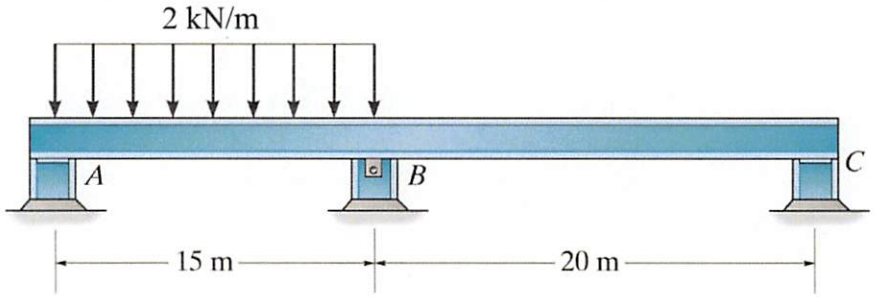
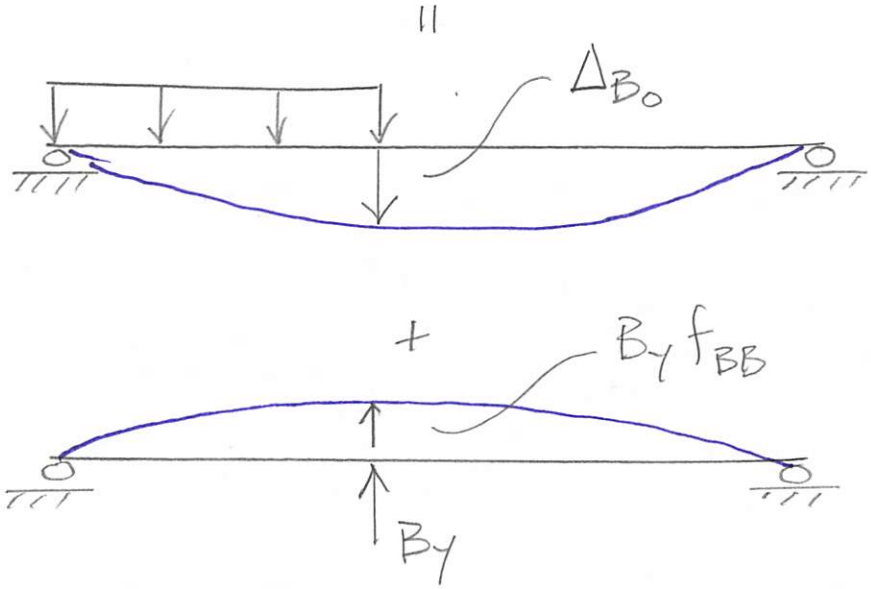
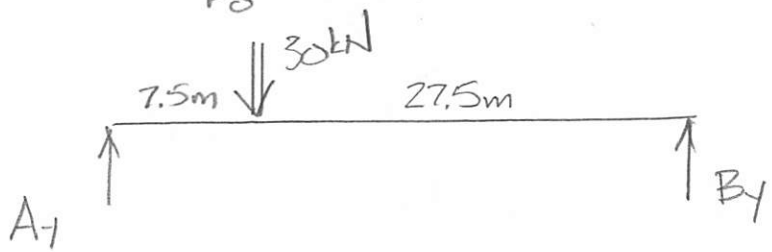
Problem 9a-5 – Compute the reactions for the following beam.





