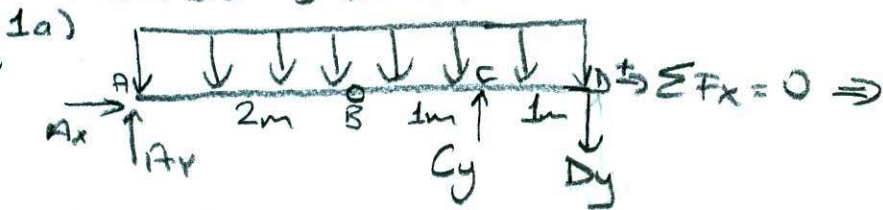


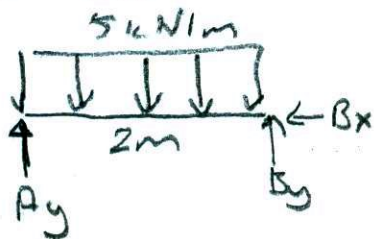
Sign convention for all questions:



From ABCD: 5 kN/m



From AB:



$$\sum F_x = 0 \Rightarrow B_x = 0$$

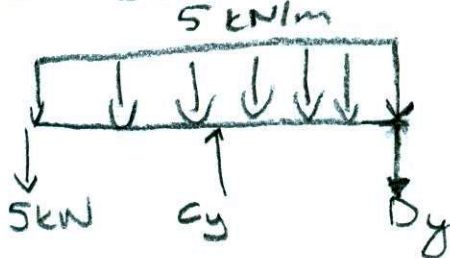
$$\sum M_B = 0 \Rightarrow -A_y(2) + 5(2)(1) = 0$$

$$A_y = 5 \text{ kN (}\uparrow\text{)}$$

$$\sum F_y = 0 \Rightarrow 5 - 5(2) + B_y = 0$$

$$B_y = 5 \text{ kN (}\uparrow\text{)}$$

From BCD:



$$\sum M_C = 0$$

$$5(1) - D_y(1) = 0$$

$$D_y = 5 \text{ kN (}\downarrow\text{)}$$

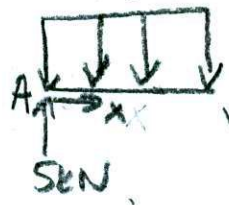
$$\sum F_y = 0$$

$$-5 - 5 - 5(2) + C_y = 0$$

$$C_y = 20 \text{ kN (}\uparrow\text{)}$$

5 kN/m

For AC:

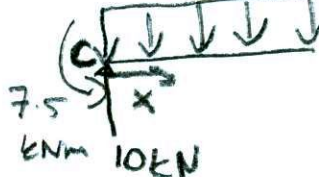


$$M(x) = 5x - 5(x)\left(\frac{x}{2}\right)$$

$$= 5x - 2.5x^2$$

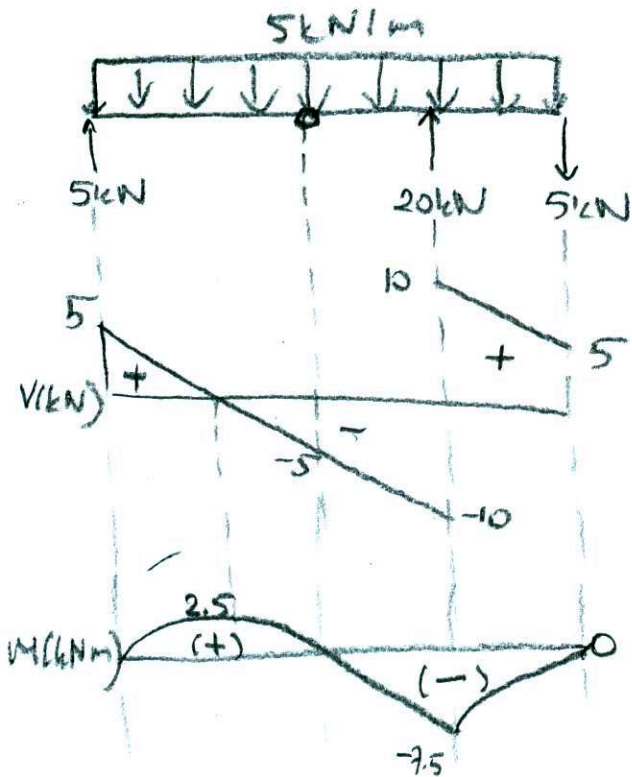
For CD:

