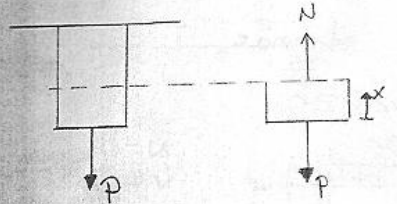
Me46A
Pauta tarea 1

P1)



Se debe considerar el peso de la sección de barra que se ve en el corte

$$\omega = \gamma V = \gamma \cdot A \cdot x$$

$$\Rightarrow \Sigma F_x = 0 \Rightarrow N = P + \gamma A x$$

Como N es máximo para $x = L$ $(L = 180\,m)$

$$\Rightarrow \sigma_{adm} = \frac{N}{A} = \frac{P + \gamma A L}{A} \Rightarrow A = \frac{P}{\sigma_{adm} - \gamma L}$$

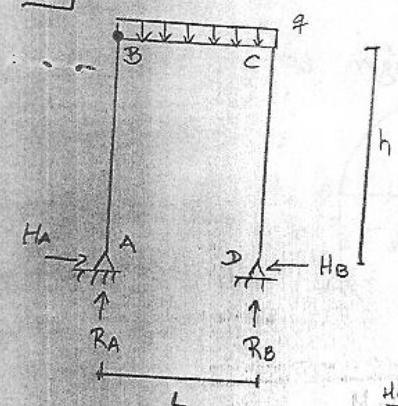
$$\Rightarrow A = \frac{1200\ \overline{kg}}{240 \times 10^6 \frac{\overline{kg}}{m^2} - 7850\ \overline{kg}/m^3 \cdot 180\,m}$$

$$A = 5{,}03 \times 10^{-6}\,m^2$$

$$\boxed{A = 5{,}03\ mm^2}$$

luego $\Delta l = \frac{N \cdot L}{EA} = \frac{(P + \gamma A L) L}{EA} = 0{,}22\,m$ //

P2)



$$\Sigma F_y = 0 \Rightarrow R_A + R_B = q \cdot L$$

$$\Sigma F_x = 0 \Rightarrow H_A + H_B = 0$$

$$\Sigma M_A = 0 \Rightarrow R_B \cdot L = \frac{q L^2}{2}$$

Además de la rótula se tiene:

$$\Sigma M_{corte} = 0$$

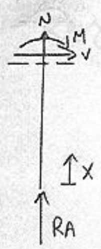
$$\Rightarrow M = H_A \cdot h$$

$$0 = H_A \cdot h \Rightarrow \boxed{H_A = H_B = 0}$$

luego $R_B = \frac{q \cdot L}{2} = R_A = 8{,}85\ \vec{kg}$

Ahora calculamos las fuerzas internas

•) tramo AB



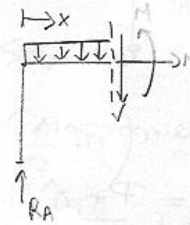
$N = -R_A$

$V = 0$

$M = 0$

$\Rightarrow N = -8{,}85\ \vec{kg}$

•) tramo BC



$N = 0$

$V = R_A - qx$

$M = R_A x - \frac{qx^2}{2}$

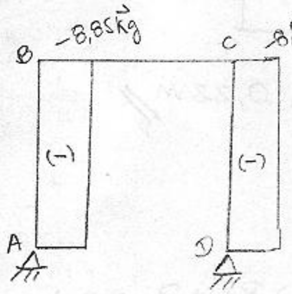
$\Rightarrow V = (8{,}85 - 5{,}9x)\ \vec{kg}$

$M = (8{,}85x - 2{,}95x^2)\ \vec{kg}m$

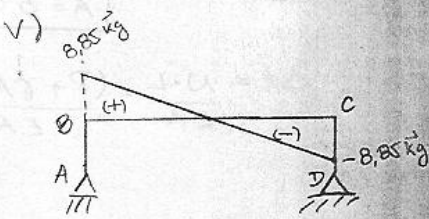
•) tramo CD identico al tramo AB $\Rightarrow N = -R_B \Rightarrow N = -8{,}85\ \vec{kg}$.

