

系別：航空太空工程學系

科目：材 料 力 學

B

准帶項目請打「V」	
✓	簡單型計算機

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1. A slightly tapered bar AB of rectangular cross section and length L is acted upon by a force P as shown in Fig. 1. The width of the bar varies uniformly from b_2 at end A to b_1 at end B . The thickness t is constant.
 - (a) Determine the strain energy U of the bar. (10%)
 - (b) Determine the elongation δ of the bar by equating the strain energy to the work done by the external force P . (10%)

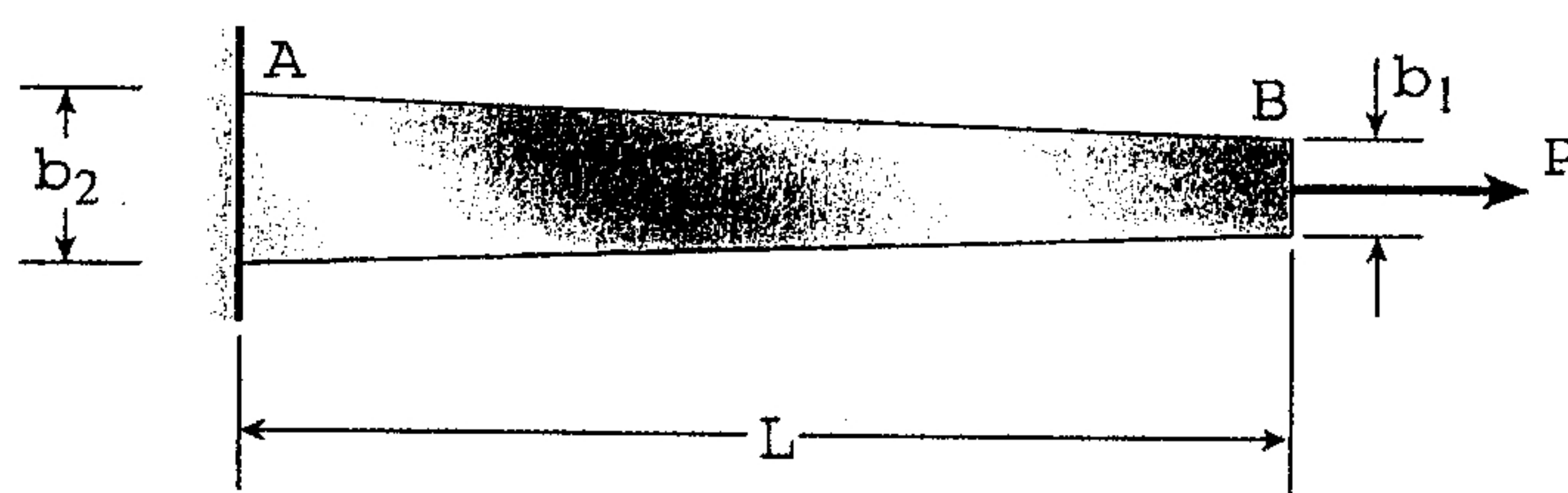


Fig. 1

2. A simple beam AB is loaded by two segments of uniform load and two horizontal forces acting at the ends of a vertical arm (see Fig. 2). Draw the shear-force and bending-moment diagrams for this beam. (25%)