5 kN/m

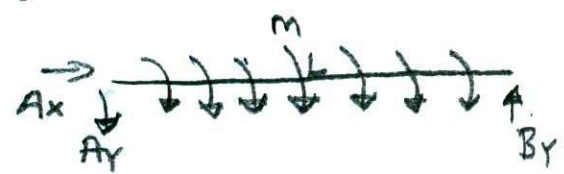


$$M(x) = -5(x)\left(\frac{x}{2}\right) + 10x - 7.5$$

$$= -2.5x^2 + 10x - 7.5$$

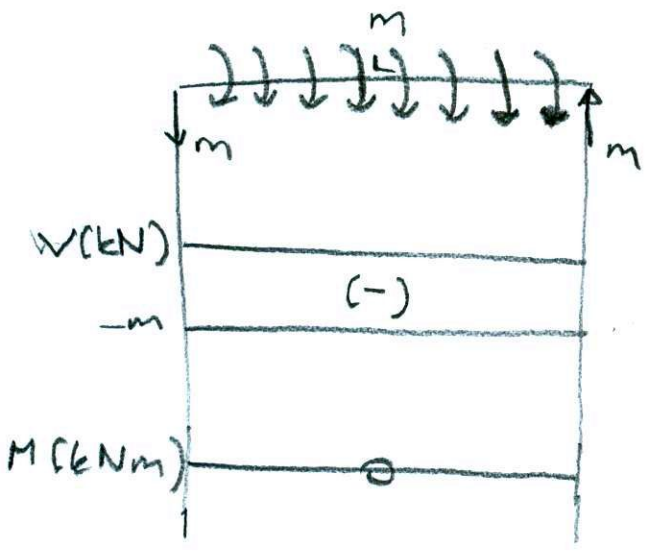


1-b)



$$\begin{aligned} \sum F_x = 0 & \Rightarrow A_x = 0 \\ \sum M_A = 0 & \Rightarrow mL - B_y(L) = 0 \\ & \Rightarrow B_y = m(\uparrow) \\ \sum F_y = 0 & \Rightarrow m - A_y = 0 \\ & \Rightarrow A_y = m(\downarrow) \end{aligned}$$

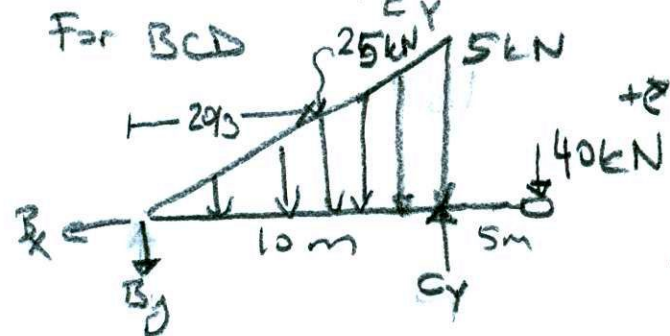
$$\begin{aligned} M(x) &= m(x) - m(x) \\ M(x) &= 0 \end{aligned}$$



c) For DE

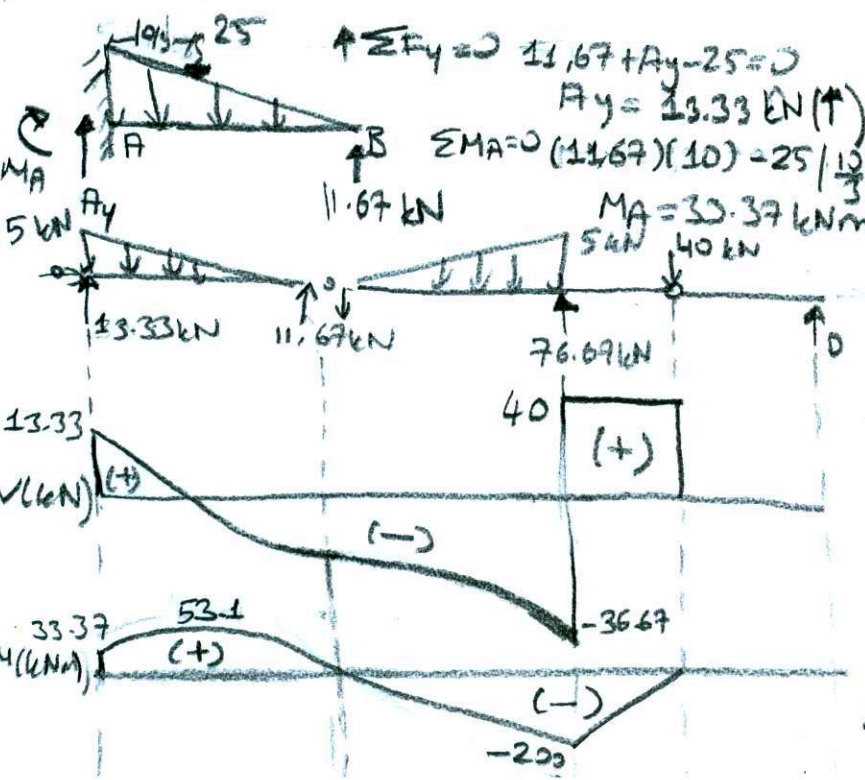


$$\begin{aligned} \sum F_x = 0 & \Rightarrow E_x = 0 \\ \sum M_D = 0 & \Rightarrow E_y = 0 \end{aligned}$$



$$\begin{aligned} \sum M_B = 0 & \Rightarrow 25 \times \left(\frac{20}{3}\right) + 40(15) - 10C_y = 0 \\ & \Rightarrow C_y = 76.67 \text{ kN} (\uparrow) \\ \sum F_y = 0 & \Rightarrow -B_y - 25 - 40 + 76.67 = 0 \\ & \Rightarrow B_y = 11.67 \text{ kN} (\downarrow) \\ \sum F_x = 0 & \Rightarrow B_x = 0 \end{aligned}$$

