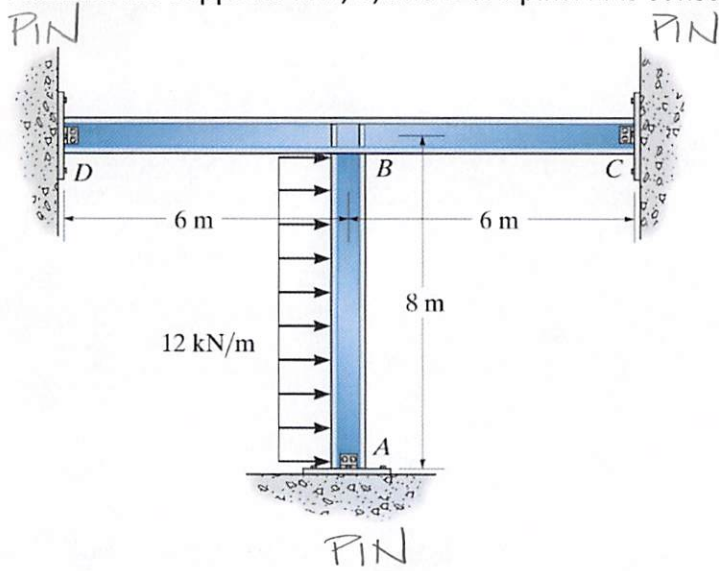


Problem 10-14 – Determine the moment that each member exerts on the joint at B , then draw the moment diagram for each member of the frame. Assume the supports at A , C , and D are pins. EI is constant. 1/4



FEM_{BA}

$$\frac{WL^2}{8} \rightarrow \frac{12 \text{ kN/m} (8 \text{ m})^2}{8 \text{ m}} = -96 \text{ kNm}$$

$$M_{BA} = \frac{3EI}{8 \text{ m}} [\theta_B] + 96 \text{ kNm} \quad (1)$$

$$M_{BC} = \frac{3EI}{6 \text{ m}} [\theta_B] \quad (2)$$

$$M_{BD} = \frac{3EI}{6 \text{ m}} [\theta_B] \quad (3)$$

JOINT B

$$\sum M_B = 0 = -M_{BA} - M_{BC} - M_{BD}$$

$$M_{BA} + M_{BC} + M_{BD} = 0 \quad (4)$$

$$(4) \quad M_{BA} + M_{BC} + M_{BD} = 0 = \left[\frac{3}{8} + \frac{3}{6} + \frac{3}{6} \right] \theta_B = -\frac{96 \text{ kNm}^2}{EI}$$

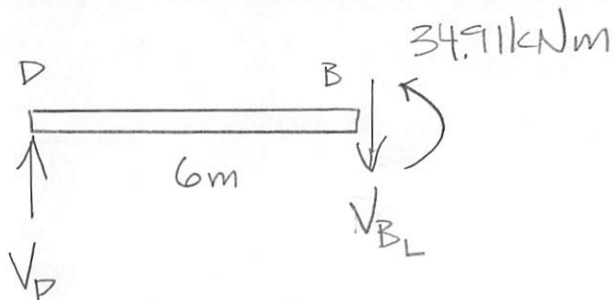
$$\frac{66}{48} \theta_B = -\frac{96 \text{ kNm}^2}{EI}$$

$$\theta_B = \underline{\underline{\frac{-2304 \text{ kNm}^2}{33 EI}}}$$

Problem 10-14 – Determine the moment that each member exerts on the joint at B, then draw the moment diagram for each member of the frame. Assume the supports at A, C, and D are pins. EI is constant. 2/4

$$\left. \begin{aligned} M_{BA} &= \frac{3EI}{8m} [\theta_B] + 96 \text{ kNm} = \underline{69.82 \text{ kNm}} \\ M_{BC} &= \frac{3EI}{6m} [\theta_B] = \underline{-34.91 \text{ kNm}} \\ M_{BD} &= \frac{3EI}{6m} [\theta_B] = \underline{-34.91 \text{ kNm}} \end{aligned} \right\} \Rightarrow M_{BA} + M_{BC} + M_{BD} = 0 \quad \checkmark$$

