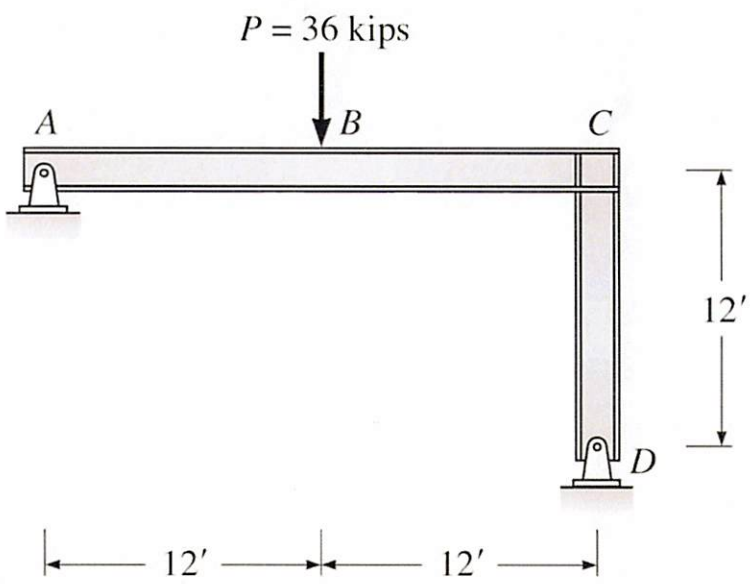
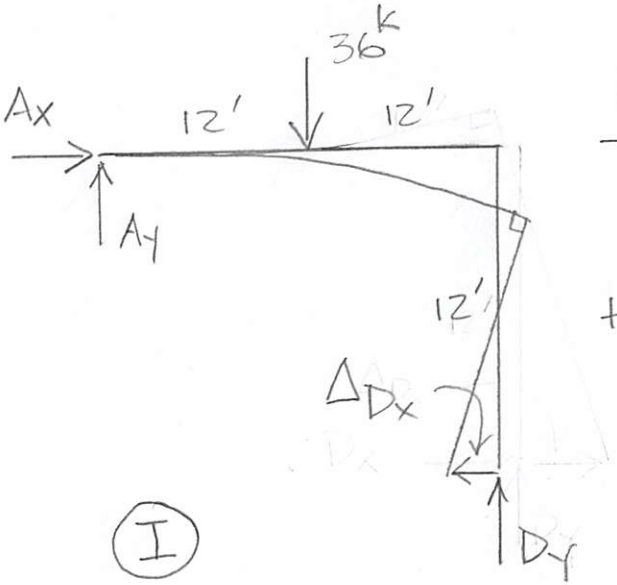
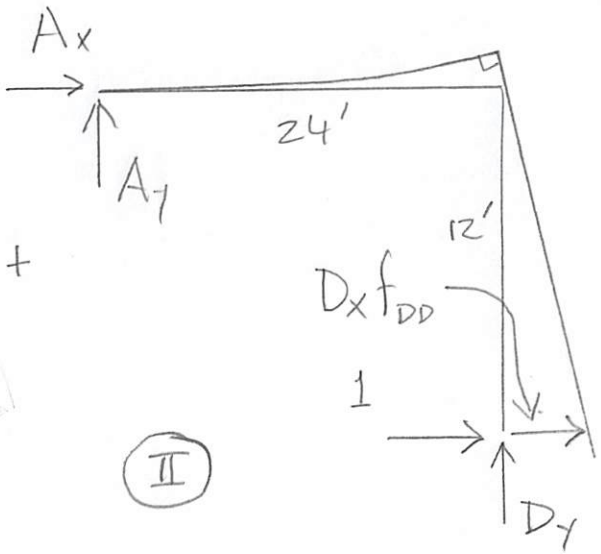
**Problem 9b-2** – Compute the reactions for the following frame. Assume $A_y$ is the redundant force.




