
AHMEDMAHDY
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يحصل الطالب على ...
*مقاطع فيديوهات لشرح المقرربشكل وافي
*ملخص للمادة للمراجعة النهائية
*محاضرات مباشرة على برنامج Zoom
*تواصل مستمر مع معلم المادة للمناقشة
للتواصل
00201024041097
00201096019763
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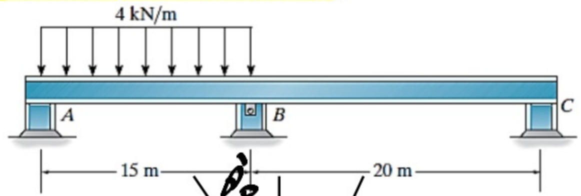
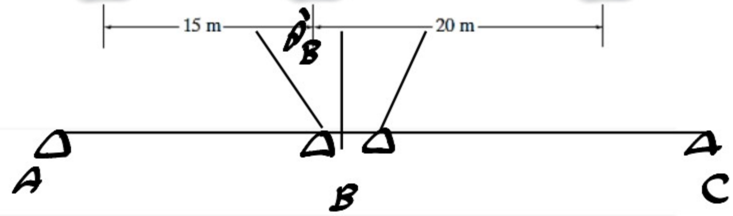
1. Determine the support reactions using force method. Assume B is a pin and A and C are rollers. EI is constant. (By=35.6 kN; Cy=2.41 kN; Ay=26.8 kN; Bx=0)

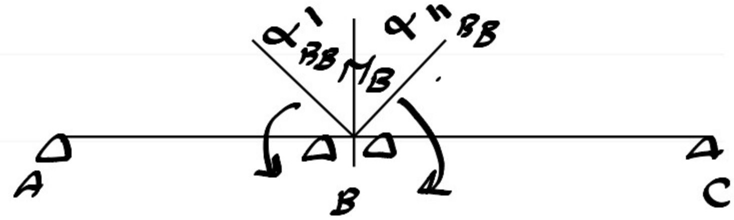




$$\theta'_B = \frac{wl^3}{24EI} = \frac{4 * 15^3}{24EI}$$

$$\theta'_B = \frac{562.5}{EI}$$

$$\theta''_B = 0$$

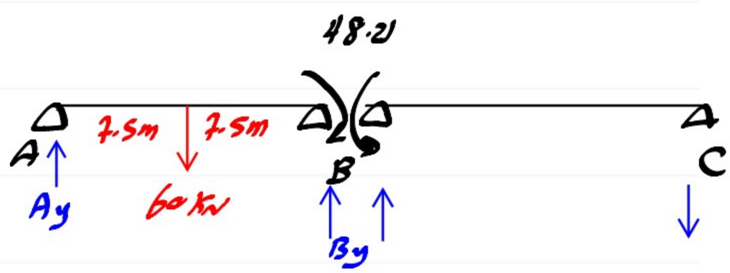


$$\alpha'_{BB} = \frac{Ml}{3EI} = \frac{1 * 15}{3EI}$$

$$\alpha''_{BB} = \frac{20}{3EI}$$

$$\theta_B + M_B \alpha_{BB} = 0 \Rightarrow \frac{562.5}{EI} + M_B \frac{35}{3EI}$$

