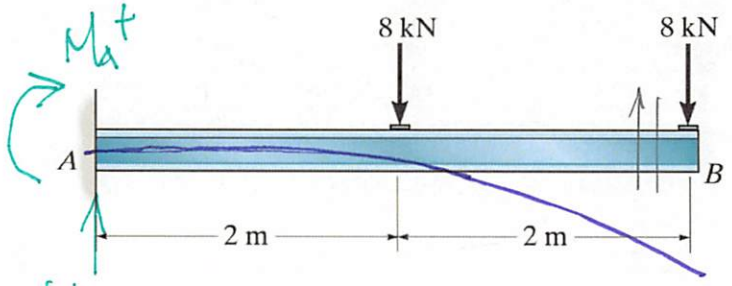
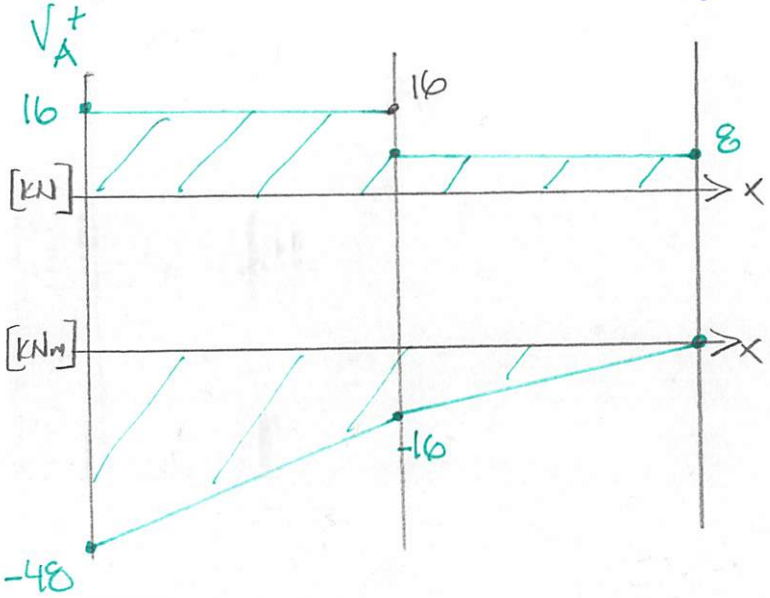
Example 7b-2: Determine the slope at *B* and the displacement at mid-span.
Assume that $E = 200$ GPa and $I = 550(10^6)$ mm^4.



$$\circlearrowleft + \Sigma M_A = 0 = -M_A - 8\,kN(2m + 4m) \qquad M_A = -48\,kN\cdot m$$

$$+\uparrow \Sigma F_y = 0 = V_A - 8\,kN - 8\,kN \qquad V_A = 16\,kN$$



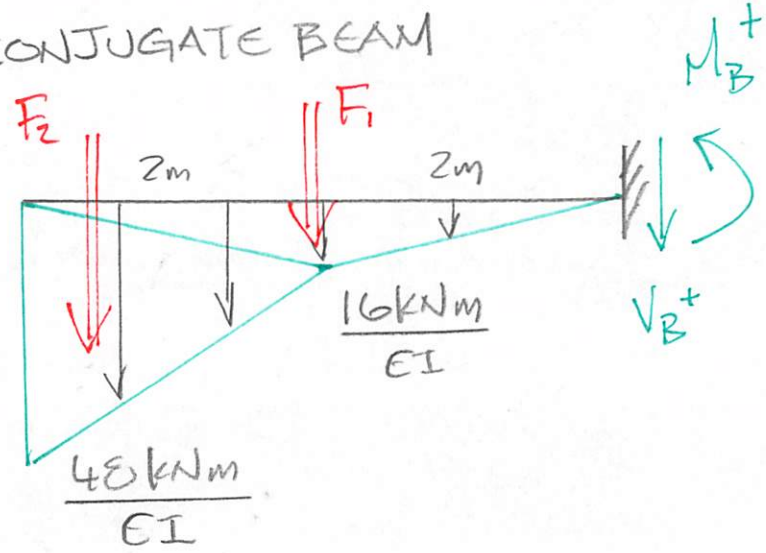
$$F_1 = \frac{1}{2}(4m)\frac{16\,kN\cdot m}{EI} = \frac{32\,kN\cdot m^2}{EI}$$

$$d_1 = 2m$$

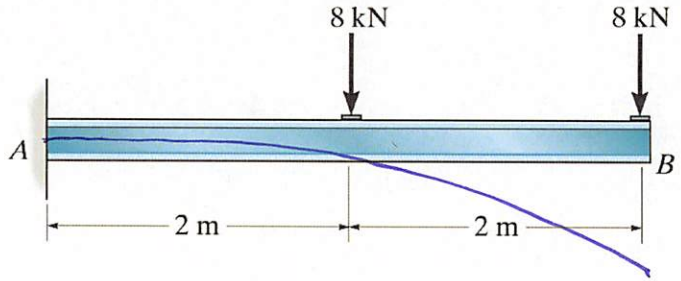
$$F_2 = \frac{1}{2}(2m)\frac{48\,kN\cdot m}{EI} = \frac{48\,kN\cdot m^2}{EI}$$

$$d_2 = 2m + \frac{2}{3}(2m) = 3.33m \text{ OR } \frac{10}{3}$$

CONJUGATE BEAM



Example 7b-2: Determine the slope at *B* and the displacement at mid-span.
Assume that $E = 200$ GPa and $I = 550(10^6)$ mm^4.



$$+\uparrow \Sigma F_y = 0 = -V_B - F_1 - F_2 \qquad V_B = -F_1 - F_2$$

$$V_B \Rightarrow \theta_B = -\frac{80\ \text{kN m}^2}{EI}$$

$$1\ \text{GPa} = \frac{\text{N}}{\text{m}^2}(10^9)$$

$$= \frac{\text{kN}}{\text{m}^2}(10^6)$$

$$\theta_B = -\frac{80\ \text{kN m}^2}{200(10^6)\ \text{kN}} \cdot \frac{\text{m}^2}{550(10^6)\ \text{mm}^4} \cdot \frac{10^{12}\ \text{mm}^4}{\text{m}^4}$$

$$= -0.00073 \text{ RADIANS}$$

$$1000\ \text{mm} = \text{m}$$

$$[10^3\ \text{mm}]^4 = \text{m}^4$$

$$10^{12}\ \text{mm}^4 = \text{m}^4$$

$$\text{(+)}\ \Sigma M_C = 0 = M_C + F_1 d_1 + F_2 d_2$$

$$M_C \Rightarrow Y_C = -\frac{224\ \text{kN m}^3}{EI}$$

$$Y_C = -\frac{224\ \text{kN m}^3}{200(10^6)\ \text{kN}} \cdot \frac{\text{m}^2}{550(10^6)\ \text{mm}^4} \cdot \frac{10^{12}\ \text{mm}^4}{\text{m}^4}$$

$$= 0.0020\ \text{m} = 2\ \text{mm}$$