For AB



$$\begin{aligned} \sum F_y = 0 & \Rightarrow 11.67 + A_y - 25 = 0 \\ & \Rightarrow A_y = 13.33 \text{ kN} (\uparrow) \\ \sum M_A = 0 & \Rightarrow (11.67)(10) - 25\left(\frac{10}{2}\right) - M_A = 0 \\ & \Rightarrow M_A = 33.37 \text{ kNm} (\circlearrowleft) \end{aligned}$$

For AB:

$$M(x) = -\left(5 - \frac{x}{2}\right) \frac{x}{2} - \frac{x^2}{4} \left(\frac{25}{3}\right) + 33.37 + 13.33x$$

$$= -x^3/6 + x^2/4 + 10.83x + 33.37$$

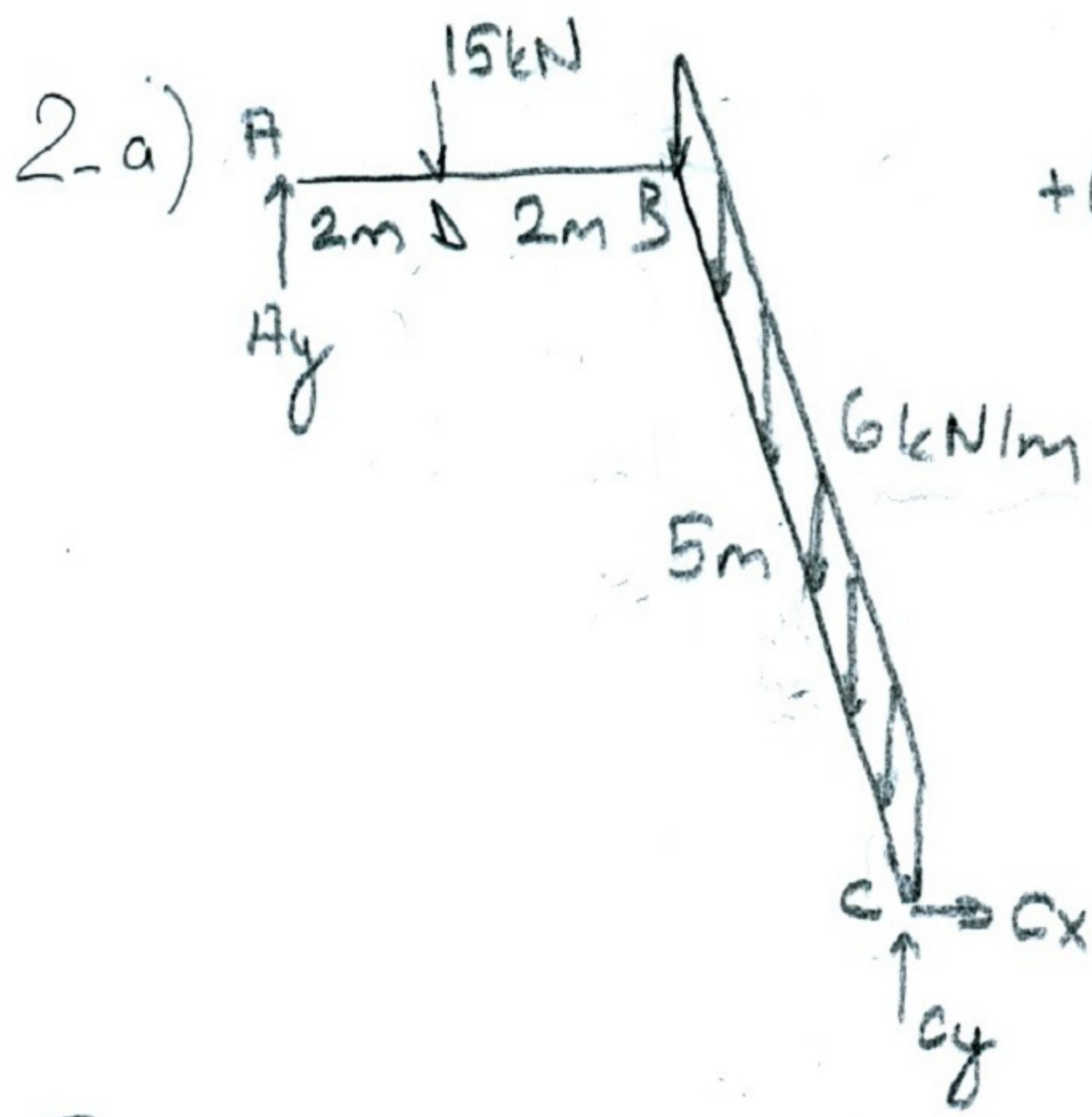
For BC:

