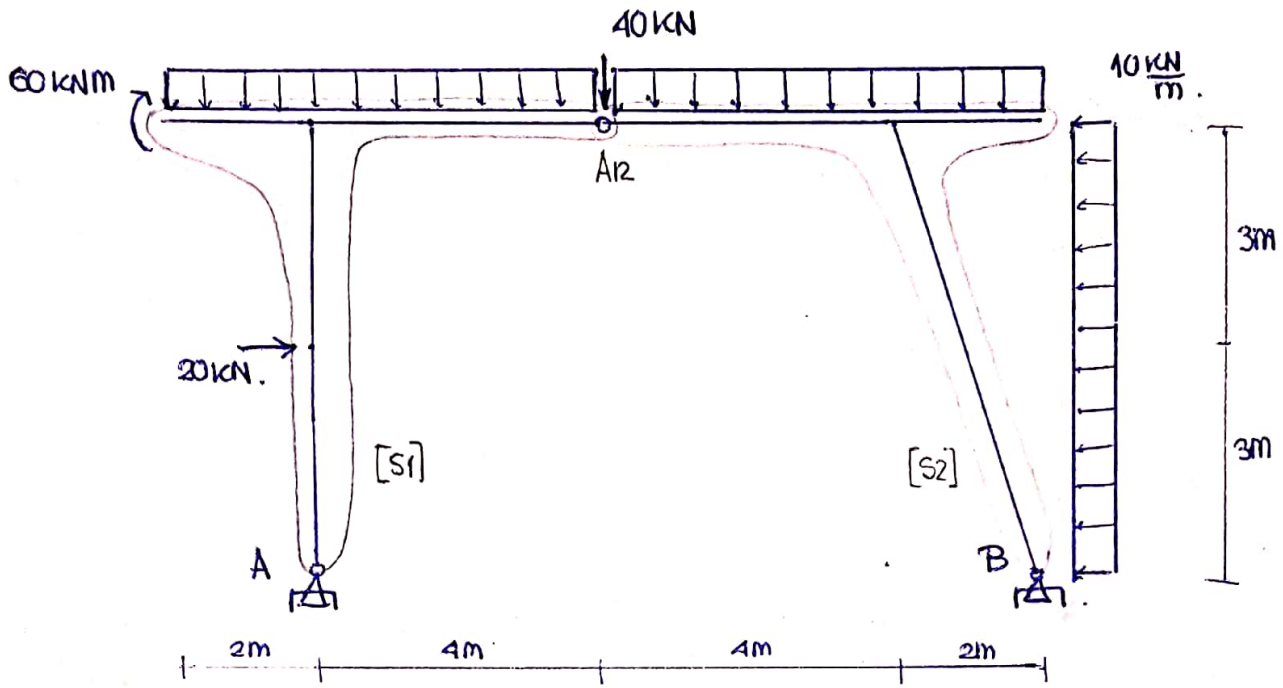


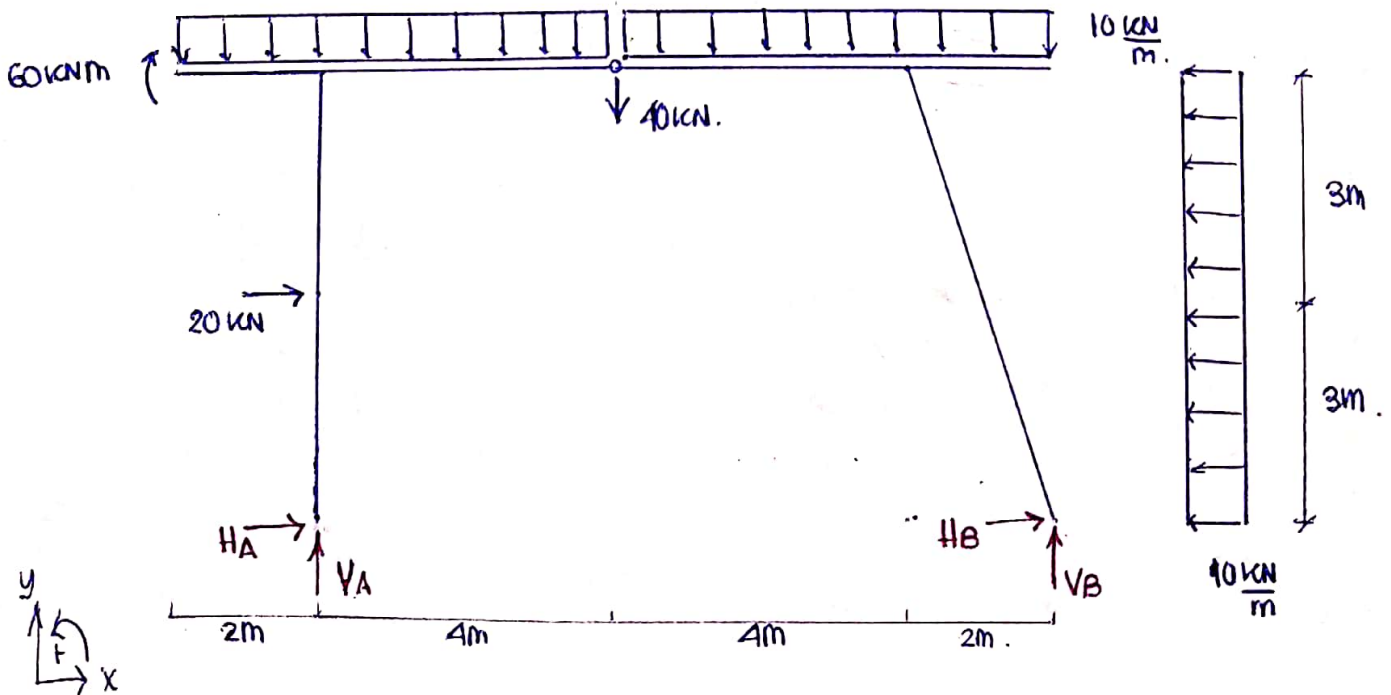
EJERCICIO.



Análisis Cinemático.

- isostático. ✓
 - arco triarticulado con sus articulaciones no alineadas → No hay vinculación aparente
- ⇒ El sistema es cinemáticamente estable.

RVE.



Ecuaciones de equilibrio absoluto

$$(1) \sum F_x = 0 \rightarrow H_A + H_B + 20 \text{ kN} - 10 \frac{\text{kN}}{\text{m}} \cdot 6\text{m} = 0$$

$$(2) \sum F_y = 0 \rightarrow V_A + V_B - 40 \text{ kN} - 10 \frac{\text{kN}}{\text{m}} \cdot 12\text{m} = 0$$

