

1. (a) From the figures shown in below, please indicate which one represents the displacement diagram and its derivatives for full-rise simple harmonic motion of a cam-follower set. Where y is the displacement for a reciprocating follower, θ is the cam angle, β is the total angle with the corresponding total lift L . (5%)
- (b) Plot the displacement diagram of the simple harmonic motion mentioned in (a). Used θ/β as x-axis, y as y-axis, $x_{\max}=80\text{mm}$ (at $\theta/\beta=1$) and $y_{\max}=26.5\text{mm}$ (at total lift L). You must indicate the displacements at $\theta/\beta=0, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1$ on the drawing, and shortly describe the method you used. (8%)
- (c) Derive a equation to describe the displacement diagram of a cam-follower set which rises with simple harmonic motion mentioned in (a). (7%)

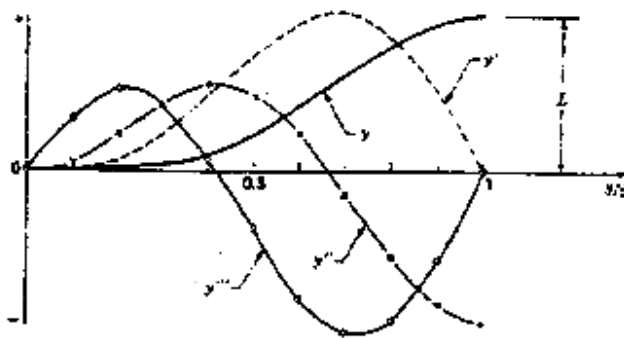


Fig. 1.1

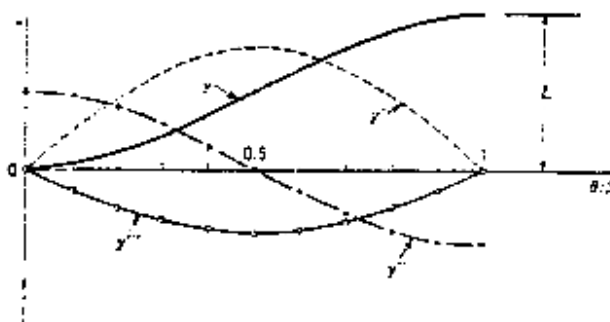


Fig. 1.2

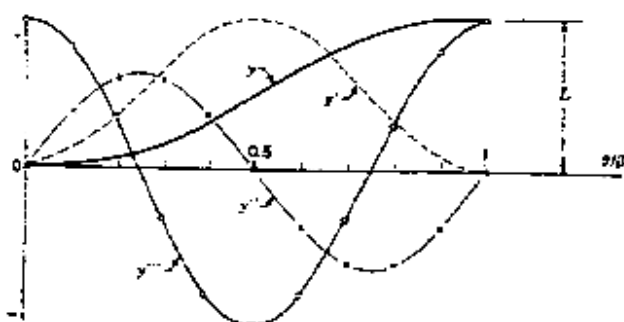
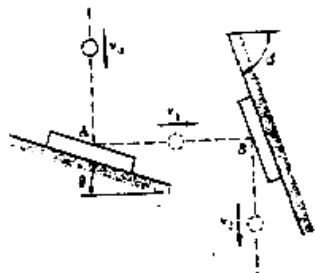


Fig. 1.3

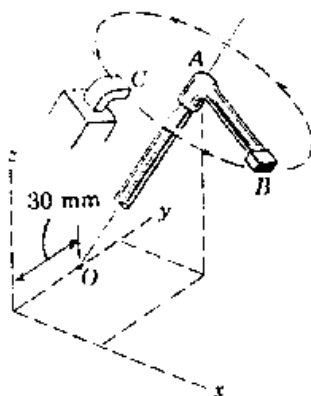
2. (20%) A steel ball falling vertically strikes a rigid plate A and rebounds horizontally as shown. Denoting by e the coefficient of restitution, determine (a) the required angle θ , (b) the magnitude of the velocity v_1 .



3. (20%) Water flows in a continuous sheet from between two plates A and B with a velocity v . The stream is split into two equal streams 1 and 2 by a vane attached to plate C . Denoting the total rate of flow by Q , determine the force exerted by the stream on plate C .



4. (20%) A timing mechanism consists of the rotating distributor arm AB and the fixed contact C . If the arm rotates about the fixed axis OA with a constant angular velocity $\omega = 30(3i + 2j + 6k)$ rad/s, and if the coordinates of the contact C expressed in millimeters are $(20, 30, 80)$, determine the magnitude of the acceleration of the tip B of the distributor arm as it passes point C .



5. (20%) The light rod and attached sphere of mass m are at rest in the horizontal position shown. Determine the period τ for small oscillations in the vertical plane about the pivot O .

