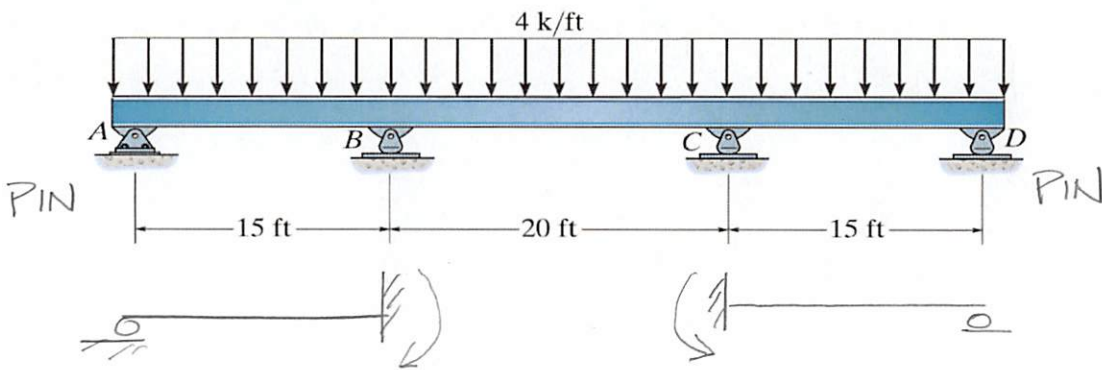


Problem 10a-3 – Determine the internal moments at the supports B and C. Assume EI is constant.



$$FEM_{BA} = FEM_{CD} = \frac{WL^2}{8} = \pm \frac{4k/ft(15ft)^2}{8}$$

$$FEM_{BC} = \frac{WL^2}{12} = \pm \frac{4k/ft(20ft)^2}{12} = \pm 133.33 \text{ kft}$$

SECTION AB – 1 EQN

$$M_{BA} = \frac{3EI}{L_{AB}} \left[\theta_B + \frac{1}{4} \right] + 112.5 \text{ kft} \quad (1)$$

SECTION BC – 2 EQNS

$$M_{BC} = \frac{2EI}{L_{BC}} \left[2\theta_B + \theta_C - \frac{3}{4} \right] - 133.33 \text{ kft} \quad (2)$$

$$M_{CB} = \frac{2EI}{L_{BC}} \left[2\theta_C + \theta_B - \frac{3}{4} \right] + 133.33 \text{ kft} \quad (3)$$

SECTION CD

$$M_{CD} = \frac{3EI}{L_{CD}} \left[\theta_C + \frac{1}{4} \right] - 112.5 \text{ kft} \quad (4)$$

JOINT B

$$\sum M_B = 0$$

$$M_{BC} = -M_{CB} - M_{BA} = 0$$

$$M_{BC} + M_{BA} = 0 \quad (5)$$

JOINT C

$$\sum M_C = 0$$

$$= -M_{CB} - M_{CD}$$

$$M_{CB} + M_{CD} = 0 \quad (6)$$

Problem 10a-3 – Determine the internal moments at the supports B and C. Assume EI is constant.

$$\textcircled{5} \quad M_{BA} + M_{BC} = 0 = \frac{3EI}{15'} [\theta_B] + 112.5 \text{ kft} + \frac{2EI}{20'} [2\theta_B + \theta_C] - 133.33 \text{ kft}$$

$$\textcircled{5a} \quad 0.4 \theta_B + 0.1 \theta_C = 20.83 \text{ kft}/EI$$

$$\textcircled{6} \quad M_{CB} + M_{CD} = 0 = \frac{2EI}{20'} [2\theta_C + \theta_B] + 133.33 \text{ kft} + \frac{3EI}{15'} [\theta_C] - 112.5 \text{ kft}$$

$$\textcircled{6a} \quad 0.1 \theta_B + 0.4 \theta_C = -20.83 \text{ kft}/EI$$

$$\textcircled{5a} - 4 \textcircled{6a} \Rightarrow -1.5 \theta_C = 104.15 \text{ kft}/EI$$

$$\theta_C = \frac{-69.433 \text{ kft}^2}{EI}$$

$$\textcircled{5a} \quad 0.4 \theta_B + 0.1 \left[-\frac{69.433 \text{ kft}^2}{EI} \right] = \frac{20.83 \text{ kft}}{EI}$$

$$\theta_B = \frac{69.433 \text{ kft}^2}{EI}$$

$$M_{BA} = \frac{3EI}{15'} [\theta_B] + 112.5 \text{ kft} = \underline{\underline{126.39 \text{ kft}}}$$

$$M_{BC} = \frac{2EI}{20'} [2\theta_B + \theta_C] - 133.33 \text{ kft} = \underline{\underline{-126.39 \text{ kft}}}$$

$$M_{CB} = \frac{2EI}{20'} [2\theta_C + \theta_B] + 133.33 \text{ kft} = \underline{\underline{126.39 \text{ kft}}}$$

$$M_{CD} = \frac{3EI}{15'} [\theta_C] - 112.5 \text{ kft} = \underline{\underline{-126.39 \text{ kft}}}$$

$$M_{BA} + M_{BC} = 0 \quad \checkmark \quad (5)$$

$$M_{CB} + M_{CD} = 0 \quad \checkmark \quad (6)$$