+




$$\Delta_{Dx} + D_x f_{DD} = 0$$

(I) $\circlearrowleft^{+} \sum M_A = 0 = -36^k(12') + D_y(24')$ $\quad D_y = 18^k$

$+\uparrow \sum F_y = 0 = A_y + D_y - 36^k$ $\quad A_y = 18^k$

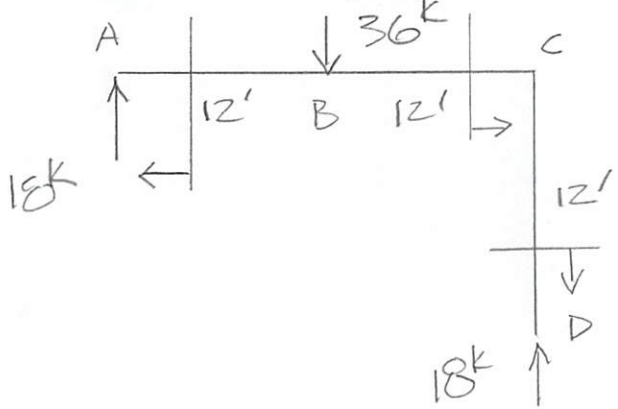
$\pm\rightarrow \sum F_x = 0 = A_x$

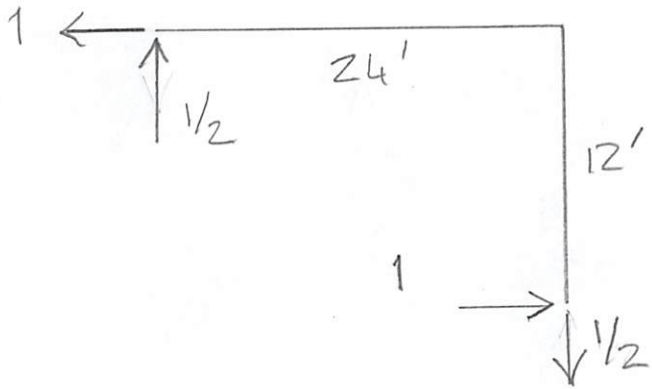
(II) $\circlearrowleft^{+} \sum M_A = 0 = 1(12') + D_y(24')$ $\quad D_y = -1/2$

$+\uparrow \sum F_y = 0 = A_y + D_y$ $\quad A_y = 1/2$

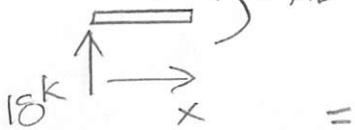
$\pm\rightarrow \sum F_x = 0 = A_x + 1$ $\quad A_x = -1$

**Problem 9b-2** – Compute the reactions for the following beam.




## SECTION AB

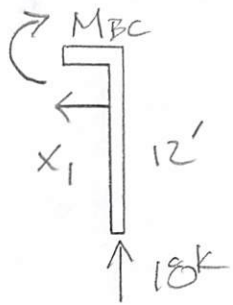



$\circlearrowleft + \sum M_{CUT} = 0$

$= M_{AB} - 18x$

$M_{AB} = (18x)$ kft

## SECTION BC




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

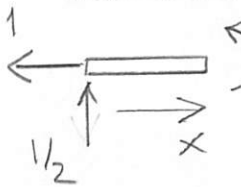
$= -M_{BC} + 18x_1$

$M_{BC} = (18x_1)$ kft

## SECTION CD


$\circlearrowleft + \sum M_{CUT} = 0 = M_{CD}$

## SECTION AB

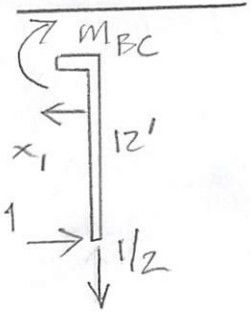



$\circlearrowleft + \sum M_{CUT} = 0$

$= m_{AB} - 1/2\,x$

$m_{AB} = x/2$

## SECTION BC

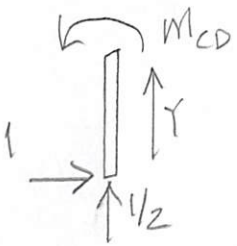



$\circlearrowleft + \sum M_{CUT} = 0$

$= -m_{BC} + 1(12') - 1/2(x_1)$

$m_{BC} = -x_1/2 + 12$

## SECTION CD




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

$= m_{CD} + 1(Y)$

$m_{CD} = -Y$

**Problem 9b-2** – Compute the reactions for the following beam.

$$EI\Delta_{D_x} = \int_0^{12} M_{AB} m_{AB}\, dx + \int_0^{12} M_{BC} m_{BC}\, dx_1$$

$$EIf_{DD} = \int_0^{12} m_{AB} m_{AB}\, dx + \int_0^{12} m_{BC} m_{BC}\, dx_1 + \int_0^{12} m_{CD} m_{CD}\, dy$$

$$EI\Delta_{Dx} = \int_0^{12} (18x)(x/2)\, dx + \int_0^{12} (18x_1)(-x_1/2 + 12)\, dx_1$$