Entonces los diagramas quedan:

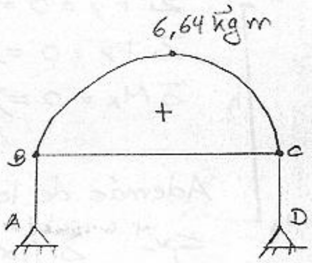
N)



V)



M)



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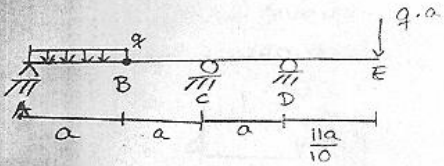


$\Sigma F_y = 0$

$(1) \Rightarrow R_A + R_C + R_D = 2q\cdot a$

$\Sigma M_C = 0$

$(2) \Rightarrow R_A\cdot 2a + \frac{21qa^2}{10} = \frac{3qa^2}{2} + R_D\cdot a$

$\Sigma M_{interno} = 0 \Rightarrow R_A\cdot a - \frac{qa^2}{2} = \cancel{M}\ 0$
en la rótula

$(3) \Rightarrow \boxed{R_A = \frac{q\cdot a}{2}}$

(3)+(2)

$\Rightarrow qa^2 + \frac{21qa^2}{10} = \frac{3qa^2}{2} + R_D\cdot a$

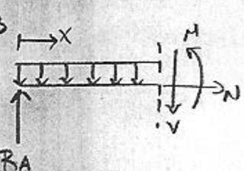
$\frac{31}{10}qa - \frac{15qa}{10} = R_D \Rightarrow \boxed{R_D = \frac{8qa}{5}}$ (4)

$(4),(3)$ en $(1) \Rightarrow \frac{qa}{2} + R_C + \frac{8qa}{5} = 2q\cdot a$

$\Rightarrow R_C = \left\{\frac{20}{10} - \frac{5}{10} - \frac{16}{10}\right\} qa \Rightarrow \boxed{R_C = -\frac{qa}{10}}$

Ahora las fuerzas internas ($N = 0\ \forall$ tramo)