$$(3) \sum M_A = 0 \rightarrow V_B \cdot 10\text{m} + 10 \frac{\text{kN}}{\text{m}} \cdot 6\text{m} \cdot 3\text{m} - 20 \text{ kN} \cdot 3\text{m} - 40 \text{ kN} \cdot 4\text{m} - 10 \frac{\text{kN}}{\text{m}} \cdot 12\text{m} \cdot 4\text{m} - 60 \text{ kNm} = 0$$

Ecuaciones de equilibrio relativo

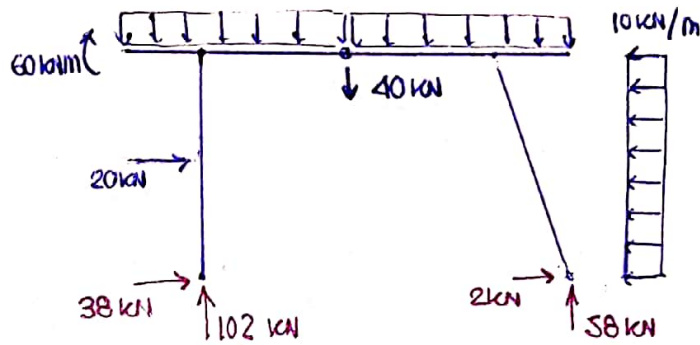
$$(A) \sum M_{A2} [s] = 0 \rightarrow 10 \frac{\text{kN}}{\text{m}} \cdot 6\text{m} \cdot 3\text{m} + 20 \text{ kN} \cdot 3\text{m} + H_A \cdot 6\text{m} - 60 \text{ kNm} - V_A \cdot 4\text{m} = 0.$$

