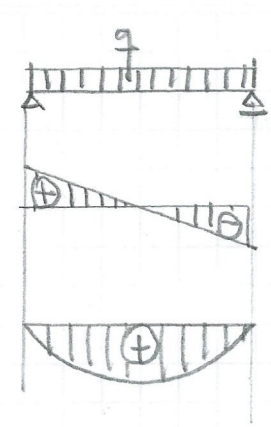
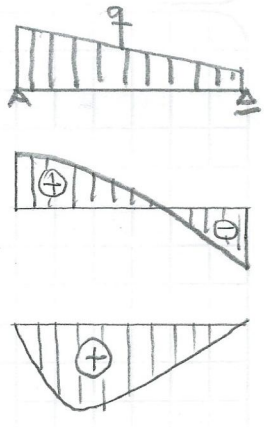


Q (cte)  
M (Lineal)

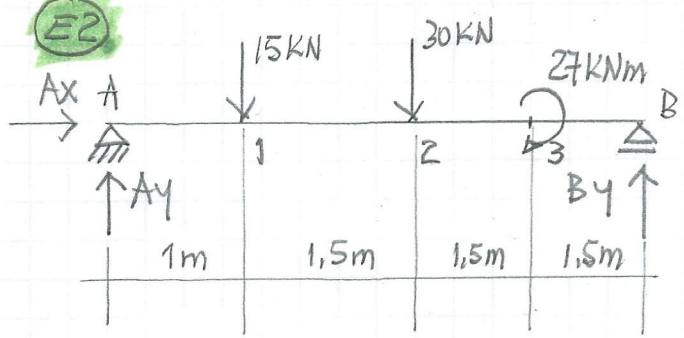


Q (Lineal)  
M (2º Orden)



Q (2º Orden)  
M (3º Orden)

E2



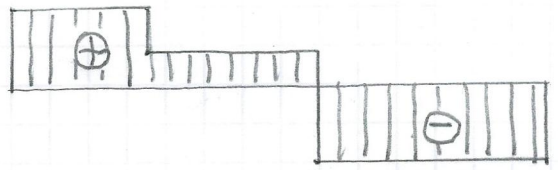
REACCIONES

$$\sum M^A = 0 = (15 \times 1) + (30 \times 2,5) + 27 - B_y \cdot 5$$

$$| B_y = 21,27 \text{ kN} |$$

$$\sum F_y = 0 = A_y - 15 - 30 + 21,27 =$$

$$| A_y = 23,73 \text{ kN} \quad | \quad A_x = 0$$



(Q)

CORTE (Q)

$$Q_{Ad} = A_y = 23,73 \text{ kN}$$

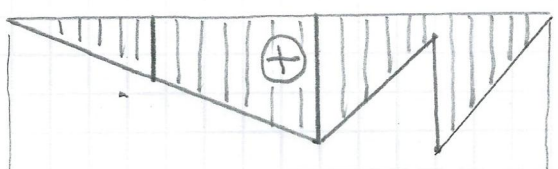
$$Q_{1i} = A_y = 23,73 \text{ kN}$$

$$Q_{1d} = A_y - 15 = 8,73 \text{ kN}$$

$$Q_{2i} = A_y - 15 = 8,73 \text{ kN}$$

$$Q_{2d} = A_y - 15 - 30 = -21,27 \text{ kN}$$

$$Q_{Bi} = 21,27 \text{ kN}$$



(M)

MOMENTOS (M)

