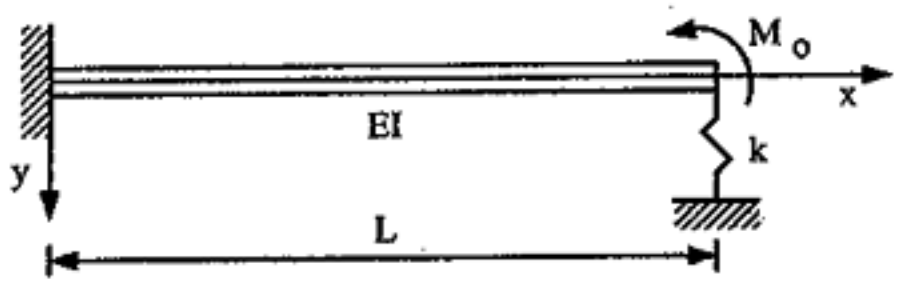
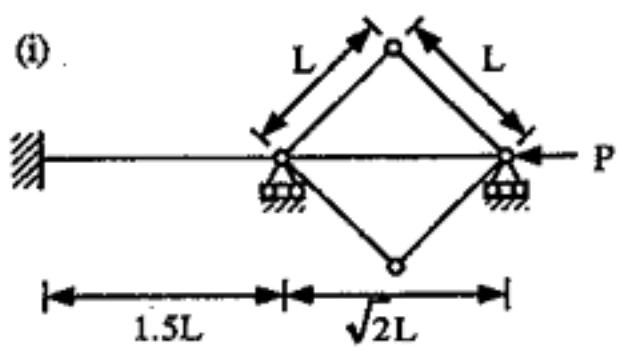
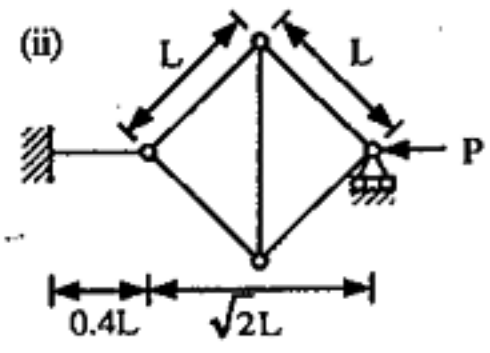
1. Use the 4th order differential equation to derive the deflection curve v(x) of the beam show below. (20%)

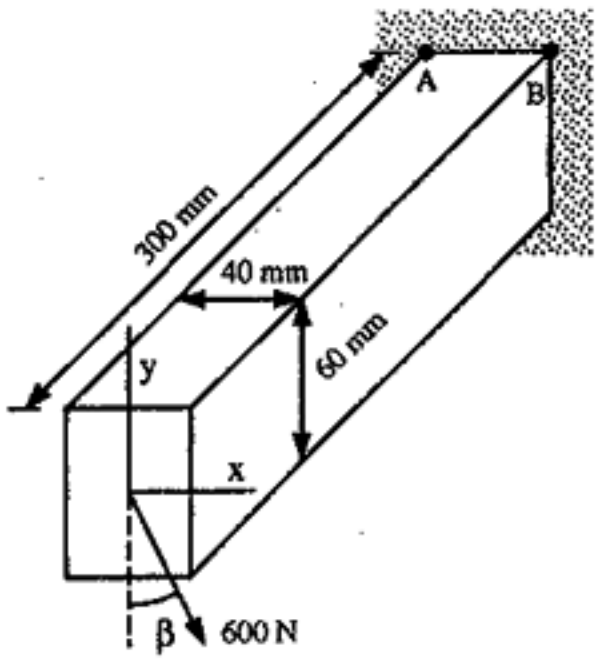


2. Assume all members have the same EI. What are the critical buckling loads P_{cr} for the following two structural systems? (20%)





3. A cantilever beam is subjected to a concentrated load 600 N at the center of the free end of the beam. The load forms an angle β between 0^o and 90^o with the vertical. (i) Determine the value of β for which the normal stress at point B is zero. (ii) Determine the value of β for which the normal stress at point A is maximum and the corresponding value of that stress. (20%)



(背面仍有題目,請繼續作答)

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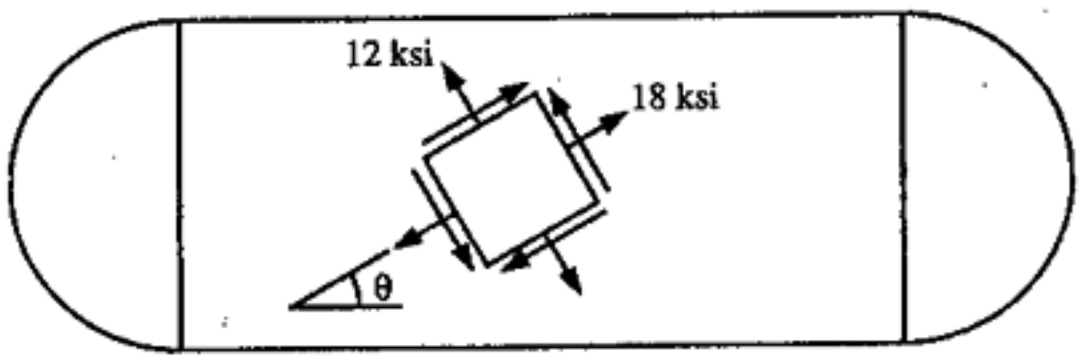
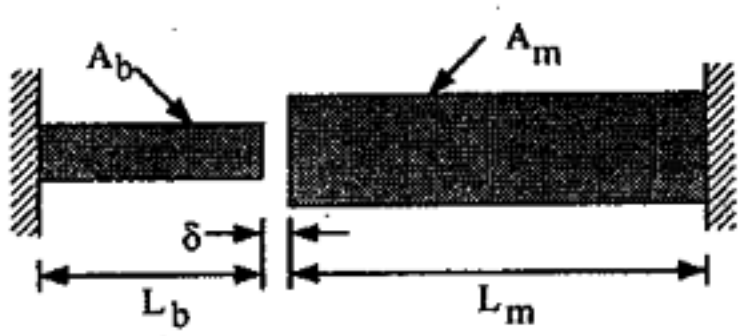
4. A cylindrical tank containing compressed air has wall thickness t = 0.5 in. and inside radius r = 10 in. The normal stresses in the wall of the tank acting on an inclined element have the values shown in the figure. (i) What is the air pressure p in the tank? (ii) What is the angle θ of the inclined element? (iii) What is the shear stress on that inclined element? (iv) What are the maximum inplane shear stress and the absolute maximum shear stress in the cylindrical tank. (20%)



5. The bimetallic thermal control shown in the figure is made of a brass (length L_b = 0.75 in. and cross-sectional area A_b = 0.1 in.^{2}) and a magnesium bar brass (length L_b = 1.3 in. and cross-sectional area A_b = 0.2 in.^{2}). There is a gap δ = 0.005 in. between their free ends at room temperature. Calculate the following quantities: (a) the temperature increase ΔT (above room temperature) at which the two bars come into contact, and (b) the stress σ in the magnesium bar when the temperature increase ΔT is 300 ^oF. Use the following material properties: $\alpha_b = 10\times10^{-6}/^oF$, $\alpha_m = 14.5\times10^{-6}/^oF$, $E_b = 15\times10^6$ psi, and $E_m = 6.5\times10^6$ psi. (20%)



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