$$(3) \rightarrow V_B = 58 \text{ kN}.$$

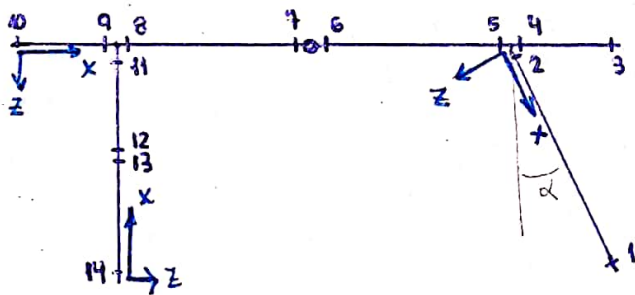
$$(2) \rightarrow V_A = 102 \text{ kN}.$$

$$(A) \rightarrow H_A = 38 \text{ kN}$$

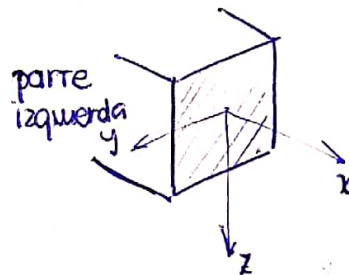
$$(1) \rightarrow H_B = 2 \text{ kN}.$$



Diagramas de características



TERNA LOCAL DERECHA



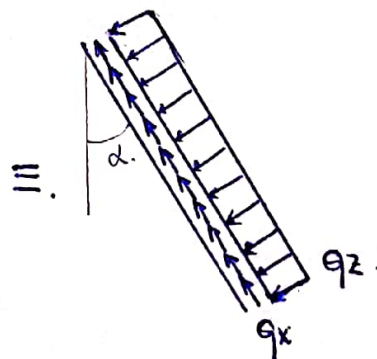
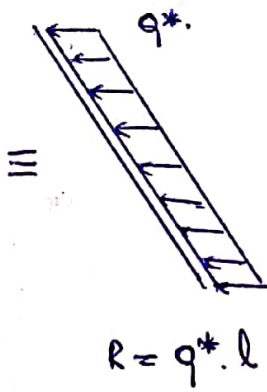
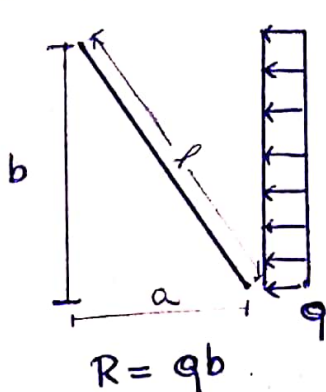
$$\frac{dN(x)}{dx} = -q_x(x)$$

$$\frac{dQ(x)}{dx} = -q_z(x)$$

$$\frac{dM(x)}{dx} = Q(x)$$

Bono 2-1

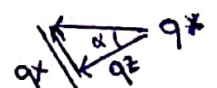
La barra inclinada tiene la particularidad de que la carga distribuida no es perpendicular al eje de la barra, como en la mayoría de los casos, entonces hay que descomponer dicha carga en una carga q_x y una carga q_z .



$$R = R$$

$$q_b = q^* \cdot l$$

$$q^* = \frac{q_b}{l}$$



$$|q_z| = q^* \cos \alpha$$

$$|q_x| = q^* \sin \alpha$$

Entonces en la barra inclinada este actuando:

$$|q_x| = q^* \sin \alpha = \frac{q b}{l} \cdot \frac{a}{l} = \frac{q b a}{l^2} = \frac{(10 \text{ kN/m}) \cdot 6 \text{ m} \cdot 2 \text{ m}}{40 \text{ m}^2} = 3 \text{ kN}$$

$$|q_z| = q^* \cos \alpha = \frac{q b}{l} \cdot \frac{b}{l} = \frac{q b^2}{l^2} = \frac{(10 \text{ kN/m}) \cdot 36 \text{ m}^2}{40 \text{ m}^2} = 9 \text{ kN}$$