$$M_A = M_B = 0$$

$$M_1 = A_y \cdot 1m = 23,73 \text{ kNm}$$

$$M_2 = A_y \cdot 2,5 - 15 \times 1,5 =$$

$$M_2 = 36,825 \text{ kNm}$$

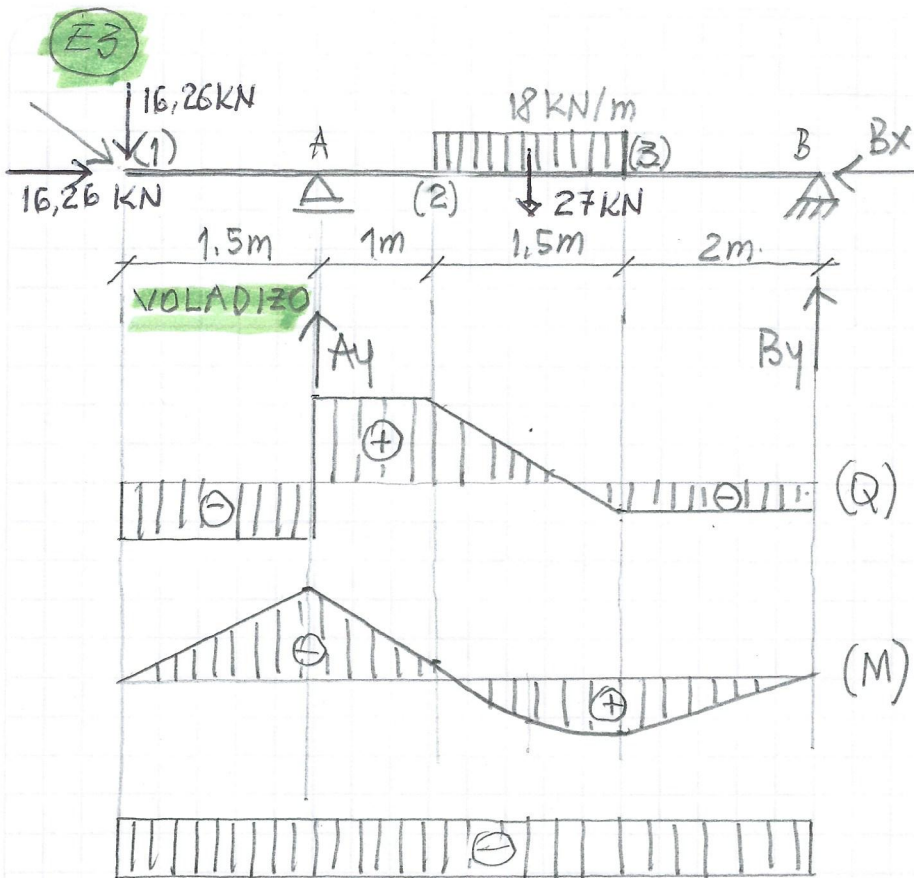
$$M_{3j} = A_y \cdot 4 - (15 \times 3) - (30 \times 1,5) -$$

$$M_{3i} = 4,92 \text{ kNm}$$

(N)

$$A_x = 0 \therefore N = 0$$

$$M_{3d} = A_y \cdot 4 - (15 \times 3) - (30 \times 1,5) + 27 = 31,92 \text{ kNm}$$



REACCIONES

$$\sum M_B = 0$$

$$-(16,26 \times 6) + A_y \cdot 4,5 - (27 \times 2,75)$$

$$A_y = 38,18 \text{ KN}$$

$$\sum F_y = 0$$

$$-16,26 + A_y - 27 + B_y$$

$$B_y = 5,08 \text{ KN}$$

$$\sum F_x = 0$$

$$16,26 - B_x = 0$$

$$B_x = 16,26 \text{ KN}$$

CORTE

$$Q_{A1} = -16,26 \text{ KN}$$

$$Q_{Ad} = -16,26 + 38,18 = 21,92 \text{ KN}$$

$$Q_2 = 21,92 \text{ KN}$$

$$Q_3 = -16,26 + 38,18 - 27$$

$$Q_3 = -5,08 \text{ KN}$$

$$Q_B = -5,08 \text{ KN}$$

MOMENTOS

$$M_1 = M_B = 0$$

$$M_A = -16,26 \times 1,50 = -24,39 \text{ KNm}$$

$$M_2 = (-16,26 \times 2,50) + (38,18 \times 1) = -2,47 \text{ KNm}$$

$$M_{2-3} = (-16,26 \times 3,25) + (38,18 \times 1,75) - \left( \frac{18 \times 0,75 \times 0,75}{2} \right) = 8,90 \text{ KNm}$$