$$M_B = -48.21$$

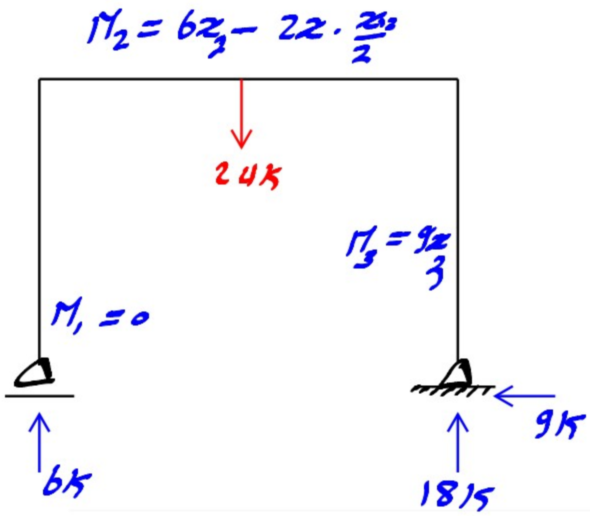


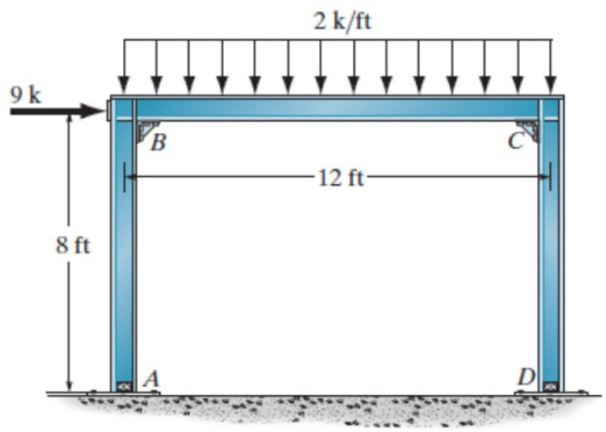
$$A_y = 30 - \frac{48.21}{15} = 26.8 \text{ kN}$$

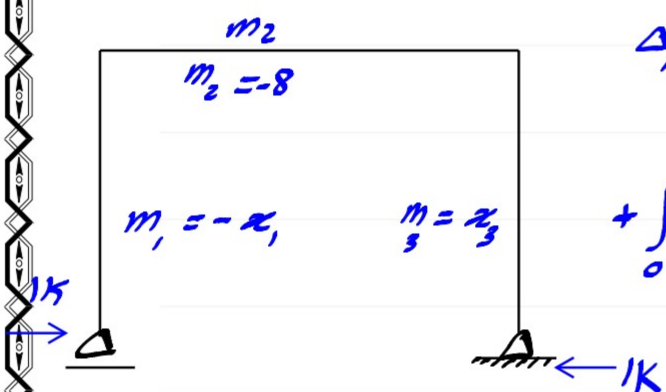
$$B_y = 30 + \frac{48.21}{15} + \frac{48.21}{20} = 35.6 \quad , \quad B_x = 0$$

$$C_y = \frac{48.21}{20} = 2.41 \text{ kN} \downarrow$$

2. Determine the reactions at the supports using force method. Assume A and D are pins. EI is constant. (Dx=6.58 k; Dy=18 k; Ay=6 k)







$$\Delta_A = \int_0^{l} \frac{mM}{EI}\,dx = \int_0^{8} \frac{0(-x_1)}{EI}\,dx$$

$$+ \int_0^{12} \frac{-8(6x - x^2)}{EI}\,dx + \int_0^{8} \frac{x_3(9x_3)}{EI}\,dx$$

$$= \frac{1152 + 1536}{EI} = \frac{2688}{EI}$$

$$f_{AA} = \int_0^{l} \frac{m^2}{EI}\,dx = 2\int_0^{8} \frac{x_1^2\,dx}{EI} + \int_0^{12} \frac{(-8)^2\,dx}{EI}$$

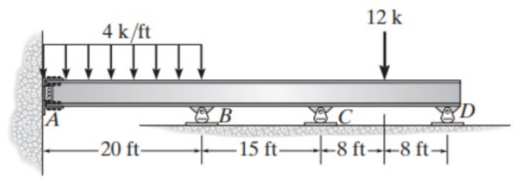
$$f_{AA} = \frac{1024}{3EI} + \frac{768}{EI} = \frac{3328}{3EI}$$

$$\Delta_A + A_x f_{AA} = 0 \Rightarrow A_x = \frac{2688 * 3}{3328}$$

$A_x = -2.42\,kN \rightarrow\ = 2.42\,k\ \leftarrow$

$D_x = 9 - 2.42 = 6.58\,k,\ A_y = 6\,k,\ D_y = 18\,k$

11–9. Determine the moments at each support, then draw the moment diagram. Assume A is fixed. EI is constant.



