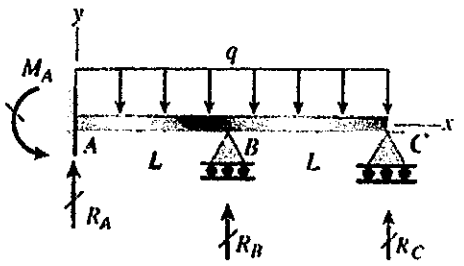
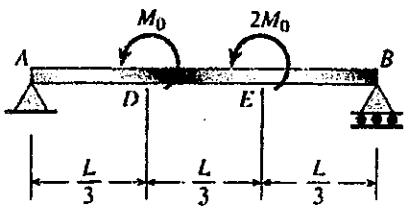
Problem 1 (30%)

A propped cantilever beam of length 2L with supports at B and C is loaded by a uniformly distributed load with intensity q. Determine all reactions, M_A, R_A, R_B, and R_C. (You may use the attached equations for your calculation)



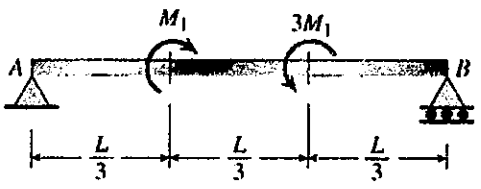
Problem 2 (30%)

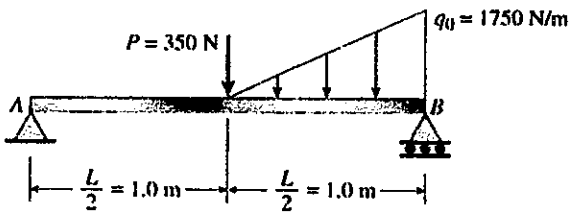
A simple AB is subjected to couples M_0 and $2M_0$ acting as shown in the figure. Determine the deflection δ at point D. (use the moment-area method)



Problem 3 (20%)

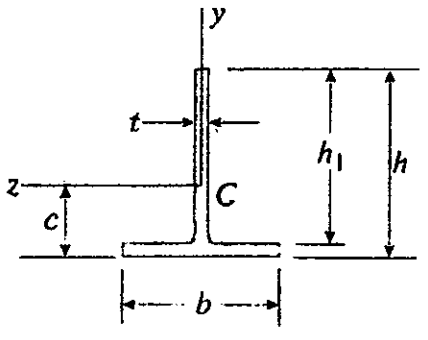
Draw the shear-force and bending-moment diagrams for each beam shown below. Clearly mark your graphs and indicate the nature of the curve (convex, concave, linear).





Problem 4 (20%)

The T-beam shown in the figure has cross-sectional dimensions as follows: $b = 210$ mm, $t = 16$ mm, $h = 300$ mm, and $h_1 = 280$ mm. The beam is subjected to a shear force $V = 68$ kN. Determine the maximum shear stress τ_{max} in the web of the beam.



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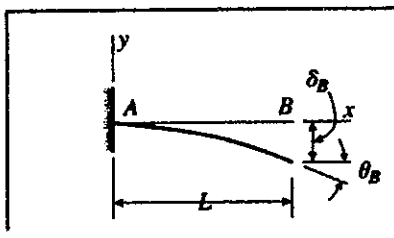
Deflections and Slopes of Cantilever Beams



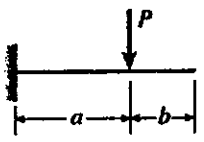
v = deflection in the y direction (positive upward)

$v' = dv/dx$ = slope of the deflection curve

$\delta_B = -v(L)$ = deflection at end B of the beam (positive downward)

$\theta_B = -v'(L)$ = angle of rotation at end B of the beam (positive clockwise)

EI = constant

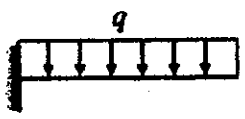


$$v = -\frac{Px^2}{6EI}(3a - x) \qquad v' = -\frac{Px}{2EI}(2a - x) \qquad (0 \le x \le a)$$

$$v = -\frac{Pa^2}{6EI}(3x - a) \qquad v' = -\frac{Pa^2}{2EI} \qquad (a \le x \le L)$$

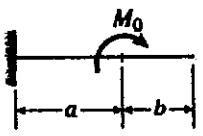
$$\text{At } x = a: \quad v = -\frac{Pa^3}{3EI} \qquad v' = -\frac{Pa^2}{2EI}$$

$$\delta_B = \frac{Pa^2}{6EI}(3L - a) \qquad \theta_B = \frac{Pa^2}{2EI}$$



$$v = -\frac{qx^2}{24EI}(6L^2 - 4Lx + x^2) \qquad v' = -\frac{qx}{6EI}(3L^2 - 3Lx + x^2)$$

$$\delta_B = \frac{qL^4}{8EI} \qquad \theta_B = \frac{qL^3}{6EI}$$



$$v = -\frac{M_0x^2}{2EI} \qquad v' = -\frac{M_0x}{EI} \qquad (0 \le x \le a)$$

$$v = -\frac{M_0a}{2EI}(2x - a) \qquad v' = -\frac{M_0a}{EI} \qquad (a \le x \le L)$$

$$\text{At } x = a: \quad v = -\frac{M_0a^2}{2EI} \qquad v' = -\frac{M_0a}{EI}$$

$$\delta_B = \frac{M_0a}{2EI}(2L - a) \qquad \theta_B = \frac{M_0a}{EI}$$

試題隨卷繳回