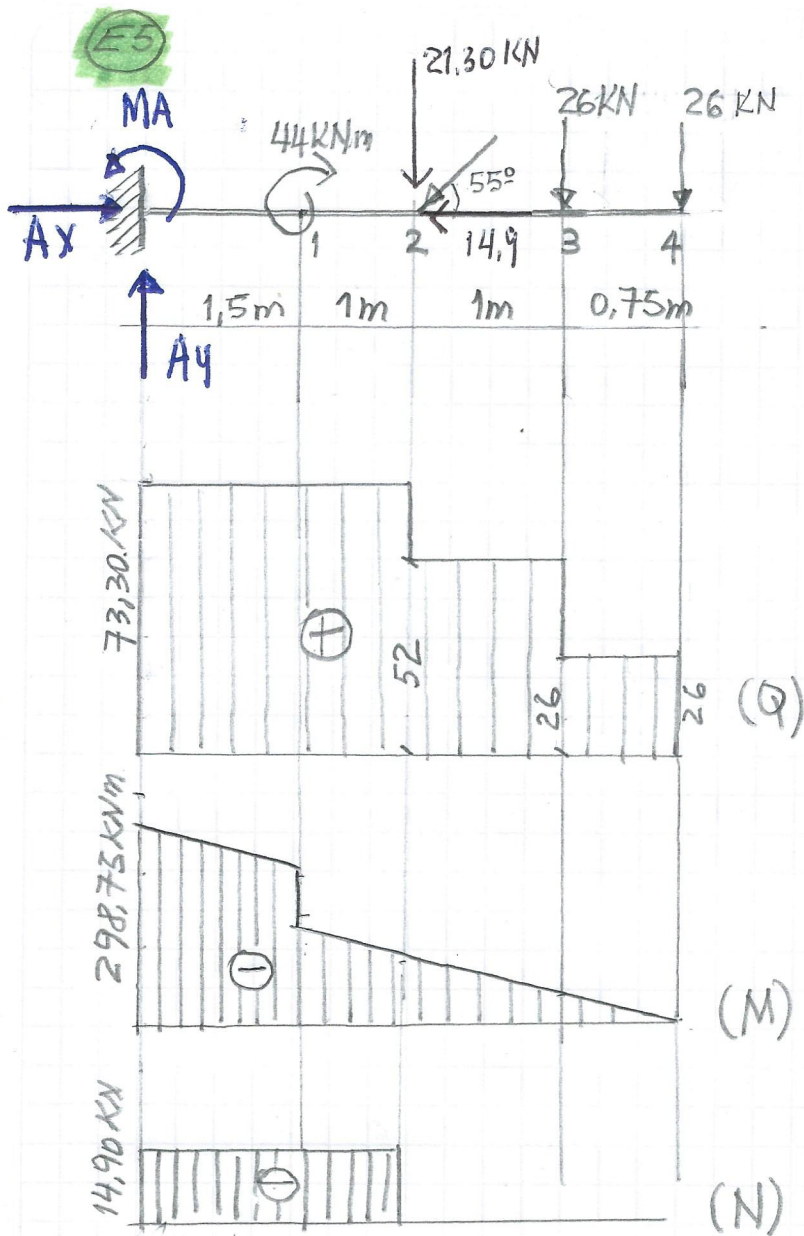
$$M_3 = -(-B_y \times 2m) = 10,16 \text{ KNm}$$

NORMAL

$$N_1 = -16,26 \text{ KN (Comprime)}$$

↓ se mantiene cte a lo largo de la viga porque no aparece en toda la longitud otra fuerza que actúe axialmente.