$$M(x) = -\left(\frac{x}{2}\right) \left(\frac{x}{2}\right) \left(\frac{x}{3}\right) - 11.67x$$

$$= -x^3/12 - 11.67x$$

For CD:

$$M(x) = -200 + 40x$$



$$+\circlearrowleft \sum M_C = 0 \quad 6(3)(1.5) + 15(1.5) - A_y(7) = 0$$

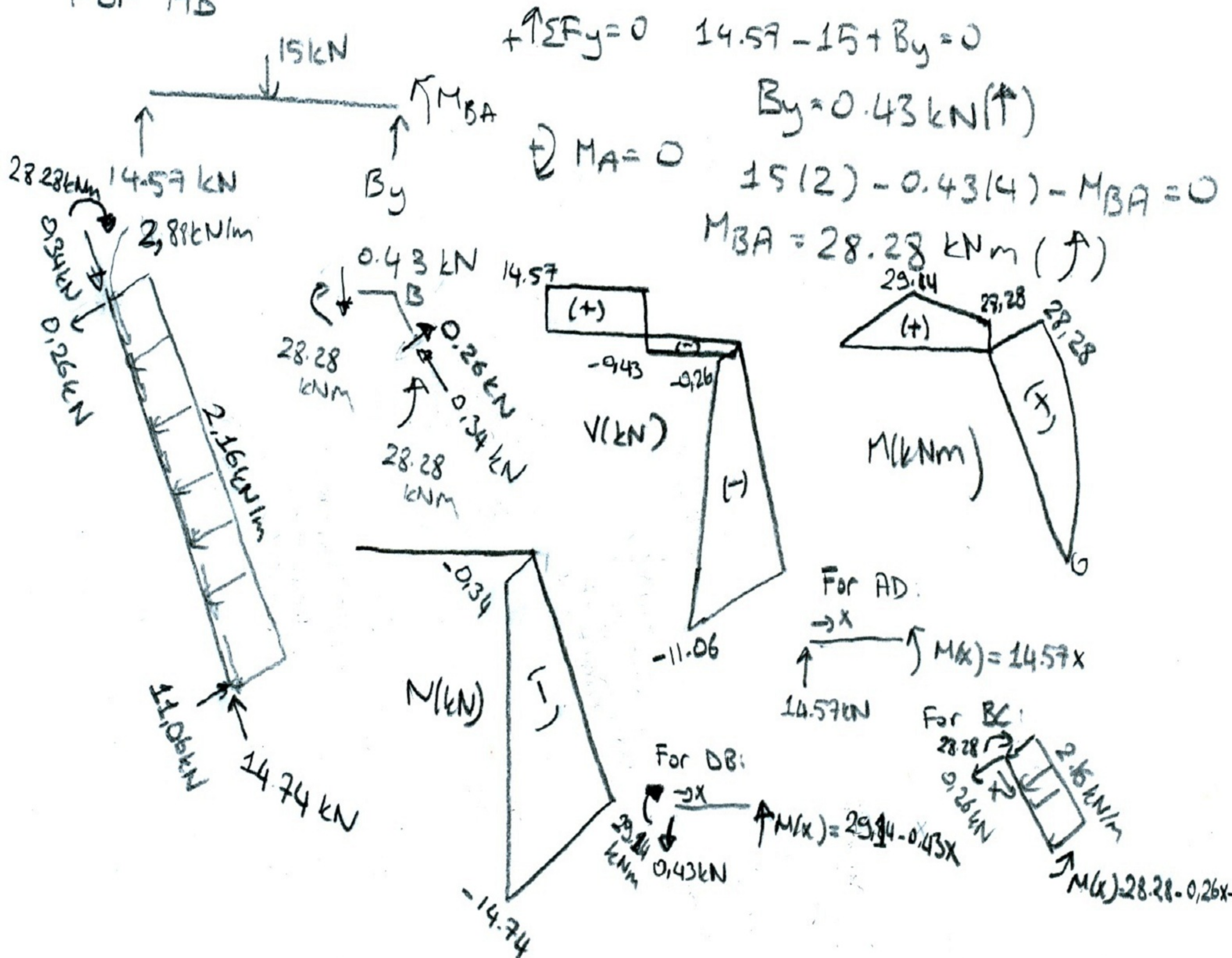
$$A_y = 14.57 \text{ kN } (\uparrow)$$

$$+\uparrow \sum F_y = 0 \quad 14.57 - 15 - 6(3) + C_y = 0$$