SECTION DB



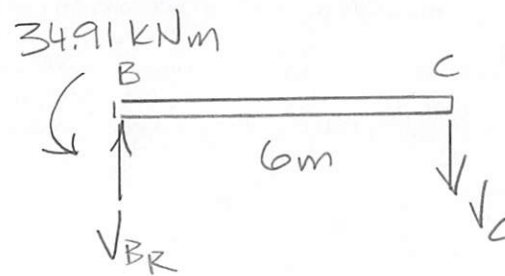
$$\sum M_B = 0 = 34.91 \text{ kNm} - V_D (6m)$$

$$\underline{V_D = 5.82 \text{ kN}}$$

$$+\uparrow \sum F_y = 0 = V_D - V_{BL}$$

$$\underline{V_{BL} = 5.82 \text{ kN}}$$

SECTION BC



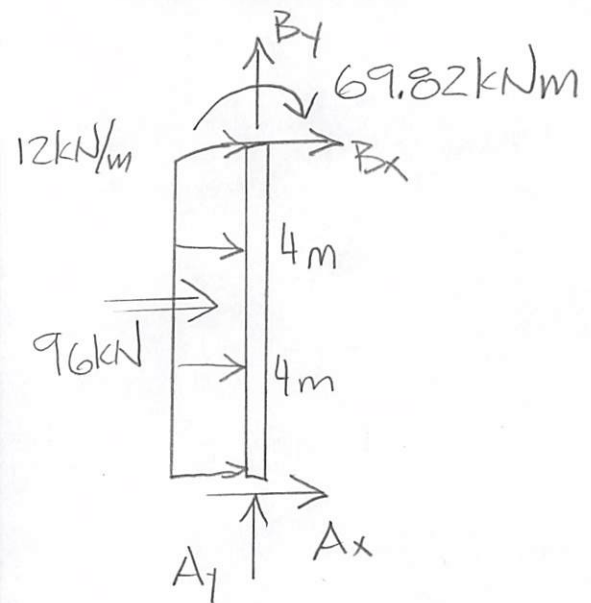
$$\sum M_B = 0 = -34.91 \text{ kNm} - V_C (6m)$$

$$\underline{V_C = 5.82 \text{ kN}}$$

$$+\uparrow \sum F_y = 0 = V_{BR} - V_C$$

$$\underline{V_{BR} = 5.82 \text{ kN}}$$

Problem 10-14 – Determine the moment that each member exerts on the joint at B , then draw the moment diagram for each member of the frame. Assume the supports at A , C , and D are pins. EI is constant.



$$\sum M_B = 0 = -69.82 \text{ kNm} + 96 \text{ kN}(4 \text{ m}) + A_x(8 \text{ m})$$

$$A_x = -39.27 \text{ kN}$$

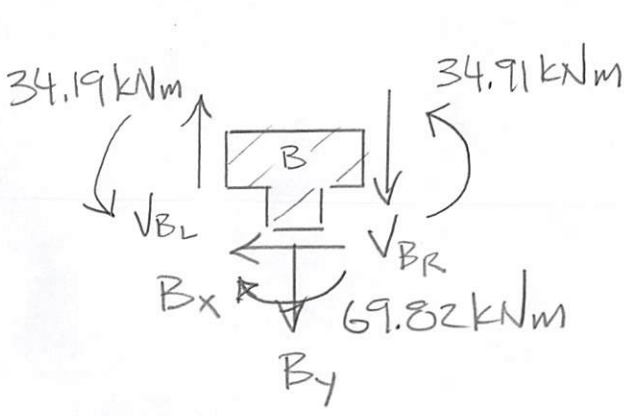
$$\sum F_x = 0 = A_x + B_x + 96 \text{ kN}$$

