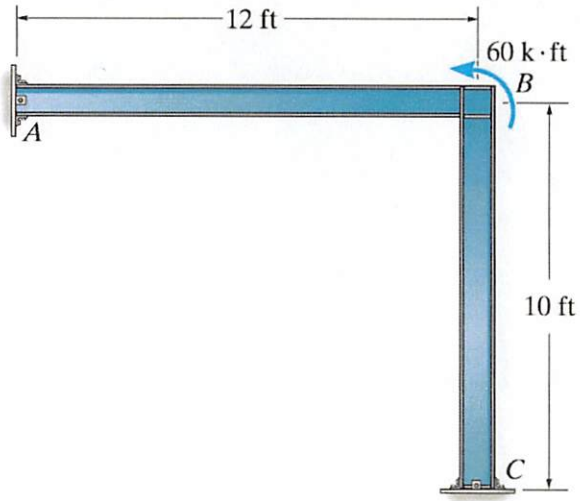
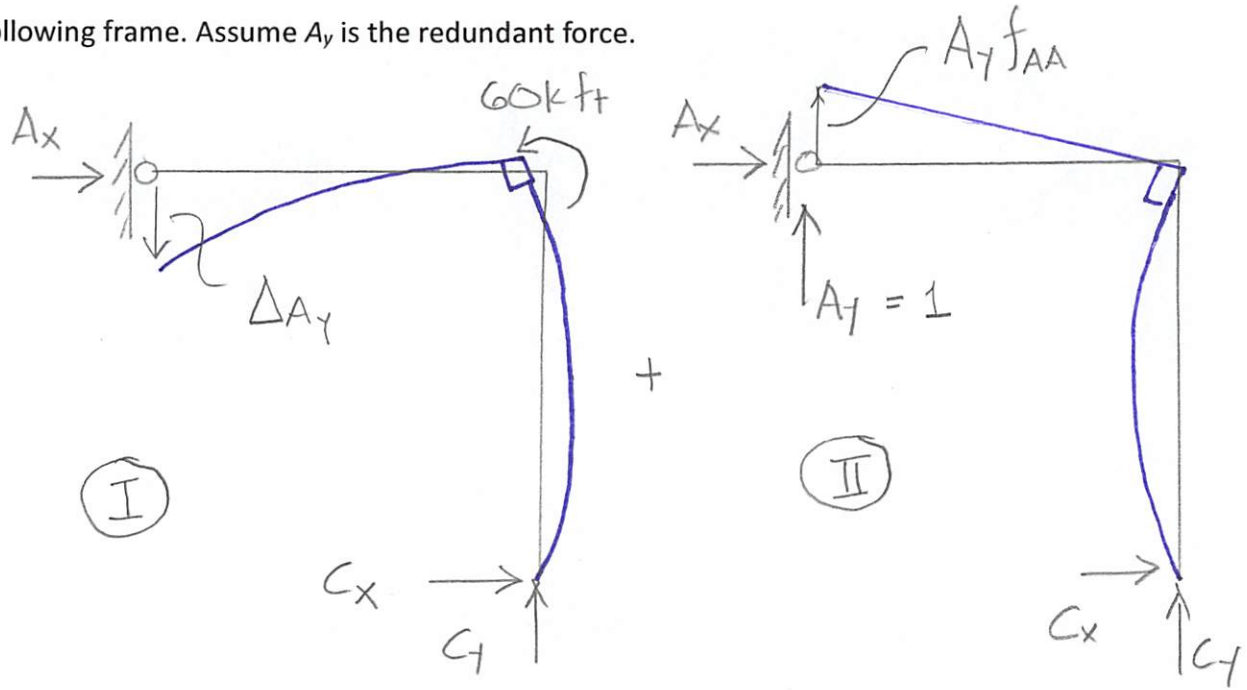
Problem 9b-1 – Compute the reactions for the following frame. Assume A_y is the redundant force.





$$\Delta_{A_y} + A_y f_{AA} = 0$$

(I) $\circlearrowleft \sum M_C = 0 = 60\,k\text{-ft} - A_x(10\,ft)$ $\quad A_x = 6^k$