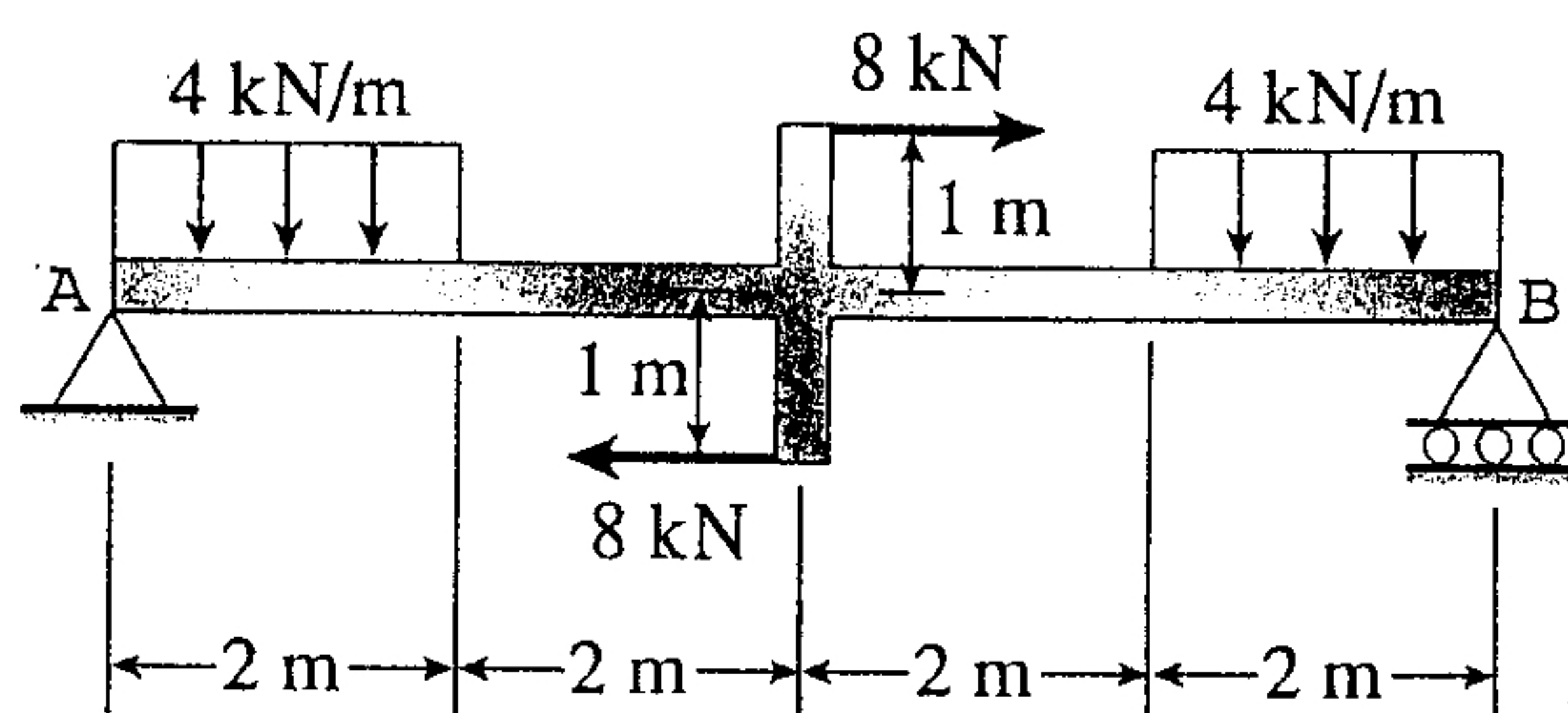


Fig. 2

本試題雙面印製

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3. A solid steel bar of diameter $d_1 = 1.50$ in. is enclosed by a steel tube of outer diameter $d_3 = 2.25$ in. and inner diameter $d_2 = 1.75$ in. Both bar and tube are held rigidly by a support at end A and joined securely to a rigid plate at end B . The composite bar, which has a length $L = 30.0$ in., is twisted by a torque $T = 5000$ lb-in. acting on the end plate.
- (a) Determine the maximum shear stresses τ_1 and τ_2 in the bar and tube, respectively. (15%)
- (b) Determine the angle of rotation ϕ (in degrees) of the end plate, assuming that the shear modulus of the steel is $G = 11.6 \times 10^6$ psi. (15%)