$$B_x = -56.73 \text{ kN}$$

$$\sum F_y = 0 = A_y + B_y$$

$$A_y = -B_y$$

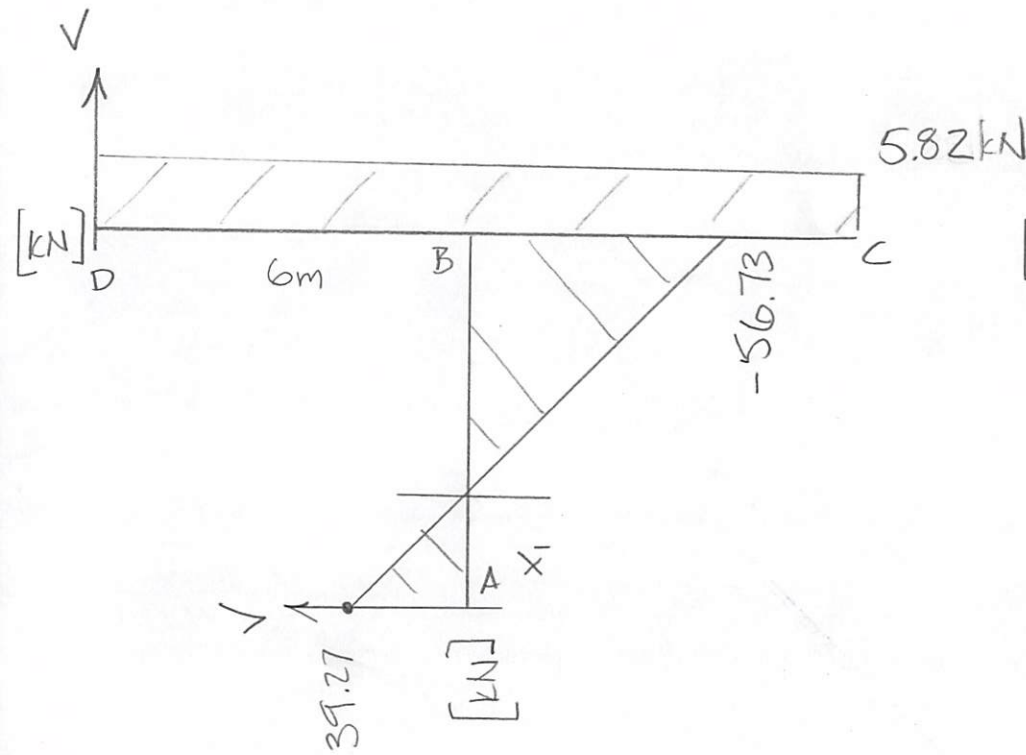
JOINT B



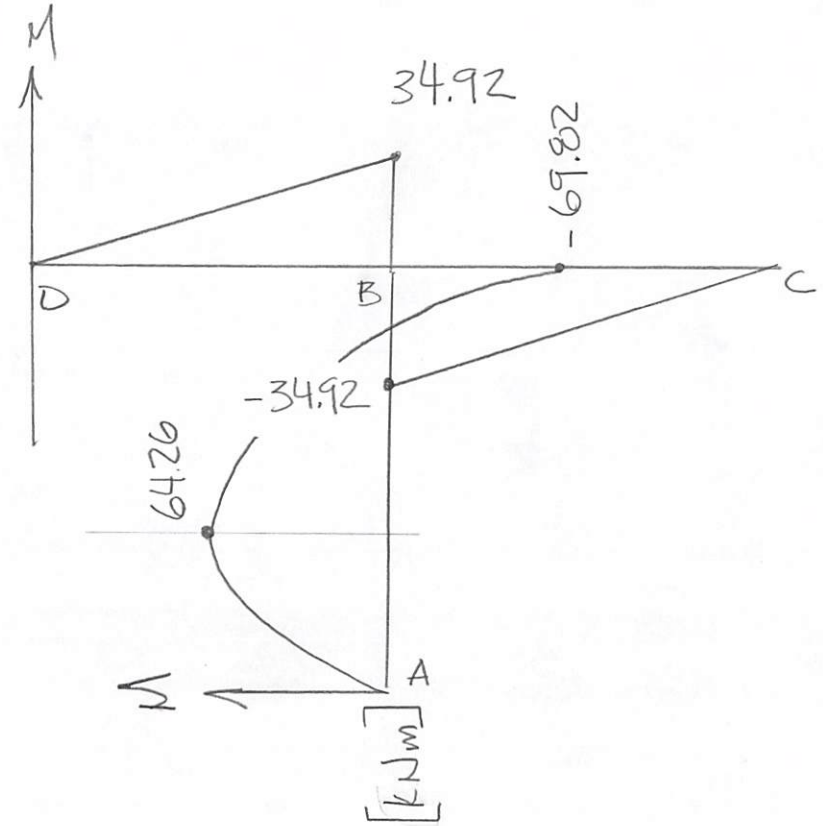
$$\sum F_y = 0 = V_{BL} - V_{BR} - B_y$$

$$B_y = 11.64 \text{ kN}$$

Problem 10-14 – Determine the moment that each member exerts on the joint at B, then draw the moment diagram for each member of the frame. Assume the supports at A, C, and D are pins. EI is constant.



[kNm]



$$x_1 = \frac{39.27 \text{ kN}}{12 \text{ kN/m}} = 3.27 \text{ m}$$