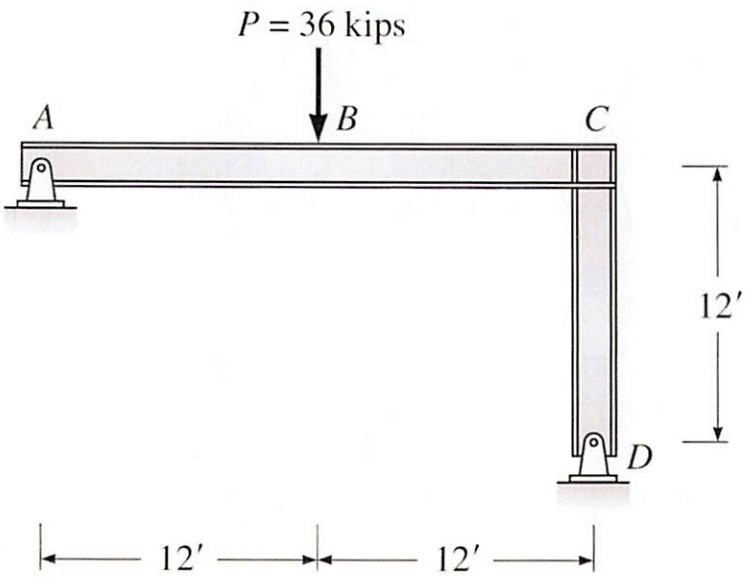
$$= 3x^3\Big|_0^{12} + \left(-3x_1^3 + 108x_1^2\right)\Big|_0^{12} = \underline{15{,}552\ \text{k-ft}^3}$$

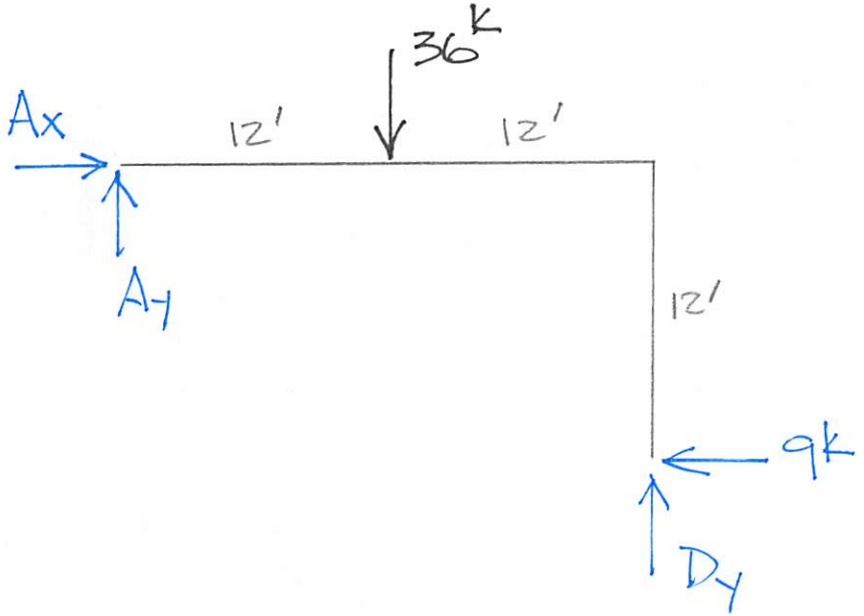
$$EIf_{DD} = \int_0^{12} (x/2)^2\, dx + \int_0^{12} (-x_1/2 + 12)^2\, dx_1 + \int_0^{12} (-1)^2\, dy$$

$$= \frac{x^3}{12}\Big|_0^{12} + \left(\frac{x^3}{12} - 6x^2 + 144x\right)_0^{12} + \frac{y^3}{3}\Big|_0^{12} = \underline{1{,}728\ \text{ft}^3}$$

$$\Delta_{Dx} + D_x f_{DD} = 0 = 15{,}552\ \text{k-ft} + D_x(3{,}456\ \text{ft}^3) \qquad \underline{D_x = -9\ \text{k}}$$

**Problem 9b-2** – Compute the reactions for the following beam.




$$\circlearrowleft + \Sigma M_A = 0 = -36^k(12') - 9^k(12') + D_y(24')$$

$$\underline{\underline{D_y = 22.5^k}}$$

$$+\uparrow \Sigma F_y = 0 = A_y + D_y - 36^k \qquad \underline{\underline{A_y = 13.5^k}}$$

$$\pm \rightarrow \Sigma F_x = 0 = A_x - 9^k \qquad \underline{\underline{A_x = 9^k}}$$