REACCIONES

$$\sum F_y = 0 = -21,30 - 26 - 26 + A_y = 0$$

$$A_y = 73,30 \text{ KN}$$

$$\sum F_x = 0 = A_x - 14,9 = 0$$

$$A_x = 14,90 \text{ KN}$$

$$\sum M^A = 0$$

$$-M_A + 44 + (21,30 \times 2,5) + (26 \times 3,5) + (26 \times 4,25) = 0$$

$$M_A = 298,75 \text{ KNm}$$

CORTE

$$Q_{Ad} = A_y = 73,30 \text{ KN}$$

$$Q_{2i} = 73,30 \text{ KN}$$

$$Q_{2d} = 73,30 - 21,30 = 52 \text{ KN}$$

$$Q_{3j} = 52 \text{ KN}$$

$$Q_{3d} = +73,30 - 21,30 - 26 = 26 \text{ KN}$$

$$Q_{4i} = 26 \text{ KN}$$

MOMENTOS

$$M_4 = 0$$

$$M_3 = -(26 \times 0,75) = -19,5 \text{ KNm}$$

$$M_2 = -[(26 \times 1,75) + (26 \times 1)] = -71,50 \text{ KNm}$$

$$M_{1d} = -[(26 \times 2,75) + (26 \times 2) + (21,30 \times 1)] = -144,80 \text{ KNm}$$

$$M_{1j} = -[(26 \times 2,75) + (26 \times 2) + (21,30 \times 1) + 44] = -188,80 \text{ KNm}$$

$$M_A = -[(26 \times 4,25) + (26 \times 3,5) + (21,30 \times 2,50) + 44] = -298,75 \text{ KNm}$$

NORMAL

$$N_A = -A_x = -14,90 \text{ KN} \rightarrow \text{Se mantiene hasta el punto (2)}$$

CORTE

$$Q_{Ad} = +R_{Ay} = 35 \text{ KN}$$

$$Q_{1i} = 35 \text{ KN}$$

$$Q_{1d} = 35 - P = 0 \text{ KN}$$

$$Q_{2i} = 0 \text{ KN}$$

$$Q_{2d} = R_{Ay} - P - P = -35 \text{ KN}$$

$$Q_{Bj} = -35 \text{ KN}$$

$$Q_{Bd} = R_{Ay} - P - P + R_{By} = 24,83 \text{ KN}$$

$$Q_{3,5m} = R_{Ay} - P - P + R_{By} - (15 \times 1,5) = 2,33 \text{ KN}$$

$$Q_{ci} = R_{Ay} - P - P + R_{By} - (15 \times 3) = -20,17 \text{ KN}$$

$$Q_{cd} = R_{Ay} - P - P + R_{By} - 45 + R_{Cy} = 21 \text{ KN}$$

$$Q_{3i} = 21 \text{ KN}$$

$$Q_{3d} = -(R_{Dy}) = -14 \text{ KN}$$

$$Q_{3d} = R_{Ay} - 2P + R_{By} - 45 + R_{Cy} - P = -14 \text{ KN}$$

MOMENTOS

$$M_A = 0 ; M_D = 0 ; M_{A1-2} = 0 ; M_{A23} = 0$$

$$M_1 = R_{Ay} \times 0,5 = 17,5 \text{ KNm}$$

$$M_2 = (R_{Ay} \times 1) - (35 \times 0,5) = 17,5 \text{ KNm}$$

$$M_{A1-2} = (R_{Ay} \times 1,5) - (35 \times 1) - (35 \times 0,5) = 0,00 \text{ KNm}$$

$$M_B = (R_{Ay} \times 2) - (35 \times 1,5) - (35 \times 1) = -17,5 \text{ KNm}$$

$$M_{3,5m} = (R_{Ay} \times 3,5) - (35 \times 3) - (35 \times 2,5) + (R_{By} \times 1,5) - (15 \times 1,5) \times 0,75 = +2,87 \text{ KNm}$$

