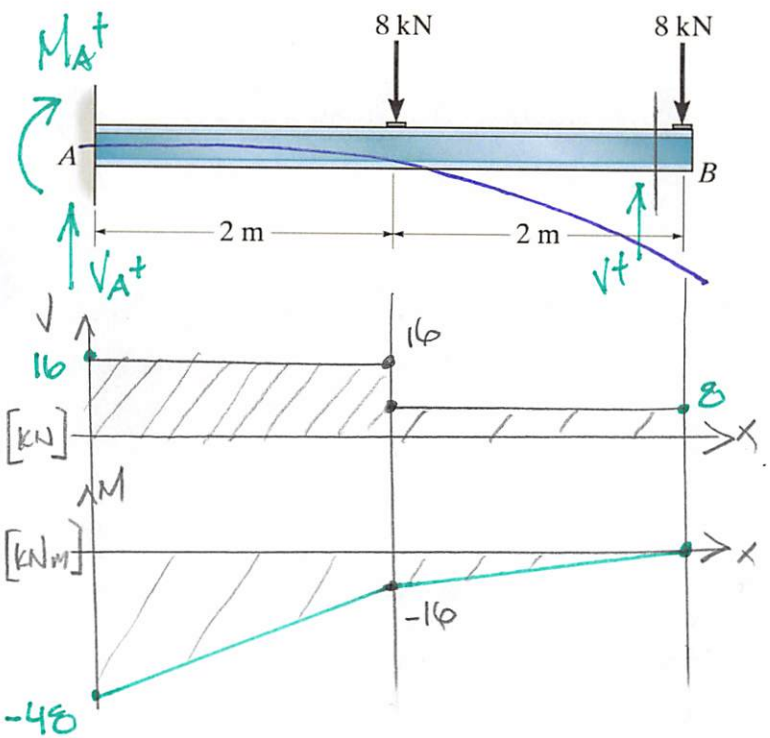
Example 7b-2: Determine the slope at *B* and the displacement at mid-span.
Assume that $E = 200$ GPa and $I = 550(10^6)$ mm^4.



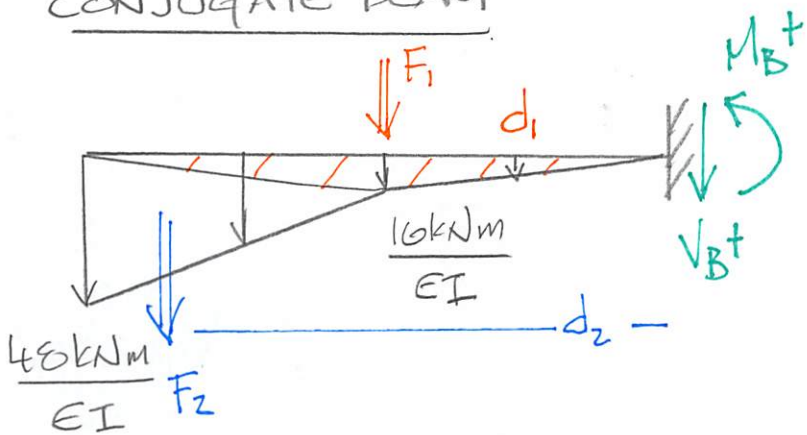
$\circlearrowleft + \sum M_A = 0 = -M_A - 8\text{kN}(2\text{m} + 4\text{m})$

$M_A = -48\ \text{kN·m}$

$+\uparrow \sum F_y = 0 = V_A - 8\text{kN} - 8\text{kN}$ $\quad V_A = 16\text{kN}$

$V_B = 8\text{kN}$

CONJUGATE BEAM



$\bar{F}_1 = \frac{1}{2}(4\text{m})\frac{16\text{kN·m}}{EI} = \frac{32\text{kN·m}^2}{EI}$ $\quad d_1 = \frac{1}{2}(4\text{m}) = 2\text{m}$

$\bar{F}_2 = \frac{1}{2}(2\text{m})\frac{48\text{kN·m}}{EI} = \frac{48\text{kN·m}^2}{EI}$ $\quad d_2 = 2\text{m} + \frac{2}{3}(2\text{m}) = \frac{10}{3}\text{m}$

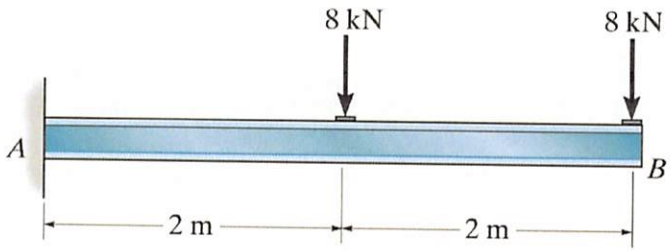
$+\uparrow \sum F_y = 0 = -V_B - \bar{F}_1 - \bar{F}_2$ $\quad V_B = -\bar{F}_1 - \bar{F}_2$

$V_B = -\frac{80\text{kN·m}^2}{EI}$

$V_B \Rightarrow \theta_B = -\frac{80\,\text{kN·m}^2}{200(10^6)\,\text{kN/m}^2}\,\frac{1}{550(10^6)\,\text{mm}^4}\left[\frac{10^3\,\text{mm}}{\text{m}}\right]^4 =$

$= 0.0007$ RADIANS

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.



$$\curvearrowleft + \Sigma M_B = 0 = M_B + F_1 d_1 + F_2 d_2$$

$$M_B = -\frac{32\,kN\,m^2}{EI}(2m) - \frac{48\,kN\,m^2}{EI}(10/3\,m)$$

$$= -\frac{224\,kN\,m^3}{EI}$$

$$M_B \Rightarrow Y_B = -\frac{224\,kN\,m^3}{200(10^6)\,kN} \left| \frac{m^2}{555(10^6)\,mm^4} \right| \left[\frac{10^3\,mm}{m}\right]^4$$

$$= 0.0020m = 2.04mm$$