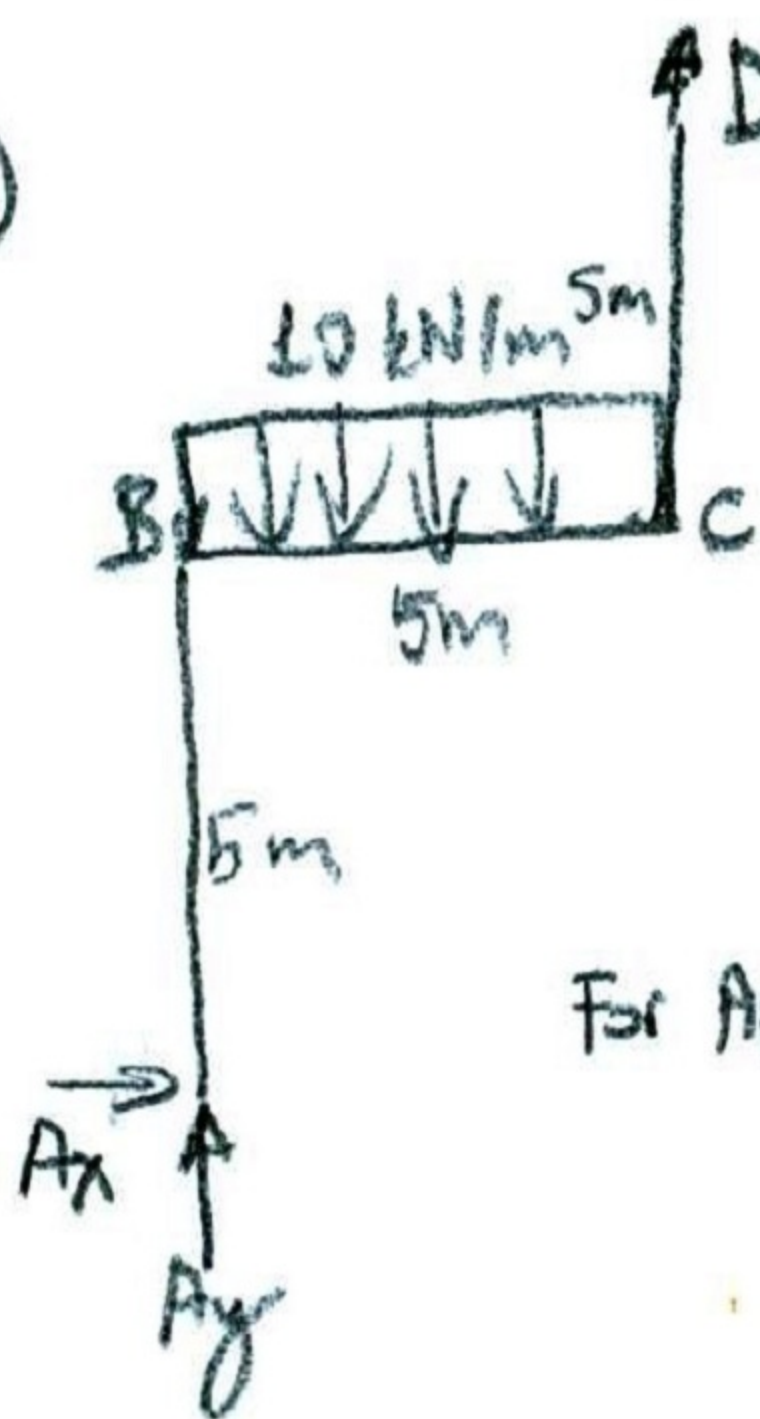
$$C_y = 18.43 \text{ kN } (\uparrow)$$

$$+\rightarrow \sum F_x = 0 \quad C_x = 0$$

For AB



b)



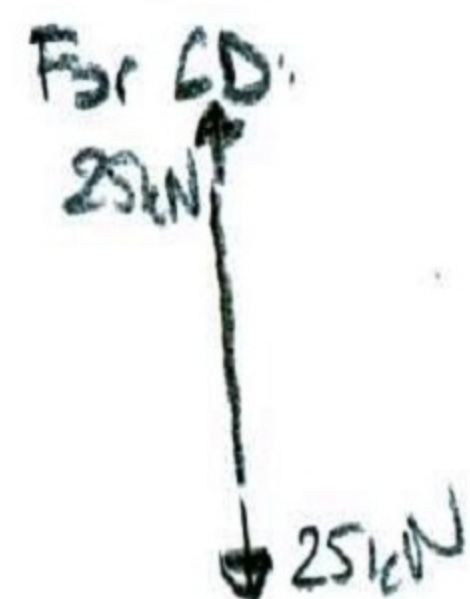
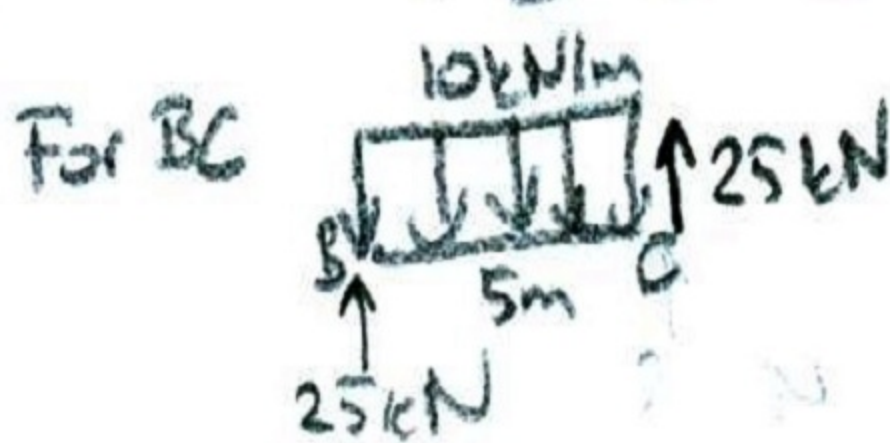
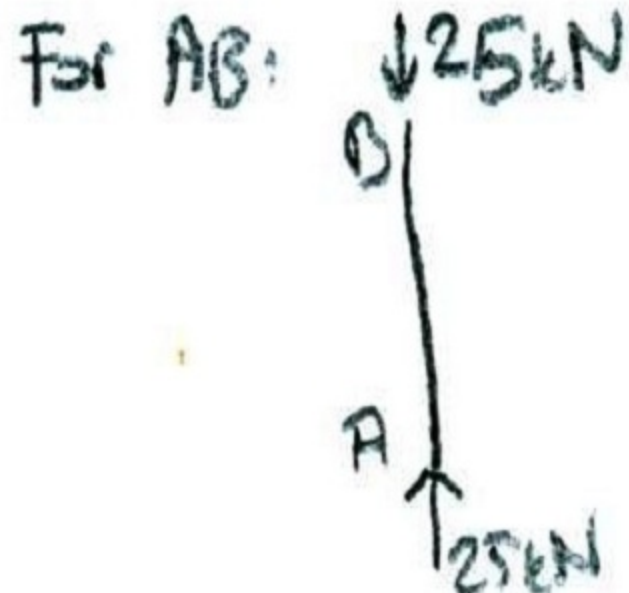
$$+\circlearrowleft \sum M_A = 0 \quad 10(5)(2.5) - D_y(5) = 0$$