$\pm\rightarrow \sum F_x = 0 = A_x + C_x$ $\quad C_x = -6^k$

$+\uparrow \sum F_y = 0 = C_y$ $\quad C_y = 0$

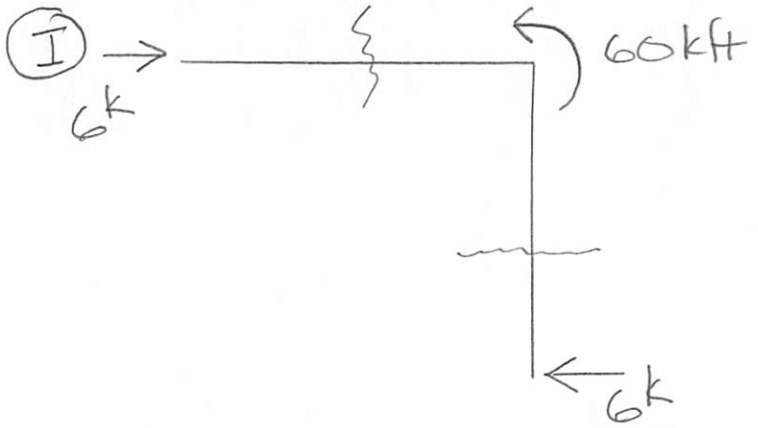
(II) $\circlearrowleft \sum M_C = 0 = -1(12\,ft) - A_x(10\,ft)$ $\quad A_x = -6/5$

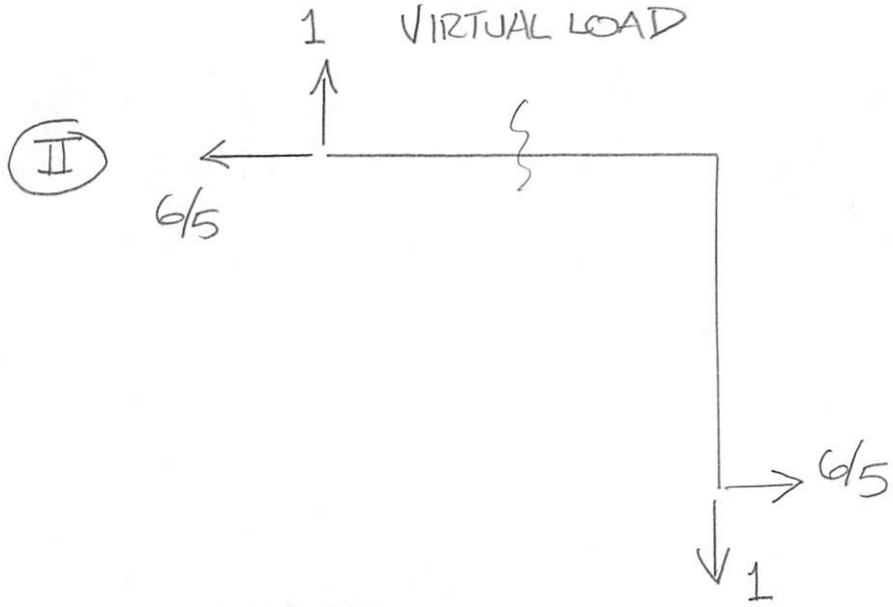
$\pm\rightarrow \sum F_x = 0 = A_x + C_x$ $\quad C_x = 6/5$

$+\uparrow \sum F_y = 0 = C_y + 1$ $\quad C_y = -1$

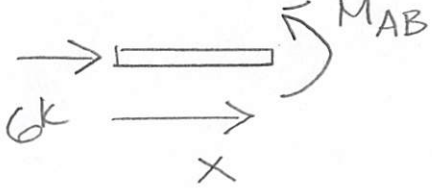
Problem 9b-1 – Compute the reactions for the following frame.

Find the displacement at *A* in the y-direction.





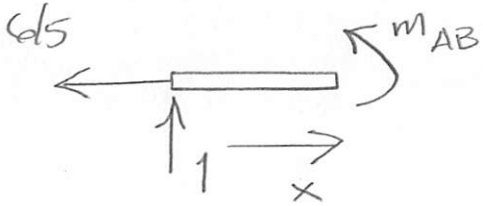
SECTION AB



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

$$= M_{AB} = 0$$

SECTION AB

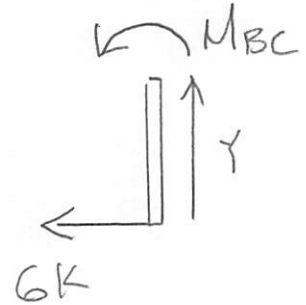


$$\circlearrowleft^{+} \Sigma M_{CUT} = 0$$

$$= m_{AB} - 1x$$

$$m_{AB} = x$$

SECTION BC



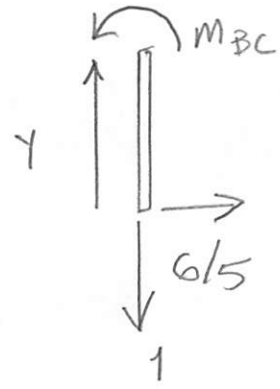
$$\circlearrowleft^{+} \Sigma M_{CUT} = 0$$

