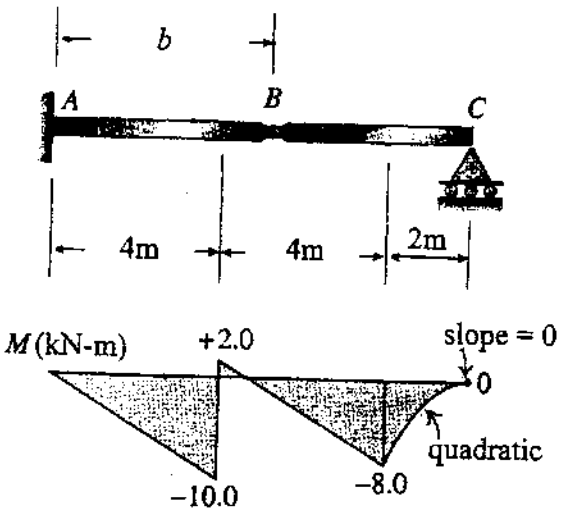
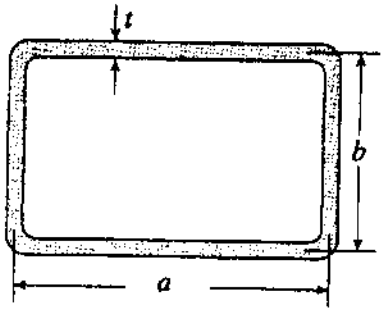
1. The bending-moment diagram for the compound beam ABC is shown in the figure. (a) Find the distance b of the internal hinge at B from point A. (b) Determine the loading on the beam. (20%)

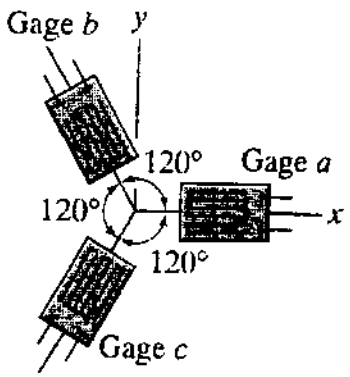


2. A thin-walled aluminum tube (the shear modulus $G = 28$ GPa) of rectangular cross section (see figure) is subjected to a torque $T = 200\,\mathrm{N\cdot m}$. The total length of the median line of the cross section is 160 mm. If the allowable shear stress is 30 MPa and the allowable rate of twist is $0.03\,\mathrm{rad/m}$, determine the smallest value of the minimum required thickness t_{min} for the varying ratio b/a. (20%)

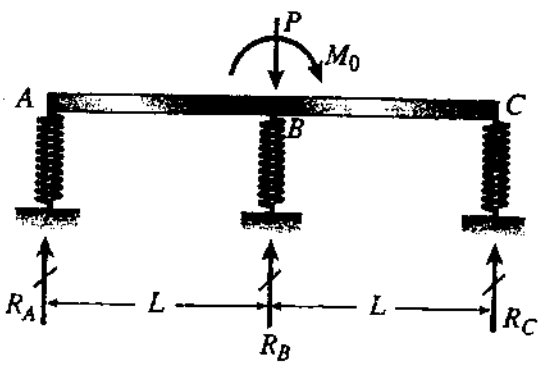


(背面仍有題目,請繼續作答)

3. The strain rosette (see figure) mounted at a point on the free surface of a structural component gives readings $\varepsilon_a = -300\times10^{-6}$, $\varepsilon_b = 200\times10^{-6}$ and $\varepsilon_c = 400\times10^{-6}$. If the material is steel with Young's modulus $E = 200$ GPa and Poisson's ratio $\nu = 1/3$, determine the principal stresses and the absolute maximum shear stress at the point. (20%)



4. A beam ABC is supported by three identical springs (see figure). The beam has constant flexural rigidity EI, and each spring has stiffness k. Determine all reactions of this beam due to the loading shown in the figure. (20%)



5. A box beam *ABC* is constructed from four wood boards and subjected to two concentrated loads, as shown in the figure. The boards are nailed at a longitudinal spacing s = 80 mm, with each nail having an allowable shear load of 200 N. All boards are 20 mm thick. What is the maximum permissible value of P that can be supported by this beam. (20%)