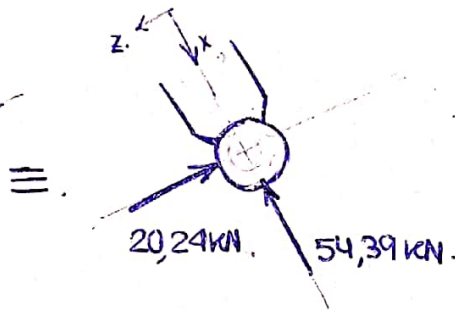
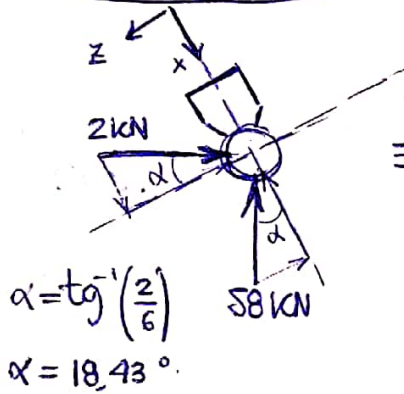
Entonces:

$$\frac{dN(x)}{dx} = -q_x(x) = \text{cte} \Rightarrow N(x) \text{ es lineal.}$$

$$\frac{dQ(x)}{dx} = -q_z(x) = \text{cte} \Rightarrow Q(x) \text{ es lineal.}$$

$$\frac{dM(x)}{dx} = Q(x) = \text{lineal} \Rightarrow M(x) \text{ es de } 2^\circ \text{ grado.}$$

Sección 1

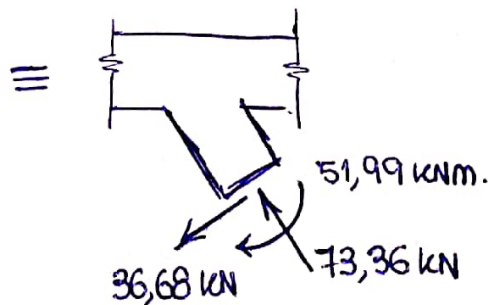
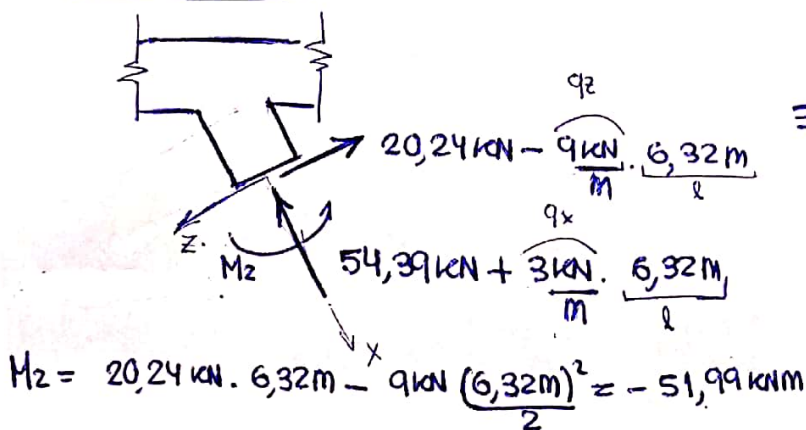


$$N_1 = -54,39 \text{ kN}$$

$$Q_1 = -20,24 \text{ kN}$$

$$M_1 = 0,$$

Sección 2



$$N_2 = -73,36 \text{ kN}$$

$$Q_2 = 36,68 \text{ kN}$$

$$M_2 = -51,99 \text{ kNm}$$

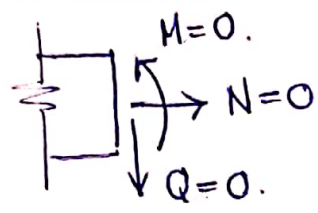
Barras 4-3

$$\frac{dN(x)}{dx} = -q_x(x) = 0 \Rightarrow N(x) = \text{cte.}$$

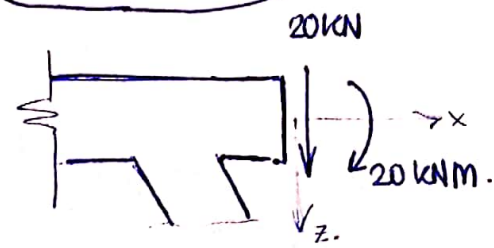
$$\frac{dQ(x)}{dx} = -q_z(x) = \text{cte} \Rightarrow Q(x) \text{ es lineal}$$

$$\frac{dM(x)}{dx} = Q(x) = \text{lineal} \Rightarrow M(x) \text{ es de } 2^\circ \text{ grado.}$$

Sección 3.