$$\Delta_{B_0} + B_y f_{BB} = 0$$

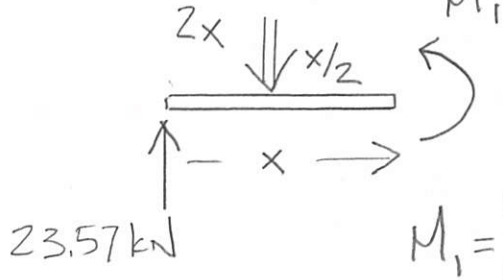
FIND Δ_{B_0} USING VIRTUAL WORK



$$\circlearrowleft + \Sigma M_C = 0 = 30\text{kN}(27.5\text{m}) - A_y(35\text{m})$$

$$A_y = 23.57\text{kN} \qquad C_y = 6.43\text{kN}$$

$0 \le x \le 15$

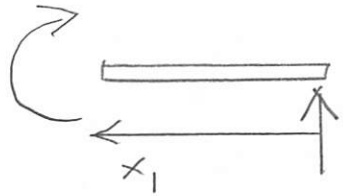


$$\circlearrowleft + \Sigma M_{CUT} = 0$$

$$= M_1 + 2x\left(\frac{x}{2}\right) - 23.57x$$

$$M_1 = \left[-x^2 + 23.57x\right]\text{kNm}$$

M_2 $0 \le x_1 \le 20$

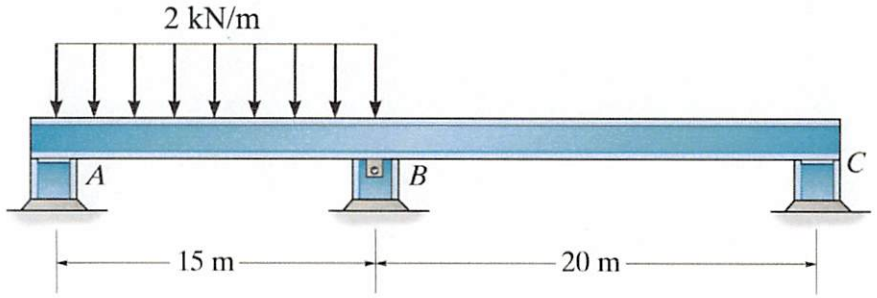


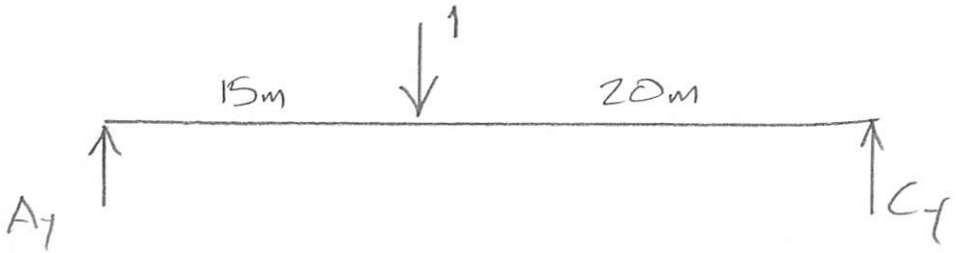
$$\circlearrowleft + \Sigma M_{CUT} = 0$$

$$= -M_2 + 6.43x_1$$

$$M_2 = 6.43x_1\ \text{kNm}$$

Problem 9a-5 – Compute the reactions for the following beam.