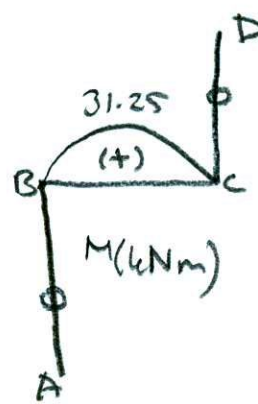
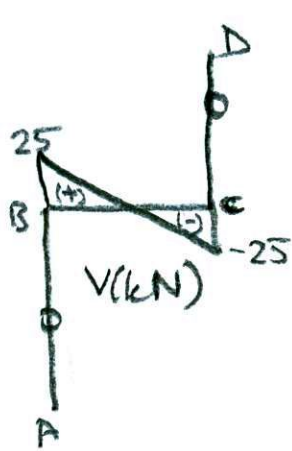
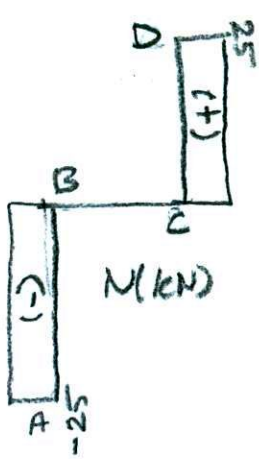
$$D_y = 25 \text{ kN } (\uparrow)$$

$$+\rightarrow \sum F_x = 0 \quad A_x = 0$$

$$+\uparrow \sum F_y = 0 \quad 10 + 5(10) - A_y = 0$$

$$A_y = 25 \text{ kN } (\uparrow)$$

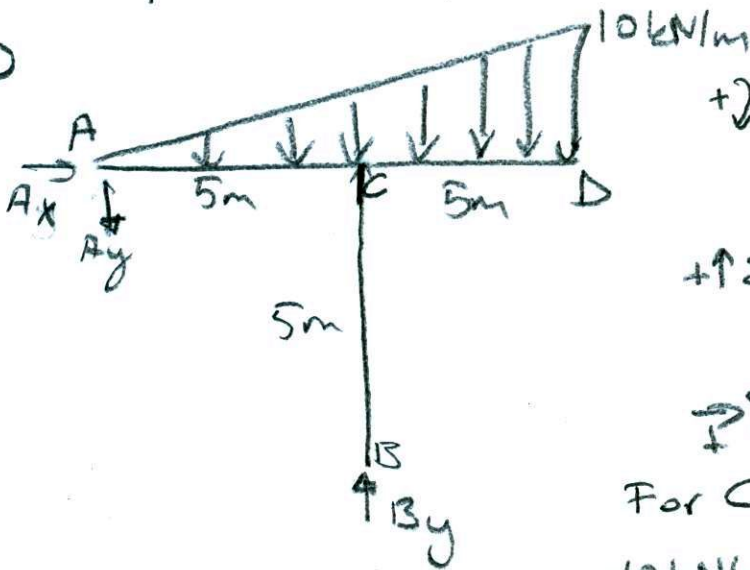




For BC:

$$25 \text{ kN} = -5x^2 + 25x$$

c)