Sección 4.

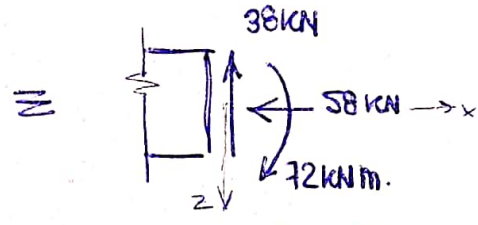
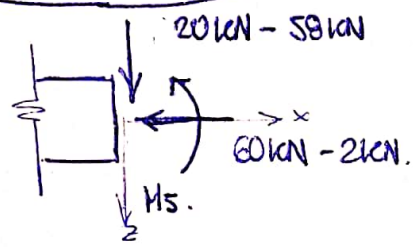


$N_4 = 0$
 $Q_4 = 20 \text{ kN}$
 $M_4 = -20 \text{ kNm}$

Barra 6-5.

$q_x = 0 \Rightarrow N(x) = \text{cte.}$
 $q_z = \text{cte} \Rightarrow Q(x) \text{ es lineal}$
 $Q(x) \text{ lineal} \Rightarrow M(x) \text{ Funcion de } 2^\circ \text{ grado.}$

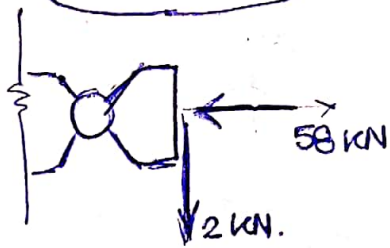
Sección 5.



$N_5 = -58 \text{ kN}$
 $Q_5 = -38 \text{ kN}$
 $M_5 = -72 \text{ kNm}$

$M_5 = 58 \text{ kN} \cdot 2 \text{ m} + 2 \text{ kN} \cdot 6 \text{ m} - 60 \text{ kN} \cdot 3 \text{ m} - 20 \text{ kN} \cdot 1 \text{ m} = -72 \text{ kNm.}$

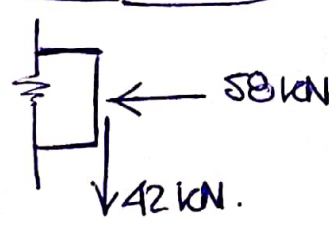
Sección 6



$N_6 = -58 \text{ kN}$
 $Q_6 = 2 \text{ kN}$
 $M_6 = 0.$

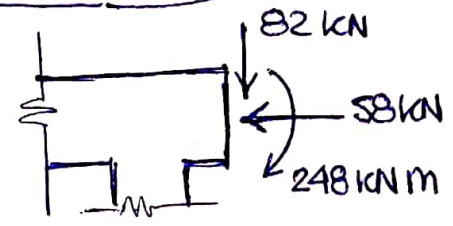
Barra 8-7

Sección 7



$N_7 = -58 \text{ kN}$
 $Q_7 = 42 \text{ kN}$
 $M_7 = 0.$

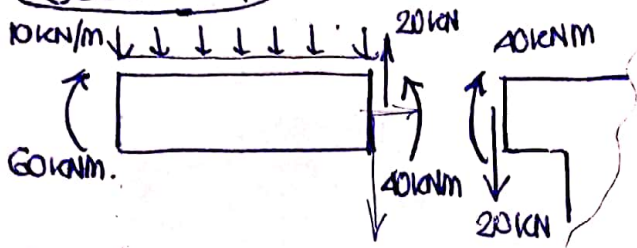
sección 8.



$N_8 = -58 \text{ kN}$
 $Q_8 = 82 \text{ kN}$
 $M_8 = -248 \text{ kNm}$

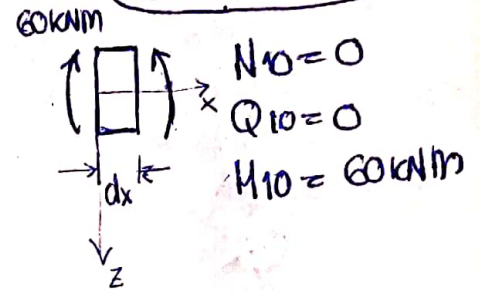
Barra 10-9.