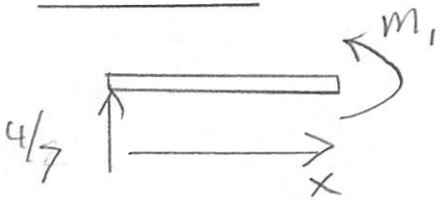




$$\circlearrowleft + \Sigma M_C = 0 = 1(20\text{m}) - A_y(35\text{m})$$

$$A_y = 4/7 \qquad C_y = 3/7$$

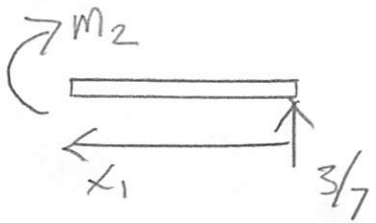
$0 \le x \le 15$



$$\circlearrowleft + \Sigma M_{CUT} = 0$$

$$= m_1 - 4/7\,x \qquad m_1 = \frac{4}{7}x$$

$0 \le x_1 \le 20$



$$\circlearrowleft + \Sigma M_{CUT} = 0$$

$$= -m_2 + \frac{3}{7}x_1 \qquad m_2 = \frac{3}{7}x_1$$

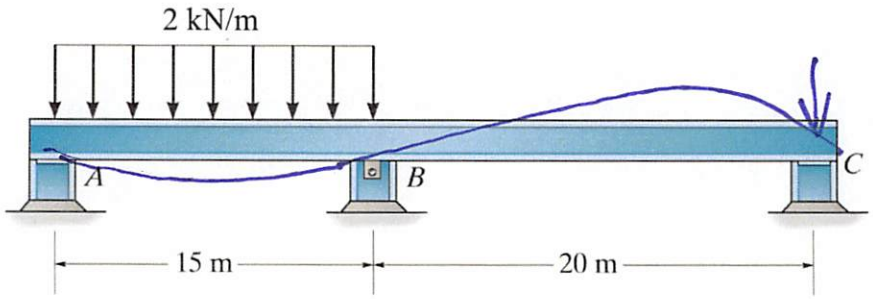
$$\Delta_{B_0} = \frac{1}{EI}\left[\int_0^{15} M_1 m_1\,dx + \int_0^{20} M_2 m_2\,dx_1\right]$$

$$= \frac{1}{EI}\left[\int_0^{15} (-x^2 + 23.57x)(4/7\,x)\,dx + \int_0^{20} (6.43x_1)(3/7\,x_1)\,dx_1\right]$$

$$= \frac{1}{EI}\left[-\frac{x^4}{7} + \frac{220x^3}{49}\right]_0^{15} + \frac{1}{EI}\left[\frac{45}{47}x_1^3\right]_0^{20}$$

$$= \frac{106{,}875\ \text{kN m}^3}{7EI}$$

Problem 9a-5 – Compute the reactions for the following beam.



FIND f_{BB}

$$f_{BB} = \frac{1}{EI}\left[\int_0^{15} m_1 m_1 dx + \int_0^{20} m_2 m_2 dx_1\right]$$

$$= \frac{1}{EI}\left[\int_0^{15} \left(\tfrac{4}{7}x\right)^2 dx + \int_0^{20} \left(\tfrac{3}{7}x_1\right)^2 dx_1\right]$$

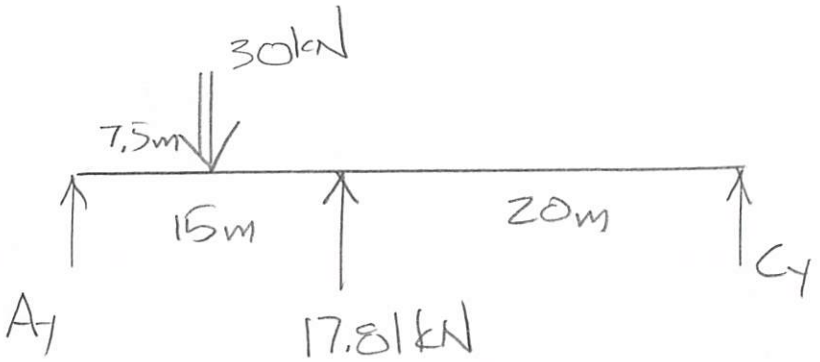
$$= \frac{1}{EI}\left[\frac{16x^3}{147}\Big|_0^{15} + \frac{9x_1^3}{147}\Big|_0^{20}\right]$$

$$= \frac{6{,}000\ m^3}{7EI}$$

(-) (+)

$$\Delta_{B_0} + B_y f_{BB} = 0 \qquad B_y = \frac{\Delta_{B_0}}{f_{BB}}$$

$$B_y = 17.81\ kN$$



$$+\circlearrowleft \Sigma M_C = 0 = 30\,kN(27.5m) - 17.81\,kN(20m) - A_y(35m)$$

$$A_y = 13.39\ kN$$

$$+\uparrow \Sigma F_y = 0 = A_y + C_y + 17.81\,kN - 30\,kN$$

$$C_y = -1.21\ kN$$