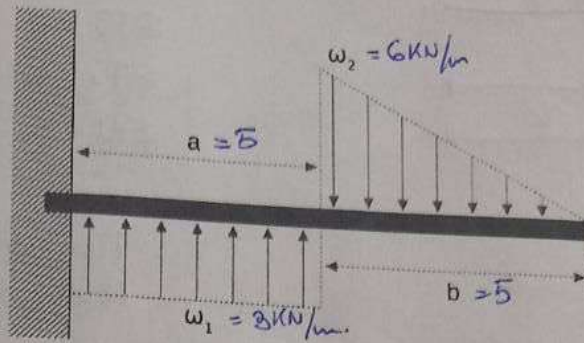


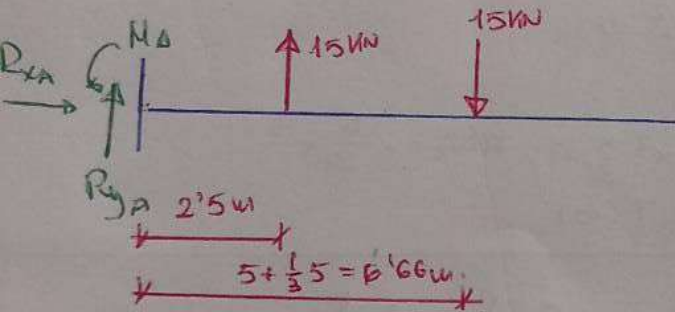
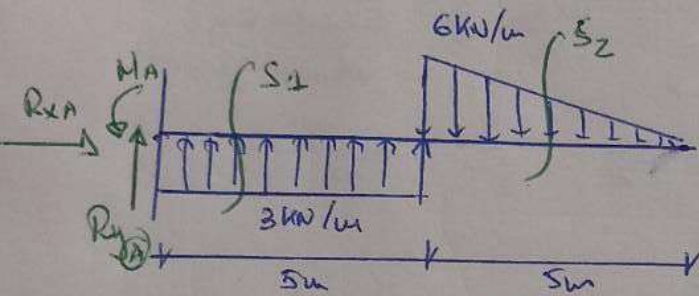
Ejercicio 5

Determine las solicitaciones en la viga de la figura, realice los diagramas correspondientes y comente las propiedades.

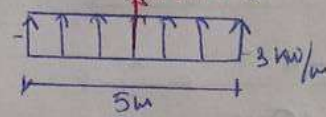
Datos:
 $a = 5\text{ m}$
 $b = 5\text{ m}$
 $\omega_1 = 3\text{ kN/m}$
 $\omega_2 = 6\text{ kN/m}$



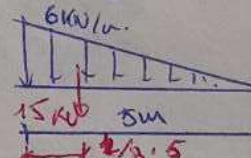
1º Reacciones exteriores



$$P_1 = b \cdot a = 3 \frac{\text{kN}}{\text{m}} \cdot 5\text{ m} = 15 \text{ kN}$$



$$P_2 = \frac{b \cdot a}{2}$$



$$P_2 = \frac{b \cdot a}{2} = 6 \frac{\text{kN}}{\text{m}} \times 5\text{ m} \cdot \frac{1}{2} = 15 \text{ kN}$$

$$\sum F_x = 0 \quad R_{xA} = 0$$

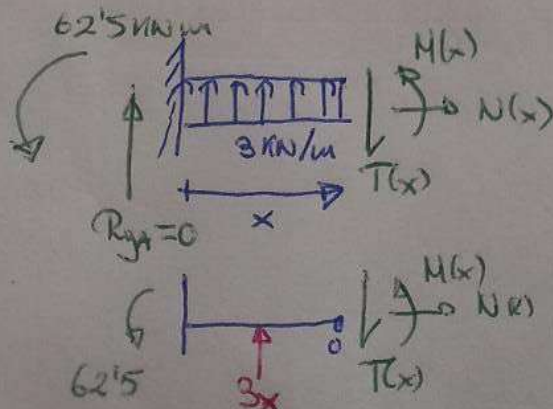
$$\sum F_y = 0 \quad R_{yA} + 15 \text{ kN} - 15 \text{ kN} = 0 \quad R_{yA} = 0$$