Sección 9



$N_9 = 0$
 $Q_9 = -20 \text{ kN}$
 $M_9 = 40 \text{ kNm}$

Sección 10.

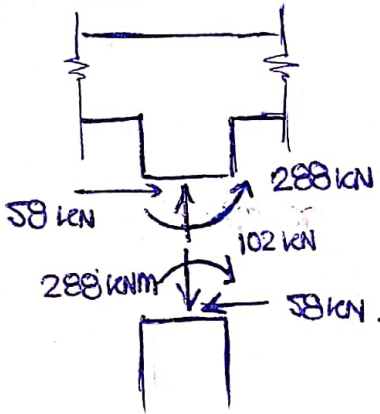


$N_{10} = 0$
 $Q_{10} = 0$
 $M_{10} = 60 \text{ kNm}$

"Vengo por izquierda y luego cambió el signo."

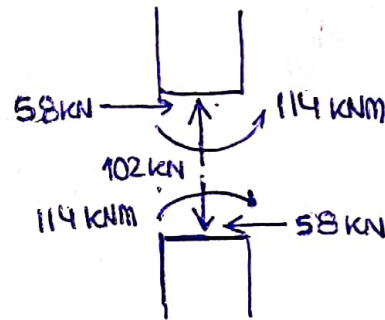
Barra 12-11

Sección 11



$N_{11} = -102 \text{ kN}$
 $Q_{11} = -58 \text{ kN}$
 $M_{11} = -288 \text{ kNm}$

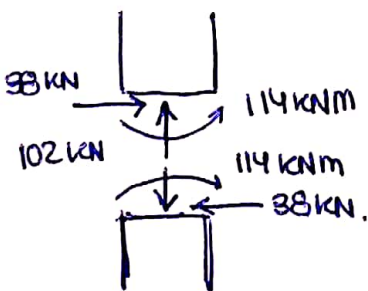
Sección 12



$N_{12} = -102 \text{ kN}$
 $Q_{12} = -58 \text{ kN}$
 $M_{12} = -114 \text{ kNm}$

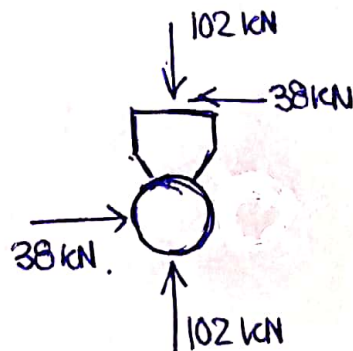
Barra 14-13

Sección 13



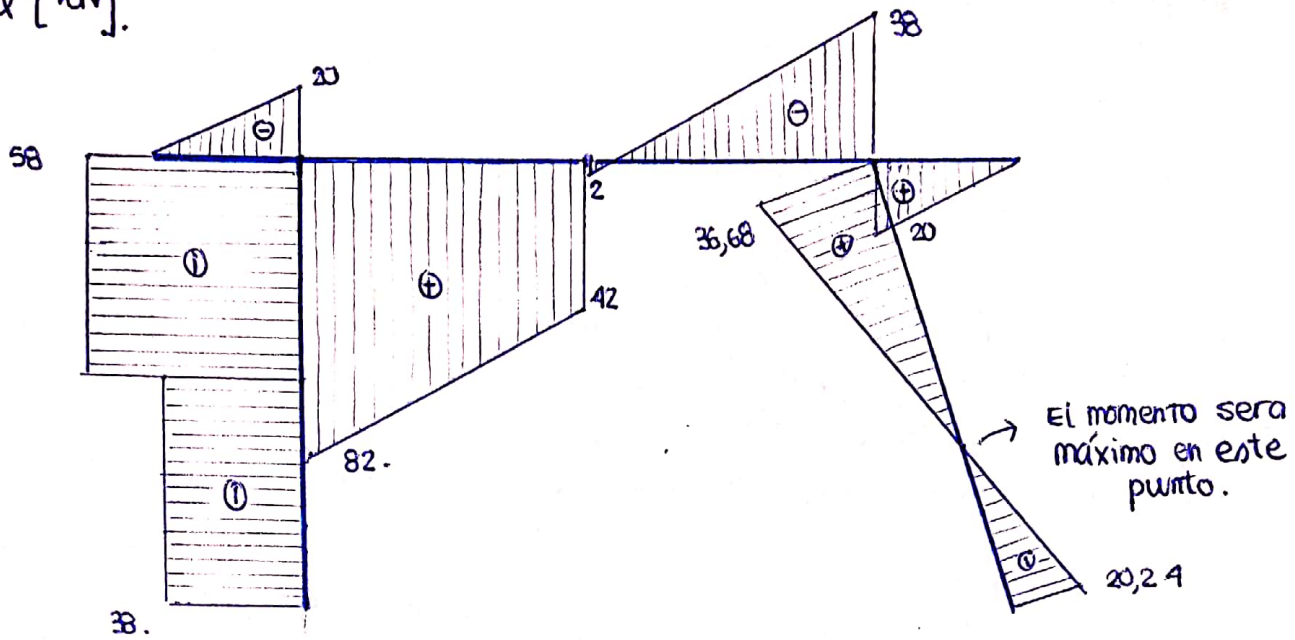
$N_{13} = -102 \text{ kN}$
 $Q_{13} = -38 \text{ kN}$
 $M_{13} = -114 \text{ kNm}$