$$M_3 = -(- (R_{Dy} \times 0,75)) = +10,50 \text{ KNm}$$

$$M_{A23} = -(- (R_{Dy} \times 1,25) + (35 \times 0,5)) = 0,00 \text{ KNm}$$

$$M_C = -(- (R_{Dy} \times 1,75) + (35 \times 1)) = -10,50 \text{ KNm}$$



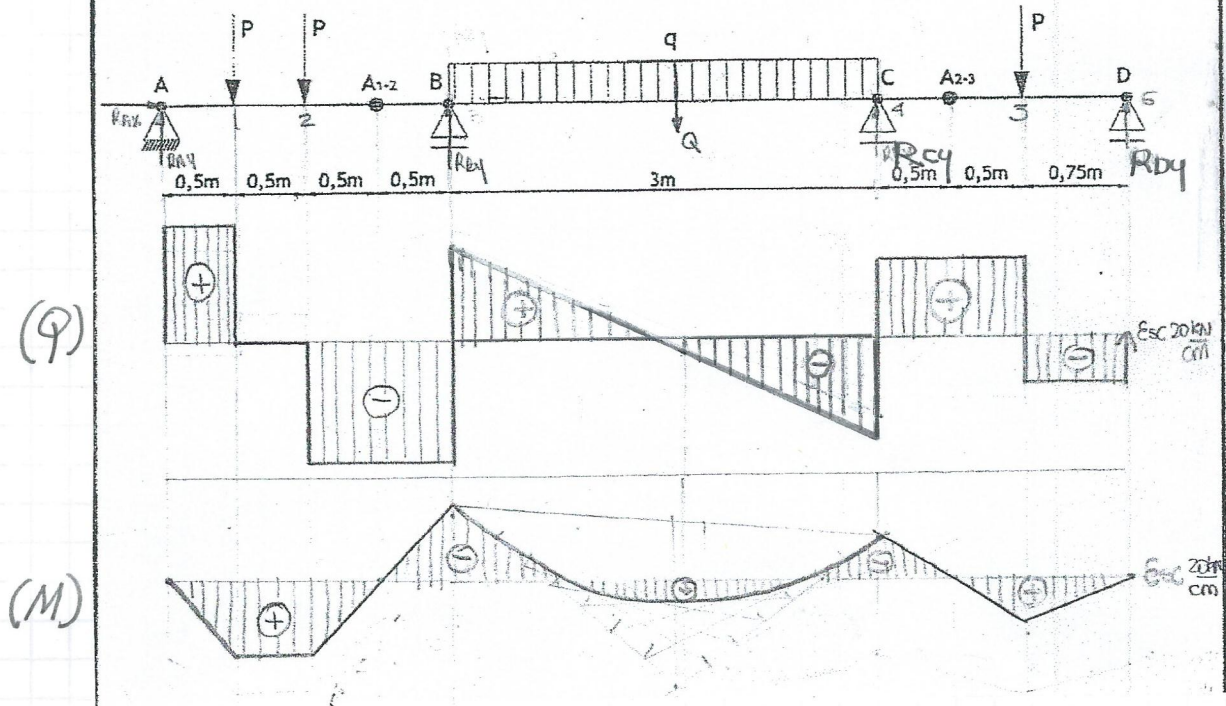
E6

## Ejercicio N°6:

Determinar los esfuerzos internos (M,N,Q) de la siguiente viga Gerber

$$q = 15 \text{ KN/m}$$

$$P = 35 \text{ KN}$$

REACCIONES

$$\sum M_{A23}^d = -R_{Dy} \cdot 1,25 \text{ m} + 35 \times 0,50 \Rightarrow R_{Dy} = 14 \text{ KN}$$

$$\sum M_{A12}^i = R_{Ay} \cdot 1,50 - 35 \times 1 \text{ m} - 35 \times 0,50 \text{ m} \Rightarrow R_{Ay} = 35 \text{ KN}$$

$$\sum F_x = 0 \Rightarrow R_{Ax} = 0$$

$$\textcircled{1} \sum M_{A12}^i = 0 = -R_{By} \cdot 0,50 \text{ m} + (15 \times 3) \times 2 \text{ m} - R_{Cy} \cdot 3,5 \text{ m} + 35 \times 4,50 - 14 \times 5,25 - R_{By} \cdot 0,50 + 174 - R_{Cy} \cdot 3,50 \text{ m} = 0$$

$$\sum M^A = 0 = (35 \times 0,5) + (35 \times 1) - R_{By} \cdot 2 + (45 \times 3,50) - R_{Cy} \cdot 5 + (35 \times 6) - (14 \times 6,75) = 325,5 - R_{By} \cdot 2 - R_{Cy} \cdot 5 \Rightarrow R_{Cy} = 65,10 - 0,4 R_{By} \quad \textcircled{2}$$

$$\text{Volvemos} \Rightarrow \textcircled{1} -R_{By} \cdot 0,5 + 174 - 227,85 + 1,40 R_{By} = 0$$

$$-53,85 + 0,9 R_{By} = 0 \Rightarrow R_{By} = 59,83 \text{ KN}$$

$$\text{De } \textcircled{2} R_{Cy} = 65,10 - (0,40 \times 59,83) = 41,17 \text{ KN} = R_{Cy}$$