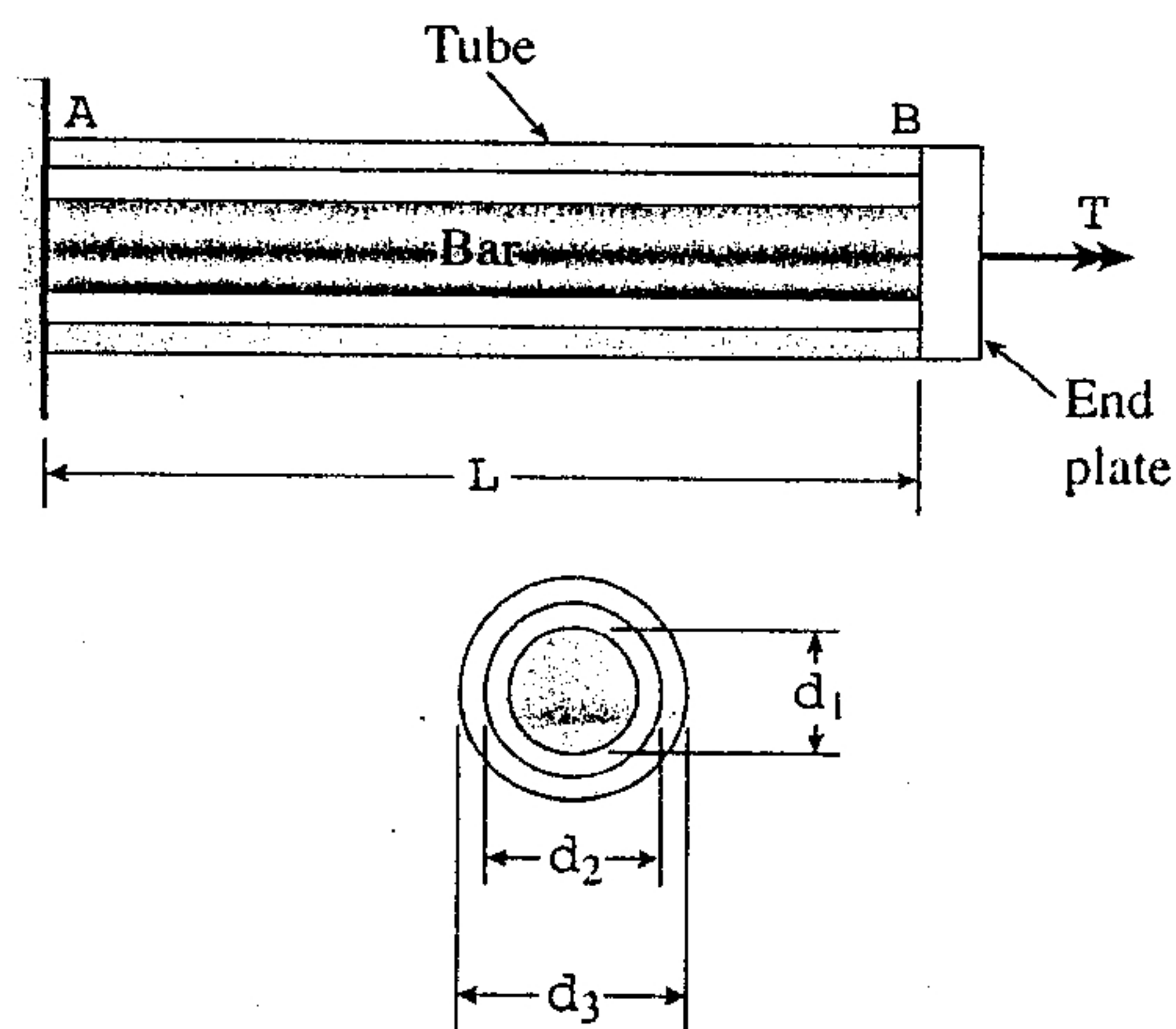


Fig. 3

4. During a test of an airplane wing, the strain gage readings from a 45° rosette (see Fig. 4) are as follows: gage A , 520×10^{-6} ; gage B , 360×10^{-6} ; and gage C , -80×10^{-6} . Determine the principal strains and maximum shear strains, and show them on sketches of properly oriented elements. (25%)