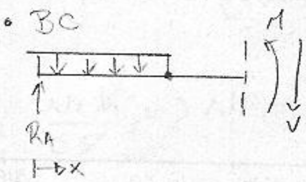
• AB



$V = R_A - qx = q\left(\frac{a}{2} - x\right)$

$M = R_A x - \frac{qx^2}{2} = q\left(\frac{ax}{2} - \frac{x^2}{2}\right)$

• BC



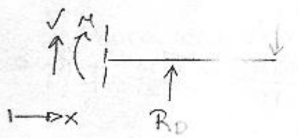
$V = R_A - q\cdot a = -\frac{qa}{2}$

$M = R_A x - qa\left(x - \frac{a}{2}\right)$

$= q\left(\frac{ax}{2} - ax + \frac{a^2}{2}\right)$

$M = -qa\left\{\frac{x}{2} - \frac{a}{2}\right\}$

• CD

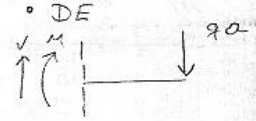


$$V = q \cdot a - R_D = -\frac{3qa}{5}$$

$$M = R_D(3a - x) - q \cdot a\left(\frac{41a}{10} - x\right)$$

$$M = \frac{8qa}{5}(3a - x) - qa\left(\frac{41a}{10} - x\right)$$

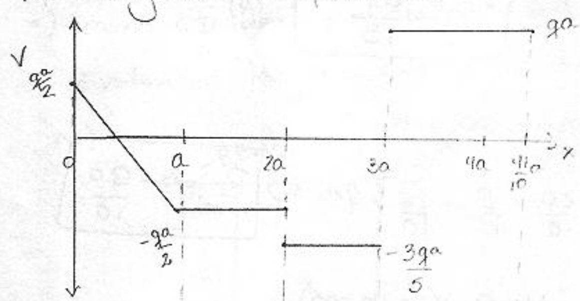
• DE

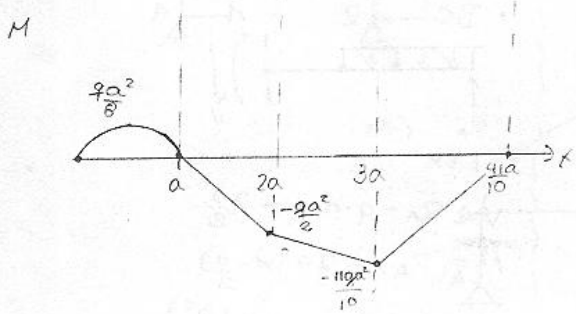


$$V = qa$$

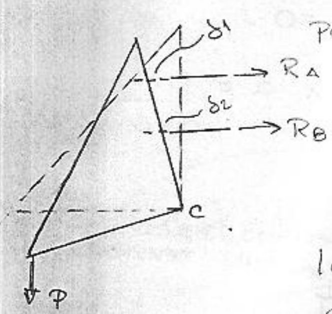
$$M = -qa\left(\frac{41}{10}a - x\right)$$

los diagramas quedan:





P4) Dejemos que se mueva libremente la escuadra y veamos que pasa con los cables.



por thales $\frac{\delta_1}{2b} = \frac{\delta_2}{b} \Rightarrow \delta_1 = 2\delta_2$

$$\Rightarrow \frac{R_A L}{EA} = \frac{2 R_B L}{EA}$$

$$\Rightarrow \boxed{R_A = 2R_B}$$

luego, de las ecuaciones de la estática

$\Sigma M_c = 0$

$$\Rightarrow P \cdot 2b = R_B b + R_A \cdot 2b$$

$$\Rightarrow 2P = R_B + 2R_A = R_B + 2 \cdot 2 R_B$$

$$R_B = \frac{2P}{5} \Rightarrow R_A = \frac{4P}{5}$$

$$\boxed{\begin{array}{l} R_B = 200\ \vec{lb} \\ R_A = 400\ \vec{lb} \end{array}}$$

P5) para que la barra se mantenga horizontal se debe cumplir que:

$$\delta_{1A} = \delta_{2C} \Rightarrow \frac{N_1 \cancel{h}}{S' \cancel{E}} = \frac{N_2 \cancel{h}}{S \cancel{E}} \Rightarrow N_1 = N_2 \frac{S'}{S}$$

$$\Rightarrow R_1 = R_2 \frac{S'}{S}$$

por sumatoria de momentos en P

$$R_1 b = R_2 a \Rightarrow \cancel{R_2} \frac{S'}{S} b = \cancel{R_2} a \Rightarrow \frac{a}{b} = \frac{S'}{S}$$

$$\left.\begin{array}{l} \delta' a - \delta b = 0 \\ a + b = l \end{array}\right\} \Rightarrow a = l - b$$

$$\Rightarrow \delta'(l-b) - \delta b = 0$$

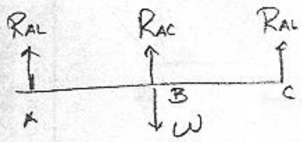
$$\delta' l - \delta' b - \delta b = 0$$

$$b = \frac{\delta' l}{\delta' + \delta} \quad \wedge \quad a = \frac{\delta l}{\delta' + \delta}$$

P6) imponiendo igualdad de desplazamientos, para que la barra rígida quede horizontal, tenemos

$$\Delta_{AC} = \Delta_{AL} \Rightarrow \frac{R_{AC}\, h}{A\, E_{AC}} = \frac{R_{AL}\, h}{A\, E_{AL}} \Rightarrow \frac{R_{AC}}{E_{AC}} = \frac{R_{AL}}{E_{AL}}$$

$$R_{AC} = R_{AL}\left(\frac{E_{AC}}{E_{AL}}\right)$$



$$\Sigma F_y = 0 \Rightarrow R_{AC} + 2R_{AL} = W$$

$$\Rightarrow R_{AL}\left(\frac{E_{AC}}{E_{AL}} + 2\right) = W$$

$$\Rightarrow \boxed{R_{AL} = \frac{W\, E_{AL}}{E_{AC} + 2E_{AL}}}$$

$$\boxed{R_{AC} = \frac{2W\, E_{AL}}{E_{AC} + 2E_{AL}}}$$