E7

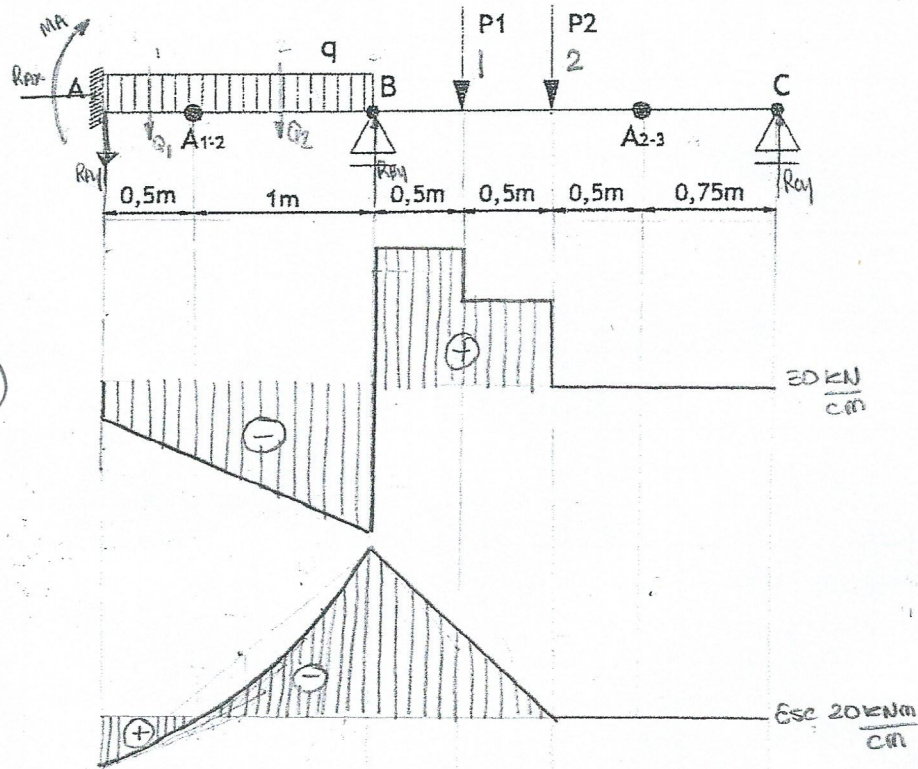
## Ejercicio N°7:

Determinar los esfuerzos internos (M,N,Q) de la siguiente viga Gerber

$$q = 27 \text{ KN/m}$$

$$P1 = 20 \text{ KN}$$

$$P2 = 35 \text{ KN}$$

REACCIONES

$$\sum M_{A2-3} = 0 = -R_{Cy} \cdot 0.75 \Rightarrow \underline{R_{Cy} = 0}$$

$$\sum M_{A1-2} = 0 = (35 \times 2) + (20 \times 1.5) - R_{By} \cdot 1 + (27 \times 1) \times 0.5 \Rightarrow$$

$$\underline{R_{By} = 113.50 \text{ KN}}$$

$$\sum F_y = 0 = -R_{Ay} - (27 \times 1.5) + R_{By} - P1 - P2 = 0$$

$$\underline{R_{Ay} = 18 \text{ KN}}$$

$$\sum M^A = 0 = M_A + (27 \times 1.5 \times 0.75) - 113.5 \times 1.5 + (20 \times 2) + (35 \times 2.5)$$