$$\sum M_A = 0 \quad M_A + 15 \text{ kN} \cdot 2.5 \text{ m} - (15 \text{ kN} \cdot 6.66 \text{ m}) = 0$$

$$M_A = 100 \text{ kNm} - 37.5 = 62.5 \text{ kNm}$$

2º Secciones o cortes

Sección 1 $0 \leq x \leq 5 \text{ m}$



$$\sum F_x = 0; \quad N(x) = 0$$

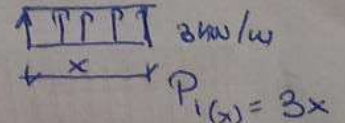
$$\sum F_y = 0; \quad -T(x) + 3x = 0$$

$$T(x) = 3x$$

$$\sum M_O = 0;$$

$$M(x) - 3x \cdot \frac{x}{2} + 62.5 = 0$$

$$M(x) = \frac{3}{2} x^2 - 62.5$$



$$M(x) = T(x)$$

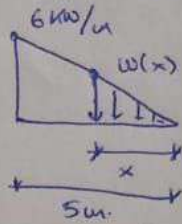
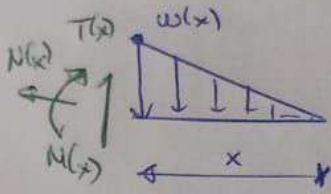
Valores:

$$T(0) = 0; \quad T(5) = 15 \text{ kN}$$

$$M(0) = -62.5 \quad M(5) = -25 \text{ kNm}$$

Sección 2 (por la derecha es más fácil)

$0 \leq x \leq 5$

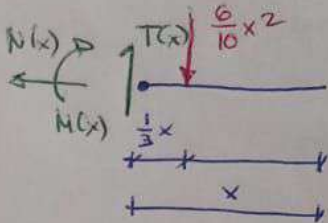


$\frac{w(x)}{x} = \frac{6}{5}$

$5w(x) = 6x$

$w(x) = \frac{6}{5}x$

$P_{2(x)} = \frac{b \cdot a}{2} = \frac{6 \cdot \frac{6}{5}x}{2} = \frac{6x^2}{5}$



$\sum F_x = 0; \quad N(x) = 0$

$\sum F_y = 0; \quad T(x) - \frac{6}{10}x^2 = 0 \quad T(x) = \frac{6}{10}x^2$

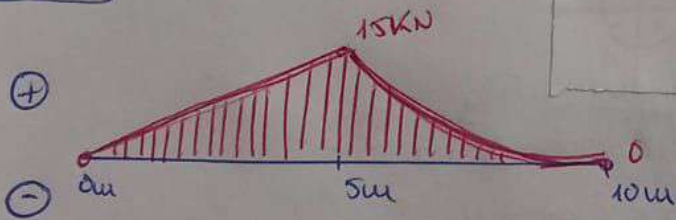
$\sum M = 0; \quad -N(x) - \frac{6}{10}x^2 \cdot \frac{x}{3} = 0 \quad M(x) = -\frac{6}{30}x^3$

• Valores:

$T(0) = 0 \quad T(5) = +\frac{6}{10}5^2 = 15 \text{ kW}$

$M(0) = 0 \quad M(5) = -\frac{6}{30}5^3 = -25 \text{ kW}\cdot\text{m}$

T (kW)