$$M_N = 2E\left(\frac{I}{L}\right)(2\theta_N + \theta_F - 3\psi) + (\text{FEM})_N$$

$$M_{AB} = \frac{2EI}{20}(2(0) + \theta_B - 0) - \frac{4(20)^2}{12}$$

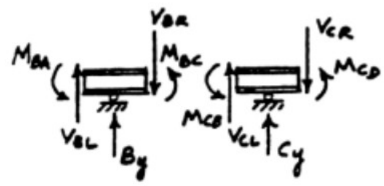
$$M_{BA} = \frac{2EI}{20}(2\theta_B + 0 - 0) + \frac{4(20)^2}{12}$$

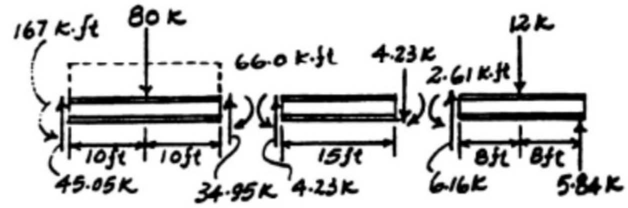
$$M_{BC} = \frac{2EI}{15}(2\theta_B + \theta_C - 0) + 0$$

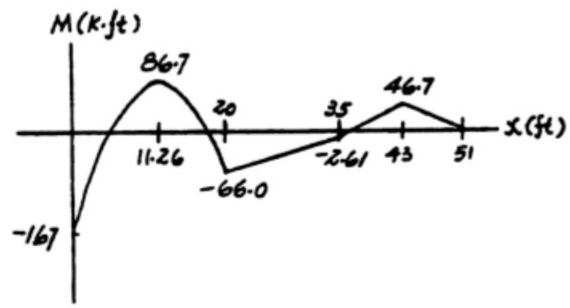
$$M_{CB} = \frac{2EI}{15}(2\theta_C + \theta_B - 0) + 0$$

$$M_N = 3E\left(\frac{I}{L}\right)(\theta_N - \psi) + (\text{FEM})_N$$

$$M_{CD} = \frac{3EI}{16}(\theta_C - 0) - \frac{3(12)16}{16}$$







$$M_{BA} + M_{BC} = 0$$

$$M_{CB} + M_{CD} = 0$$

Solving

$$\theta_C = \frac{178.08}{EI}$$

$$\theta_B = -\frac{336.60}{EI}$$

$$M_{AB} = -167 \text{ k} \cdot \text{ft}$$

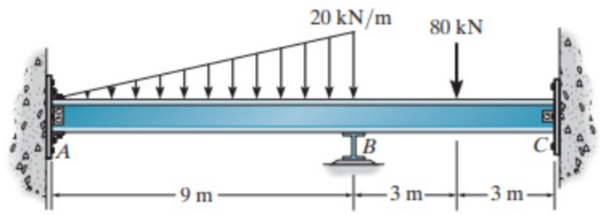
$$M_{BA} = 66.0 \text{ k} \cdot \text{ft}$$

$$M_{BC} = -66.0 \text{ k} \cdot \text{ft}$$

$$M_{CB} = 2.61 \text{ k} \cdot \text{ft}$$

$$M_{CD} = -2.61 \text{ k} \cdot \text{ft}$$

*11–12.** Determine the moments acting at A and B. Assume A is fixed supported, B is a roller, and C is a pin. EI is constant.