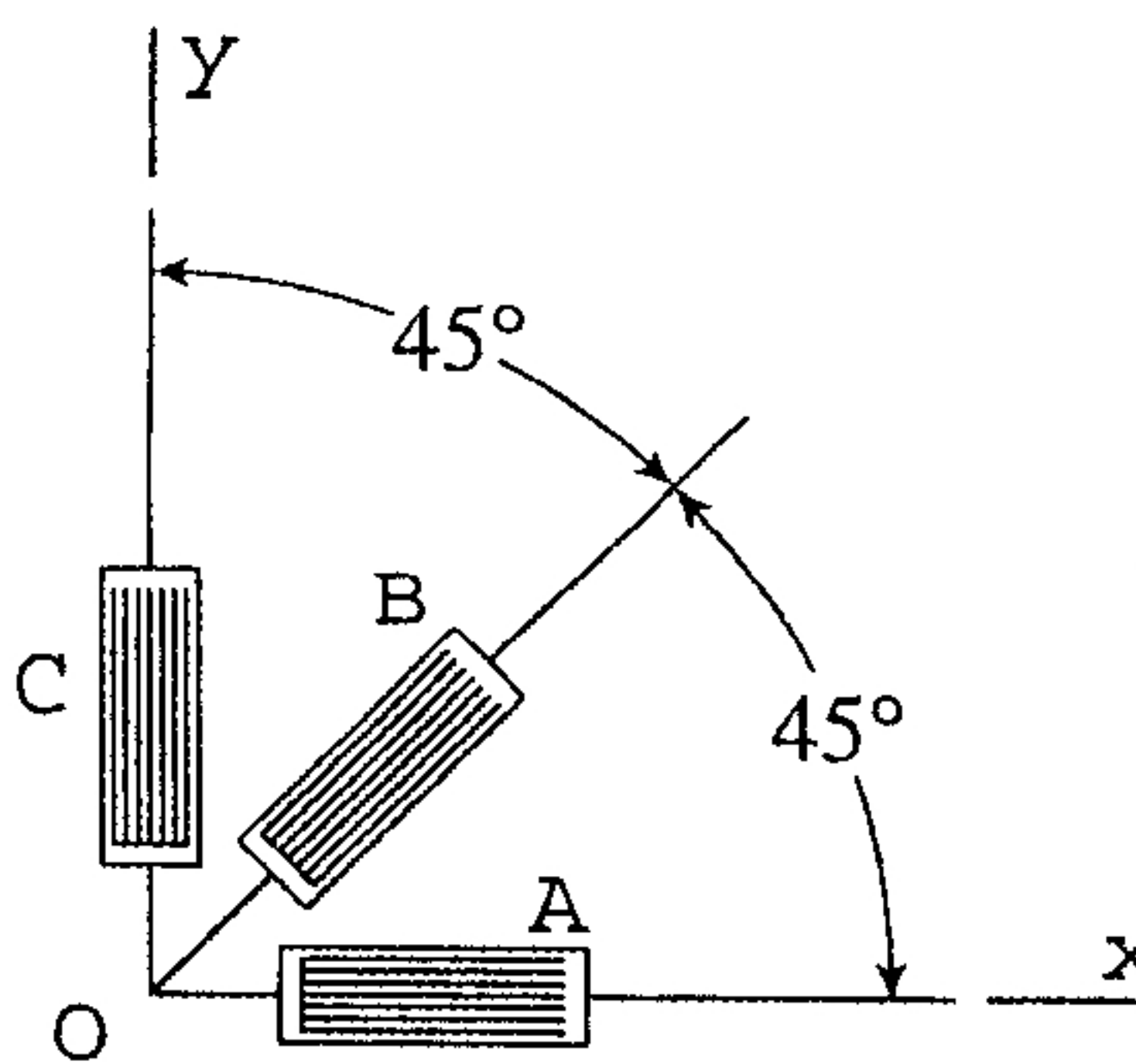


Fig. 4