

- What is the shear strain γ_{xy} ? (5%)
 - A plate shown in Fig. 1 is held in the rigid horizontal guides at its top and bottom, AD and BC. If its right side CD is given a uniform horizontal displacement of 2 mm, determine the shear strain at E relative to the x-y axes. (10%)
- A thin circular ring is hinged at each end and loaded by a central concentrated force P as shown in Fig. 2.
 - Determine the horizontal reactions at each end. (15%)
 - Determine the vertical displacement under the point of application of the central force P. (10%)

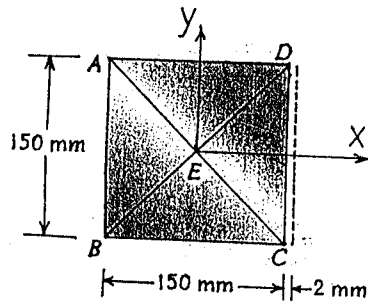


Fig. 1

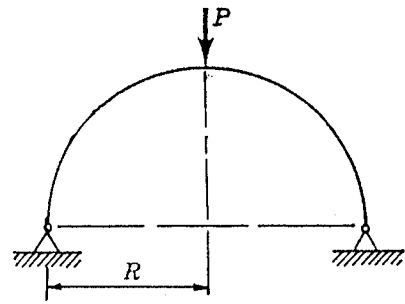
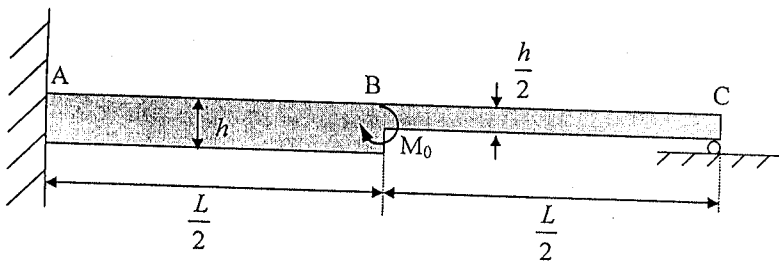


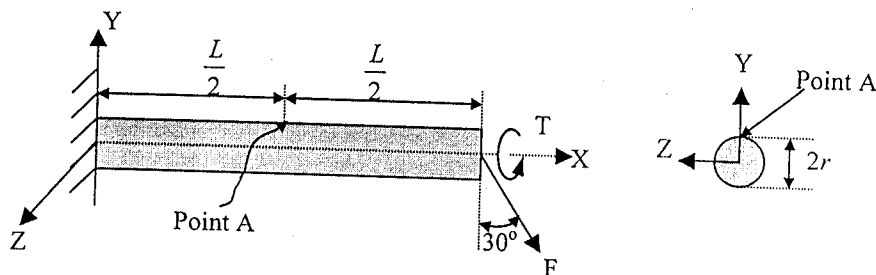
Fig. 2

- As shown in the figure, a non-uniform cantilevered beam is subject to a couple moment (M_0) at point B. Please determine, (a) the reaction force at point C, and (b) the deflection at point B. The width of the beam is b and the Young's modulus is E. (20%)



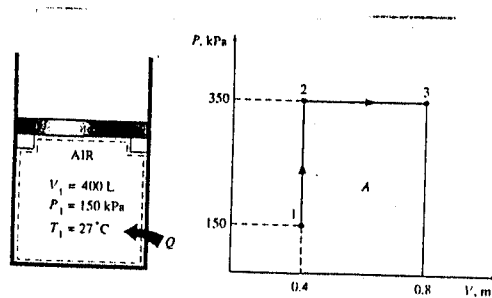
- A solid shaft is subjected to a force F and a torque T at the end as shown in the figure. Please determine (a) all the six stress components at point A, and (b) the magnitudes of principal stresses at point A. (20%)

(note: moment of inertia for circular area, $I_y = I_z = \frac{1}{4} \pi r^4$)



(背面仍有題目,請繼續作答)

5. A piston-cylinder device initially contains air at 150 kPa and 27°C. At this state, the piston is resting on a pair of stops, as shown, and the enclosed volume is 400L. The mass of the piston is such that a 350kPa pressure is required to move it. The air is now heated until its volume has doubled. Determine (a) the final temperature, (b) the work done by the air, and (c) the total heat transfer to the air. $C_v = 0.718 \text{ kJ/kg} \cdot \text{K}$ (10%)



6. Determine if this heat engine violates the second law of thermodynamics on the basis of (a) the Clausius inequality (b) the Carnot principle (10%)