$$(\text{FEM})_{AB} = \frac{wL^2}{30} = -54, \quad (\text{FEM})_{BC} = \frac{3PL}{16} = -90$$

$$(\text{FEM})_{BA} = \frac{wL^2}{20} = 81$$

Applying Eqs. 11–8 and 11–10,

$$M_{AB} = \frac{2EI}{9}(\theta_B) - 54$$

$$M_{BA} = \frac{2EI}{9}(2\theta_B) + 81$$

$$M_{BC} = \frac{3EI}{6}(\theta_B) - 90$$

Moment equilibrium at B:

$$M_{BA} + M_{BC} = 0$$

$$\frac{4EI}{9}(\theta_B) + 81 + \frac{EI}{2}\theta_B - 90 = 0$$

$$\theta_B = \frac{9.529}{EI}$$

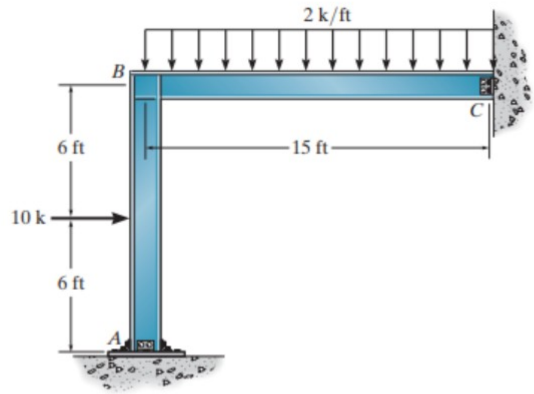
Thus,

$$M_{AB} = -51.9 \text{ kN}\cdot\text{m}$$

$$M_{BA} = 85.2 \text{ kN}\cdot\text{m}$$

$$M_{BC} = -85.2 \text{ kN}\cdot\text{m}$$

11–17. 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 support at A is fixed and C is a pin. EI is constant.



Fixed End Moments. Referring to the table on the inside back cover,

$$(\text{FEM})_{AB} = -\frac{PL}{8} = -\frac{10(12)}{8} = -15 \text{ k}\cdot\text{ft} \quad (\text{FEM})_{BA} = \frac{PL}{8} = \frac{10(12)}{8} = 15 \text{ k}\cdot\text{ft}$$

$$(\text{FEM})_{BC} = -\frac{wL^2}{8} = -\frac{2(15^2)}{8} = -56.25 \text{ k}\cdot\text{ft}$$

Slope Reflection Equations. Applying Eq. 11–8 for member AB,

$$M_N = 2Ek(2\theta_N + \theta_F - 3\psi) + (\text{FEM})_N$$

$$M_{AB} = 2E\left(\frac{I}{12}\right)[2(0) + \theta_B - 3(0)] + (-15) = \left(\frac{EI}{6}\right)\theta_B - 15 \qquad (1)$$

$$M_{BA} = 2E\left(\frac{I}{12}\right)[2\theta_B + 0 - 3(0)] + 15 = \left(\frac{EI}{3}\right)\theta_B + 15 \qquad (2)$$

For member BC, applying Eq. 11–10

$$M_N = 3Ek(\theta_N - \psi) + (\text{FEM})_N$$

$$M_{BC} = 3E\left(\frac{I}{15}\right)(\theta_B - 0) + (-56.25) = \left(\frac{EI}{5}\right)\theta_B - 56.25 \qquad (3)$$

Equilibrium. At joint B,

$$M_{BA} + M_{BC} = 0$$

$$\left(\frac{EI}{3}\right)\theta_B + 15 + \left(\frac{EI}{5}\right)\theta_B - 56.25 = 0$$

$$\theta_B = \frac{77.34375}{EI}$$

Substitute this result into Eqs. (1) to (3)

$$M_{AB} = -2.109 \text{ k}\cdot\text{ft} = -2.11 \text{ k}\cdot\text{ft} \qquad \textbf{Ans.}$$

$$M_{BA} = 40.78 \text{ k}\cdot\text{ft} = 40.8 \text{ k}\cdot\text{ft} \qquad \textbf{Ans.}$$

$$M_{BC} = -40.78 \text{ k}\cdot\text{ft} = -40.8 \text{ k}\cdot\text{ft} \qquad \textbf{Ans.}$$

The negative signs indicate that $\mathbf{M}_{AB}$ and $\mathbf{M}_{BC}$ have counterclockwise rotational sense. Using these results, the shear at both ends of member AB and BC are computed and shown in Fig. a and b respectively. Subsequently, the shear and Moment diagram can be plotted, Fig. c and d respectively.