$$+\circlearrowleft \sum M_A = 0 \quad 10(10/2)(20/3) - B_y(5) = 0$$

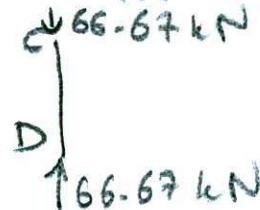
$$B_y = 66.67 \text{ kN}$$

$$+\uparrow \sum F_y = 0 \quad -10(10/2) - A_y + 66.67 = 0$$

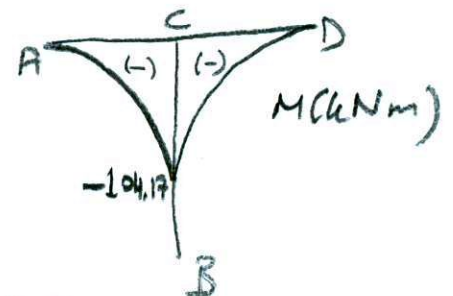
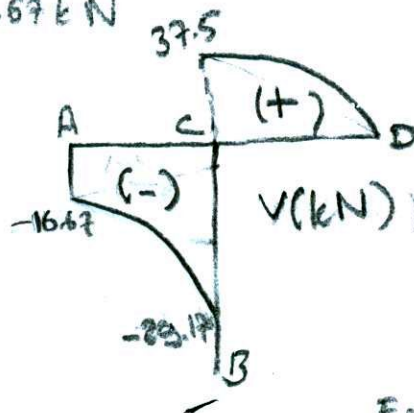
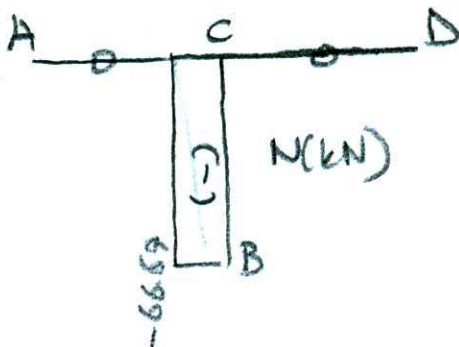
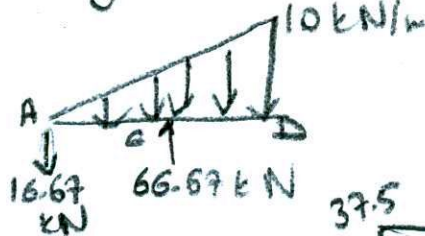
$$A_y = 16.67 \text{ kN}(\downarrow)$$

$$+\rightarrow \sum F_x = 0 \quad A_x = 0$$

For CD:



For ACD:



For AC:

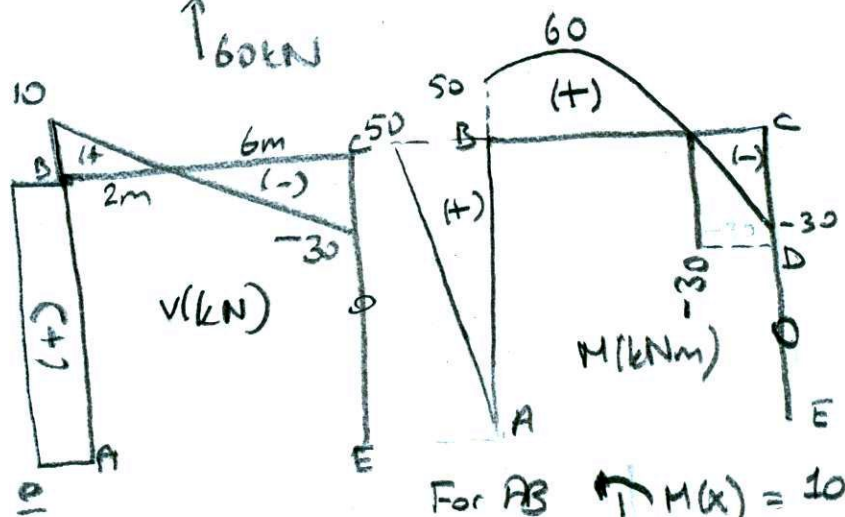
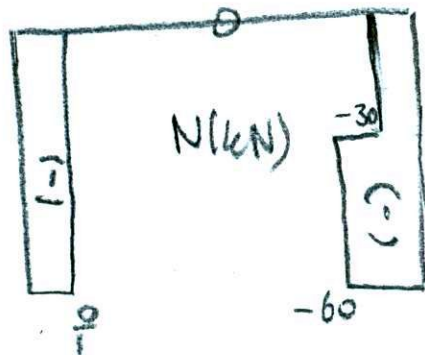
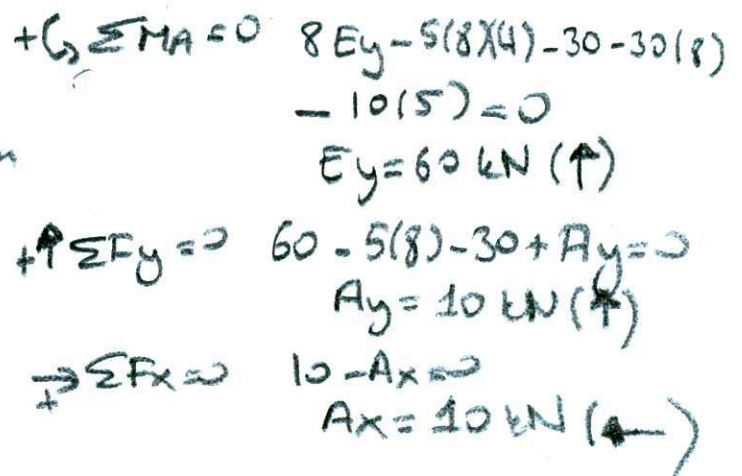
$$M(x) = -x(x/2)(x/3) - 16.67x$$