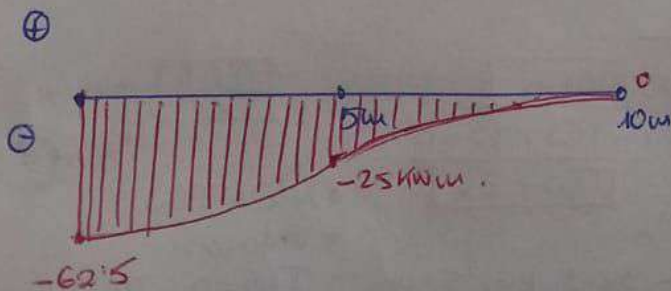


Continuidad

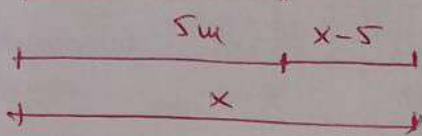
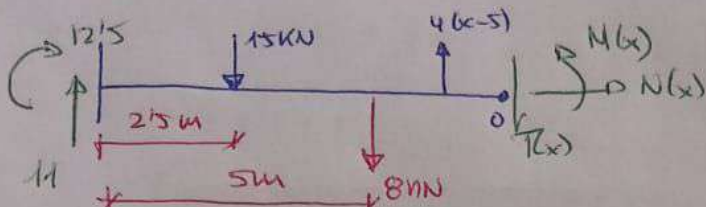
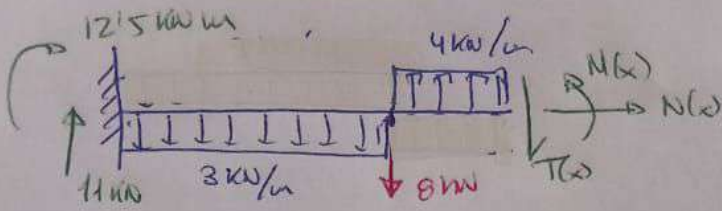
$T(5)$ por la derecha = $T(5)$ por la izquierda.

$M(5)$ por la derecha = $M(5)$ por la izquierda.

M (kWm)



Sección 2 $5 \leq x \leq 8$



4 kN/m
 $P_2(x) = 4 \cdot (x-5)$

$\sum F_x = 0; \boxed{N(x) = 0}$

$\sum F_y = 0; 11 \text{ kN} - 15 \text{ kN} - 8 \text{ kN} + 4 \cdot (x-5) - T(x) = 0$

$\boxed{T(x) = 4x - 32}$

$\sum M = 0; M(x) - 12.5 + 11 \cdot x + 15(x-2.5) + 8 \cdot (x-5) - 4(x-5)(x-5) = 0$

$M(x) - 12.5 - 11x + 15x - 37.5 + 8x - 40 - 2(x^2 - 2.5x + 2.5) = 0$

$M(x) = 12.5 + 11x - 15x + 37.5 - 8x + 40 + 2x^2 - 20x + 50 = 0$

$\boxed{M(x) = 140 - 32x + 2x^2}$

$M'(x) = T(x)$

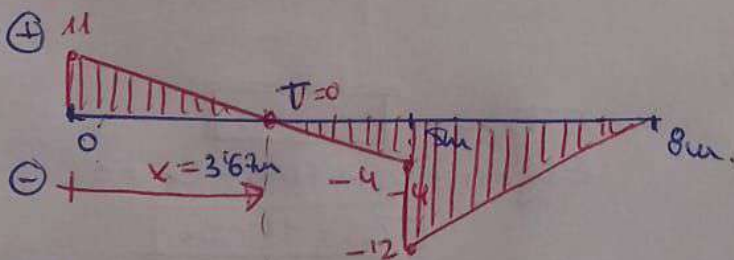
Valores ; $T(5) = -12 \text{ kN}$

$T(8) = 0$

$M(5) = 20 \text{ kNm}$

$T(0) = 12 \text{ kN/m}$

$T(\text{kN})$

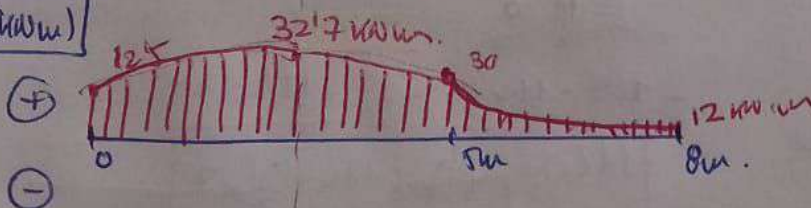


Busco donde $T = 0$.

$0 = 11 - 3x \quad x = \frac{11}{3} = 3.67 \text{ m}$

$M(3.67 \text{ m}) = 12.5 + 11 \cdot 3.67 - \frac{3}{2} \cdot 3.67^2 = 12.5 + 40.37 - 20 = 32.67 \text{ kNm}$

