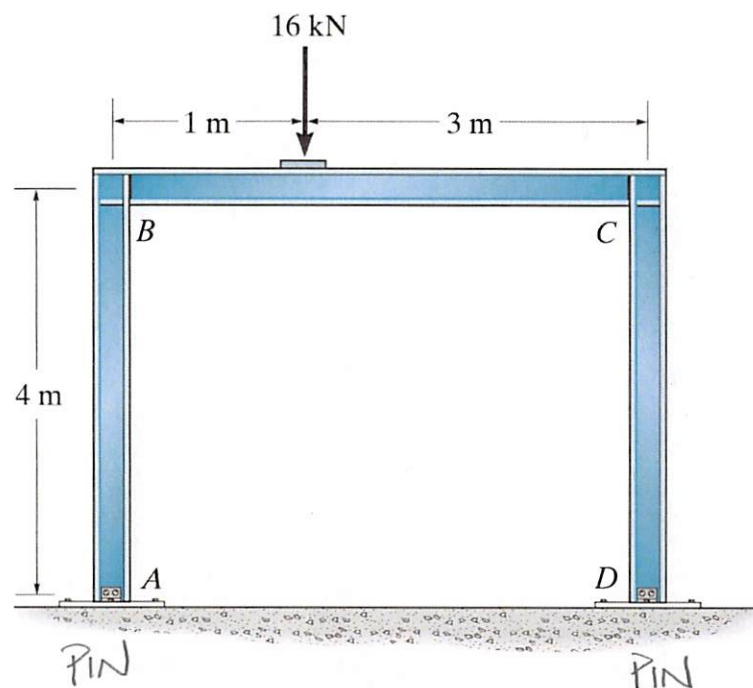


Problem 10c-1 – Determine the moments at B and C. Assume the supports at A and D are pins. EI is constant.



$$FEM_{BC} = \frac{Pb^2a}{L^2} \left(\begin{array}{c} a \downarrow P \\ b \end{array} \right) \frac{Pa^2b}{L^2}$$

$$\frac{Pb^2a}{L^2} = \frac{16\text{ kN}(3\text{ m})^2 1\text{ m}}{(4\text{ m})^2} = -9\text{ kNm}$$

$$\frac{Pa^2b}{L^2} = \frac{16\text{ kN}(1\text{ m})^2 3\text{ m}}{(4\text{ m})^2} = 3\text{ kNm}$$

SECTION AB - 1 EQN

$$M_{BA} = \frac{3EI}{4\text{ m}} [\theta_B - \psi_{AB}] \quad (1)$$

SECTION BC - 2 EQNS

$$M_{BC} = \frac{2EI}{4\text{ m}} [2\theta_B + \theta_C - 3\psi_{BC}] - 9\text{ kNm} \quad (2)$$

$$M_{CB} = \frac{2EI}{4\text{ m}} [2\theta_C + \theta_B - 3\psi_{BC}] + 3\text{ kNm} \quad (3)$$

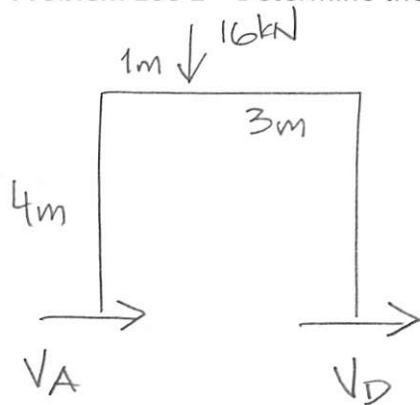
SECTION CD - 1 EQN

$$M_{CD} = \frac{3EI}{4\text{ m}} [\theta_C - \psi_{CD}] \quad (4)$$

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

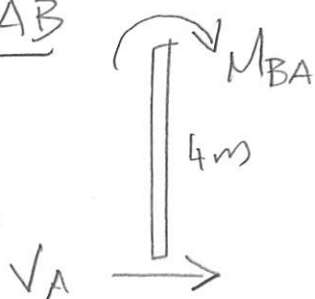
JOINT C $M_{CB} + M_{CD} = 0 \quad (6)$

Problem 10c-1 – Determine the moments at B and C. Assume the supports at A and D are pins. EI is constant.



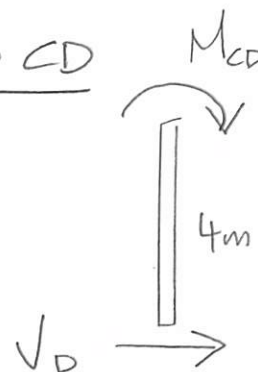
$$\rightarrow \sum F_x = 0 = V_A + V_D \quad (7) \Rightarrow \frac{M_{BA}}{4m} + \frac{M_{CD}}{4m} = 0$$

FBD AB



$$\begin{aligned} \sum M_B &= 0 \\ &= -M_{BA} + V_A(4m) \\ V_A &= \frac{M_{BA}}{4m}^* \end{aligned}$$

FBD CD



$$\begin{aligned} \sum M_C &= 0 \\ &= -M_{CD} + V_D(4m) \\ V_D &= \frac{M_{CD}}{4m}^* \end{aligned}$$

$$\begin{aligned} (7a) \quad \frac{M_{BA}}{4m} + \frac{M_{CD}}{4m} &= 0 = \frac{3EI}{4m} [\theta_B - \psi_{AB}] + \frac{3EI}{4m} [\theta_C - \psi_{AB}] \\ 0.75\theta_B + 0.75\theta_C - 1.5\psi_{AB} &= 0 \end{aligned}$$

$$\begin{aligned} (5a) \quad M_{BA} + M_{BC} &= 0 = \frac{3EI}{4m} [\theta_B - \psi_{AB}] + \frac{2EI}{4m} [2\theta_B + \theta_C] - 9 \text{ kNm} \\ 1.75\theta_B + 0.5\theta_C - 0.75\psi_{AB} &= 9 \text{ kNm}/EI \end{aligned}$$

Problem 10c-1 – Determine the moments at B and C. Assume the supports at A and D are pins. EI is constant.

$$\textcircled{6a} \quad M_{CB} + M_{CD} = 0 = \frac{2EI}{4m} [2\theta_C + \theta_B] + 3kNm + \frac{3EI}{4m} [\theta_C - \psi_{AB}]$$

$$\underline{\underline{0.5\theta_B + 1.75\theta_C - 0.75\psi_{AB} = -3kNm/EI}}$$

SOLVING THESE 3 EQUATIONS USING EXCEL

$$M_{BA} = \frac{3EI}{4m} [\theta_B - \psi] = \underline{3.6kNm}$$

$$M_{BC} = \frac{2EI}{4m} [2\theta_B + \theta_C] - 9kNm = \underline{-3.6kNm}$$

$$M_{CB} = \frac{2EI}{4m} [2\theta_C + \theta_B] + 3kNm = \underline{3.6kNm}$$

$$M_{CD} = \frac{3EI}{4m} [\theta_C - \psi] = \underline{-3.6kNm}$$

$$\left[\begin{array}{l} \theta_B = \frac{6.80kNm^2}{EI} \\ \theta_C = -\frac{2.80kNm^2}{EI} \\ \psi_{AB} = \frac{2kNm^2}{EI} \end{array} \right.$$

$$\psi_{AB} = \frac{\Delta}{L}$$

$$\begin{aligned} \Delta &= \psi_{AB} L \\ &= \frac{8kNm^3}{EI} \end{aligned}$$