$$= -x^3/6 + 16.67x$$

For CD:

$$M(x) = -x(x/2)(x/5) - 5(x/2)(x/2) + 37.5x - 104.17$$

$$= -x^3/6 - 2.5x^2 + 37.5x - 104.17$$



For AB $\curvearrowright M(x) = 10x_1$

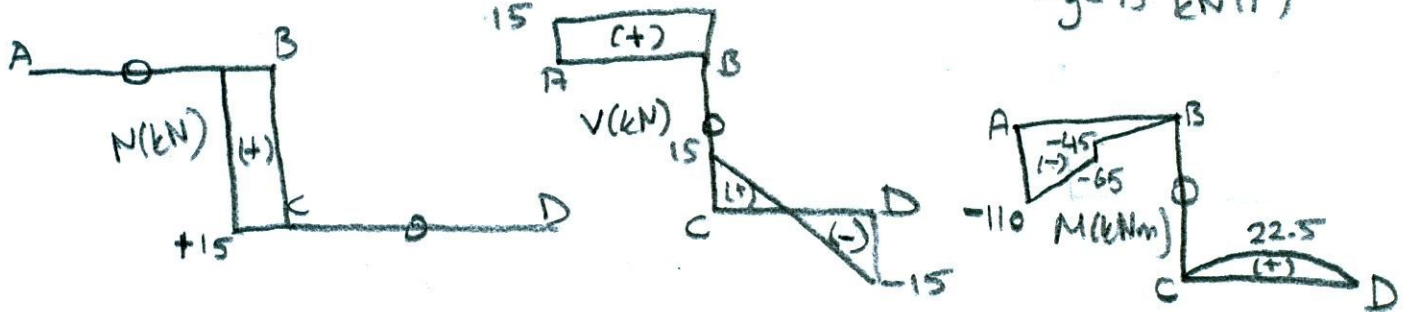
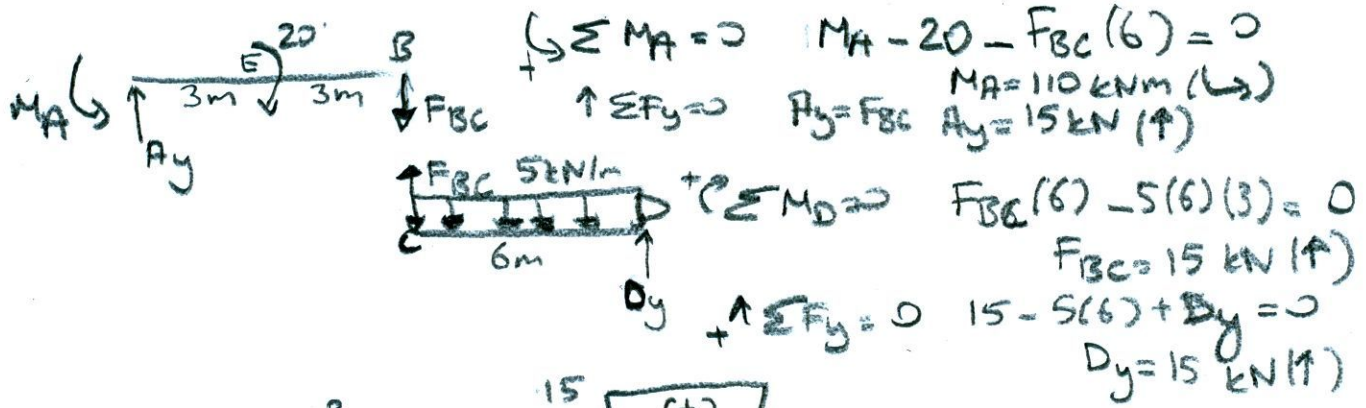
For BC

50 kNm
 5 kN/m
 10 kN
 x_2
 $M(x)$

$$= 50 + 10x_2 - 5x_2\left(\frac{1}{2}x_2\right)$$
$$= -2.5x_2^2 + 10x_2 + 50$$

For CD $M(x) = -30 \text{ kNm}$

e) BC acts as a link



For AE: $M(x) = -110 + 15x$

EB: $M(x) = -45 + 15x$

CD: $M(x) = -5(x)(x/2) + 15x = -2.5x^2 + 15x$