Sección 14

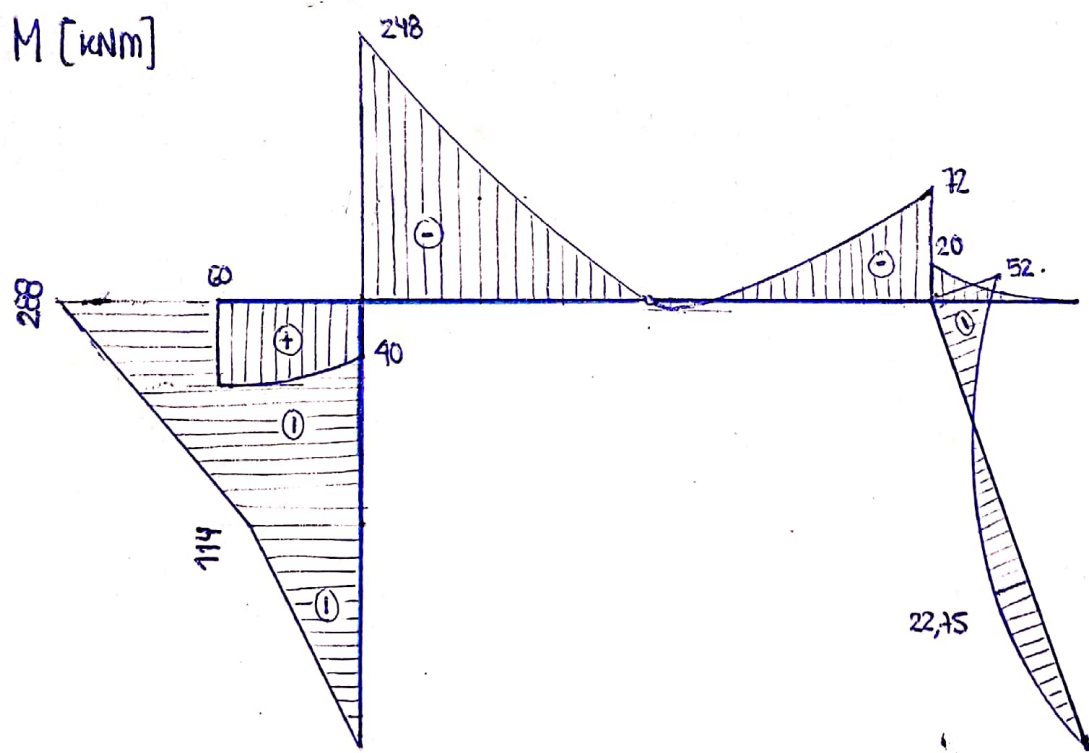


$N_{14} = -102 \text{ kN}$
 $Q_{14} = -38 \text{ kN}$
 $M_{14} = 0$

Q [kN].



M [kNm]



N [kN]

