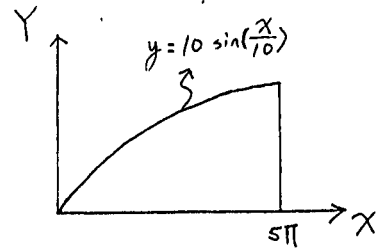


(一) 求解以下二微分方程式: (15分)

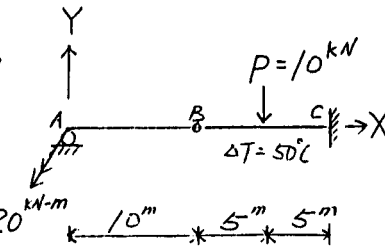
(a)  $(2y + x^2)dx = xdy$

(b)  $y'' + 4y' + 3y = 4e^{-x}$  且  $y(0) = 0, y'(0) = 2$ . Note:  $y'' = \frac{d^2y}{dx^2}, y' = \frac{dy}{dx}$

(二) Locate the centroid of the area bounded by the x-axis, the line  $x = 5\pi$  and the curve  $y = 10 \sin(\frac{x}{10})$  as shown at right. (15分)



(三) 樑之一端為固定端, 另一端為滾軸支承, 樑中央有一個hinge. 若hinge右邊之樑中央有一集中載重  $P = 10^{kN}$  向下, 而滾軸端有一出平面彎矩載重  $M = 20^{kN-m}$ . 若hinge右邊之樑同時受到溫度升高  $50^\circ C$  之荷載, 求桿件 (AC) 內:

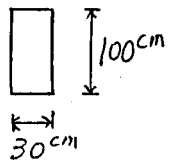


(a) 最大之拉應力為若干

(b) 最大之拉應力在 X 軸何處

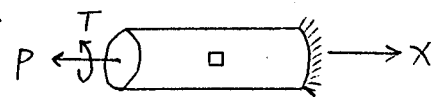
(c) 最大之拉應力位於樑斷面之上或下方

Note: 樑斷面為  $30cm \times 100cm$ ,  $\alpha = 23 \times 10^{-6} / ^\circ C$  (20分)



(四) A cylindrical shaft is fixed at one end as shown.

The free end is subjected to an axial force  $P = 3^{MN}$  and torsion  $T = 70^{kN-m}$  at the center as shown.



The diameter of the shaft is  $20cm$ . Assume no stress concentration effect.

(a) Calculate the principal stress of a square situated on the surface of the shaft.

(b) If the shaft is made of plane concrete and will crack under current loading, what would be the angle of the crack with respect to the X axis?

Note: For a circular shaft  $J_p = \frac{\pi r^4}{2}$  (30分)

(五) The cantilever beam AB supports a uniformly distributed load  $w$  and a concentrated load  $P$  as shown. knowing that  $L = 2^m$ ,  $w = 4^{kN/m}$ ,  $P = 6^{kN}$  and  $EI = 5^{MN-m^2}$ , determine the deflection at A (20分)