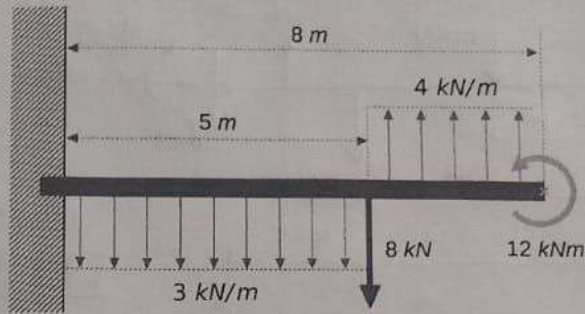
$M(\text{kNm})$



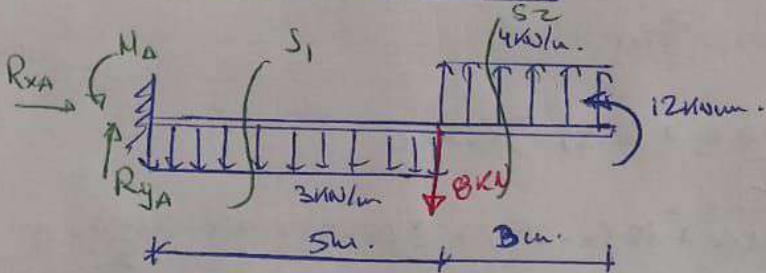
Se cumple con la ley de similitud.

Ejercicio 4

Determine las solicitaciones en la viga de la figura, realice los diagramas correspondientes y comente las propiedades.

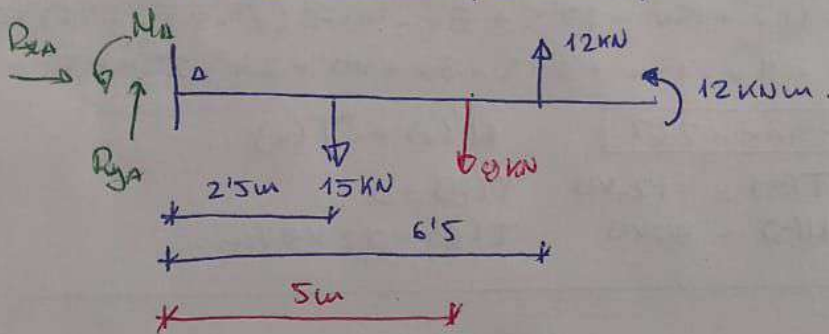


1º Reacciones externas



$$P_1 = b \cdot a = 3 \frac{\text{kN}}{\text{m}} \cdot 5 \text{ m} = 15 \text{ kN}$$

$$P_2 = b \cdot a = 4 \frac{\text{kN}}{\text{m}} \cdot 3 \text{ m} = 12 \text{ kN}$$



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

$$\sum F_y = 0; R_{yA} - 15 \text{ kN} + 12 \text{ kN} - 8 = 0$$

$$R_{yA} = 11 \text{ kN}$$

$$\sum M_A = 0;$$

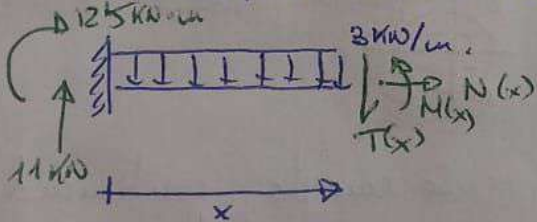
$$M_A + 12 \text{ kNm} - (15 \text{ kN} \cdot 2.5 \text{ m}) - (8 \text{ kN} \cdot 5 \text{ m}) - (12 \text{ kN} \cdot 6.5 \text{ m}) = 0$$

$$M_A = -12 + 37.5 + 40 - 78$$

$$M_A = -12.5 \text{ kN} \cdot \text{m}$$

2º Secciones o cortes

Sección 1 $0.5 \leq x \leq 5 \text{ m}$



$$\sum F_x = 0 \Rightarrow N(x) = 0$$

$$\sum F_y = 0 \Rightarrow -T(x) + 11 \text{ kN} - 3x = 0$$

$$T(x) = 11 - 3x$$

$$\sum M = 0$$

$$-12.5 - 11 \cdot x + 3x \cdot \frac{x}{2} + M(x) = 0$$

$$M(x) = 12.5 + 11x - \frac{3}{2}x^2$$

$$M'(x) = T(x)$$

Valores:

$$T(0) = 11 \text{ kN} \quad T(5) = -4 \text{ kN}$$

$$M(0) = 12.5 \text{ kNm} \quad M(5) = 80 \text{ kNm}$$