$$\underline{M_A = 12.375 \text{ KNm}}$$

$$\sum F_x = 0 \Rightarrow \underline{R_{Ax} = 0}$$



CORTE

$$Q_A^d = -R_{AY} = -18 \text{ KN}$$

$$Q_B^i = -R_{AY} - (27 \times 1,5) = -58,50 \text{ KN}$$

$$Q_B^d = -R_{AY} - (27 \times 1,5) + R_{BY} = 55 \text{ KN}$$

$$Q_{1i} = 55 \text{ KN}$$

$$Q_{1d} = -R_{AY} - (27 \times 1,5) + R_{BY} - 20 = 35 \text{ KN}$$

$$Q_{2i} = 35 \text{ KN}$$

$$Q_{2d} = -R_{AY} - (27 \times 1,5) + R_{BY} - 20 - 35 = 0,00 \text{ KN}$$

MOMENTOS

$$M_C = 0 ; M_{A12} = 0$$

$$M_A = +12,375 \text{ KNm}$$

$$M_{A12} = 12,375 - (27 \times 0,5 \times 0,25) - R_{AY} \times 0,50 = 0,00 \text{ KNm}$$

$$M_B^{(d)} = -(20 \times 0,5) - (35 \times 1,00 \text{ m}) = -45 \text{ KNm}$$

$$M_1^{(d)} = -35 \times 0,50 = -17,5 \text{ KNm}$$

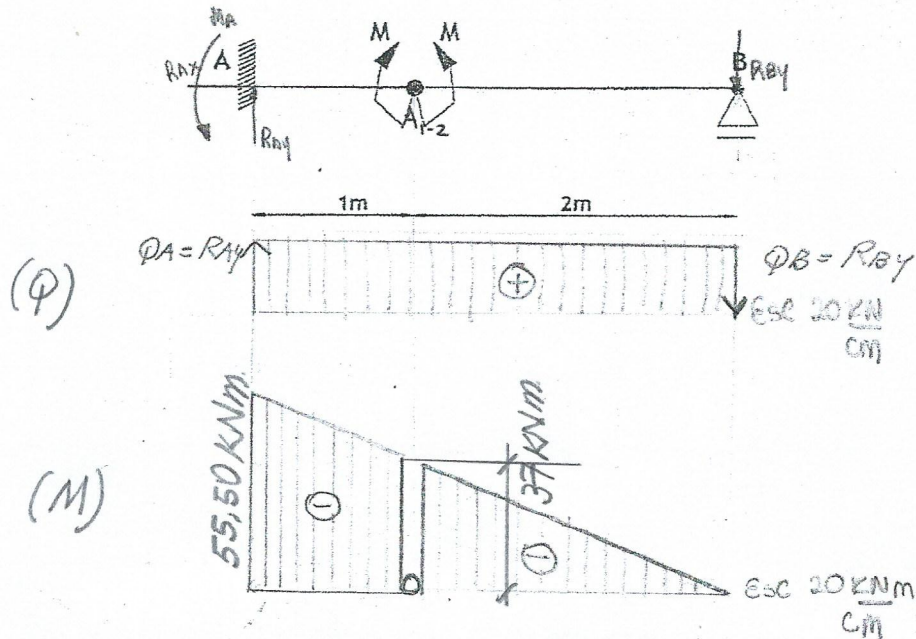
$$M_2^d = 0,00 \text{ KNm}$$

E8

## Ejercicio N°8:

Determinar los esfuerzos internos (M,N,Q) de la siguiente viga Gerber

M = 37KNm

REACCIONES

$$\sum F_x = 0 \Rightarrow \underline{R_{Ax} = 0}$$

$$\sum M_{A12} = 0 \Rightarrow R_{By} \times 2m - M = 0 \Rightarrow \underline{R_{By} = 18,5 \text{ kN}}$$

$$\sum F_y = 0 \Rightarrow R_{Ay} - R_{By} = 0 \Rightarrow \underline{R_{Ay} = 18,50 \text{ kN}}$$

$$\sum M^A = 0 = -M_A + M - M + (18,5 \times 3) = 0 \Rightarrow \underline{M_A = 55,50 \text{ kNm}}$$

CORTE

$$Q_{Ad} + R_{Ay} = 18,5 \text{ kN} \quad ; \quad Q_{Bi} = 18,5 \text{ kN}$$

MOMENTOS

$$M_A = -55,50 \text{ kNm} \quad ; \quad M_B = 0$$

$$M_{A12} = -55,50 + (18,50 \times 1) + 37 \text{ kNm} = 0,00$$

$$M_{A12} = -55,50 + (18,50 \times 1) = -37 \text{ kNm}$$