$$= M_{BC} - 6k(Y)$$

$$M_{BC} = [6y]\,kft$$

$$0 \le y \le 10'$$

SECTION BC



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

$$= m_{BC} + 6/5\,y$$

$$m_{BC} = -6/5\,y$$

Problem 9b-1 – Compute the reactions for the following frame.

Find the displacement at *A* in the y-direction due to A_y.

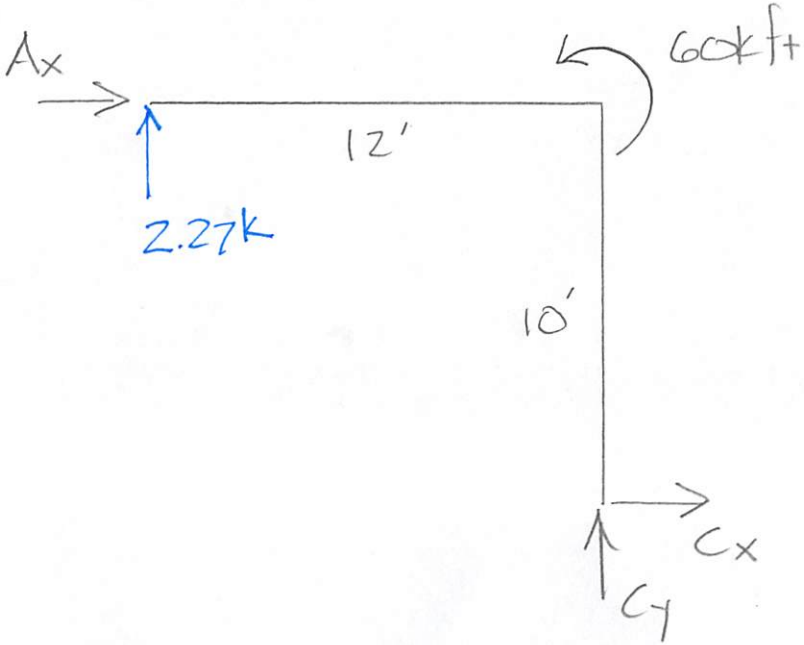
$$\Delta_{A_y} = \frac{1}{EI}\left[\int_0^{12} M_{AB} m_{AB}\,dx + \int_0^{10} M_{BC} m_{BC}\,dy\right] = \frac{1}{EI}\left[\int_0^{10} (6y)\left(-\tfrac{6}{5}y\right)dy\right] = \frac{36y^3}{15}\Big|_0^{10}$$

$$= -\frac{2{,}400\ \text{k ft}^3}{EI}$$

$$f_{AA} = \frac{1}{EI}\left[\int_0^{12} m_{AB} m_{AB}\,dx + \int_0^{10} m_{BC} m_{BC}\,dy\right]$$

$$= \frac{1}{EI}\left[\int_0^{12} x^2\,dx + \int_0^{10} \left(\frac{6y}{5}\right)^2 dy\right] = \frac{x^3}{3}\Big|_0^{12} + \frac{12y^3}{25}\Big|_0^{10} = \frac{1{,}056\ \text{ft}^3}{EI}$$

$$\Delta_{A_y} + A_y f_{AA} = 0 \quad = -\frac{2{,}400\ \text{k ft}^3}{EI} + A_y\left(\frac{1{,}056\ \text{ft}^3}{EI}\right) \qquad A_y = 2.27^{\text{k}}$$



$$\circlearrowleft + \Sigma M_C = 0 = 60\text{k ft} - 2.27^{\text{k}}(12') - A_x(10')$$

$$A_x = 3.27^{\text{k}}$$

$$+\uparrow \Sigma F_y = 0 = C_y + 2.27^{\text{k}}$$

$$C_y = -2.27^{\text{k}}$$

$$\overset{+}{\rightarrow} \Sigma F_x = 0 = A_x + C_x$$

$$C_x = -3.27^{\text{k}}$$