

Answers

1. (b) $v(x) = x \tan \theta \left(1 - \frac{x}{2L}\right)$
2. (a) $t = \frac{LT}{EA}$, $s = \frac{5L^3}{3EI}$
(b) $h = \frac{HL^3}{E(AL^2 + 3I)}$, $v = \frac{VL^3}{E(AL^2 + 3I)}$
3. (b) External force at E is 1 to the right, horizontally.
4. (a) $I_{ube} = 16.9 \times 10^{-6} \text{ m}^4$, $I_{bar} = 8.53 \times 10^{-6} \text{ m}^4$
(b) 10.5 mm
5. (a) (i) 0, 0, 600, -700 kN
(ii) 0, -600, 0, 608 kN
(iii) -700, -700, 849 kN
(b) 1.98 m
6. (a) $R_R = 3 \times 10^6 \text{ Nm}^{-1}$, $R_L = 15 \times 10^6 \text{ Nm}^{-1}$
(b) $S = (2x - 0.015x^2) \text{ MN}$, $M = (x^2 - 0.005x^3) \text{ MNm}$
(c) $t > 21.2 \text{ mm}$
8. (b) Thickness of metal lost on either side 0.33 mm (< 1 mm). Material can be used.
9. (a) $D_B/D_A = 0.414$
(b) Theoretical density = 3.21 Mg m^{-3}
11. (b) (i) $\epsilon_t = 0.5$ (ii) $\sigma_n \cong 107 \text{ MPa}$
(c) $N_f \cong 6.25 \times 10^4 \text{ cycles}$
12. (b) (ii) $N_f \cong 9.81 \times 10^7 \text{ cycles}$
(c) K_{IC}^2/σ_y , Best material: medium carbon steel