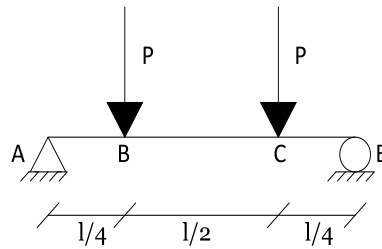


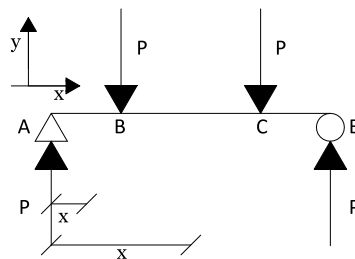
VIGAS ISOSTATICAS

EJERCICIO 1: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



1°) REACCIONES \rightarrow POR SIMETRIA; $R_A=P$ $R_B=P$

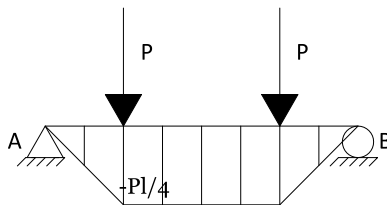
- LEY DE FLECTORES;



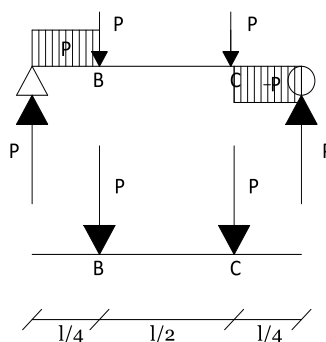
- ENTRE A Y C $\rightarrow M(x) = -Px \rightarrow M_c = -\frac{Pl}{4}$

- ENTRE C Y D $\rightarrow M(x) = -Px + P(x - \frac{l}{4}) = -\frac{Pl}{4}$

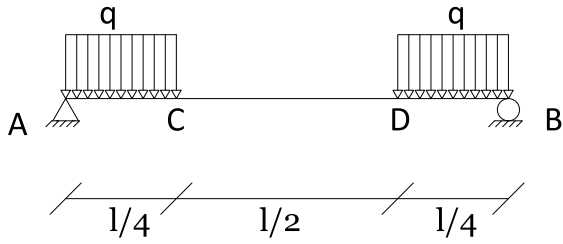
Y POR SIMETRÍA:



- LEY DE CORTANTES;



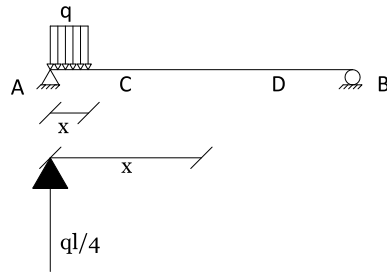
EJERCICIO 2: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



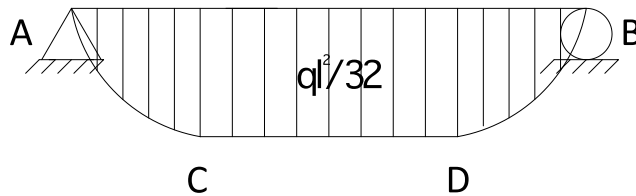
POR SIMETRIA; $R_A = R_B = \frac{ql}{4}$

- LEY DE FLECTORES;

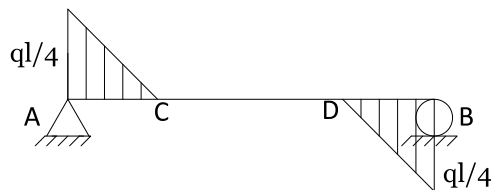
- ENTRE A Y C $\rightarrow M(x) = -\frac{ql}{4}x + \frac{qx^2}{2}$



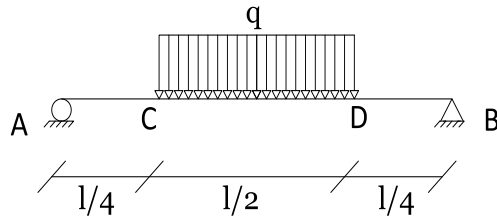
- ENTRE C Y D $\rightarrow M(x) = -\frac{ql}{4}x + \frac{ql}{4}\left(x - \frac{l}{8}\right) = \frac{-ql^2}{32}$



- LEY DE CORTANTES;

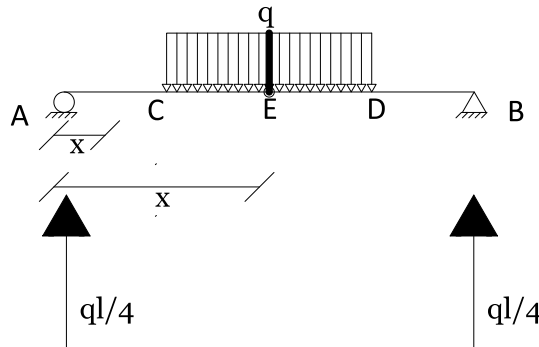


EJERCICIO 3: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



POR SIMETRIA; $R_A = R_B = \frac{ql}{4}$

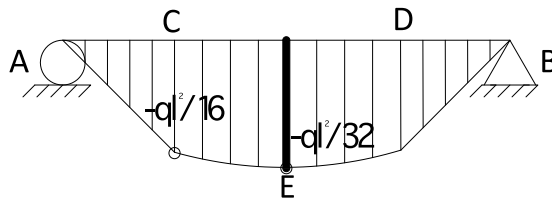
- LEY DE FLECTORES;



- FLECTOR ENTRE A Y C $\rightarrow M(x) = -\frac{ql}{4}x \rightarrow M_C = -\frac{ql^2}{16}$

- FLECTOR ENTRE C Y D $\rightarrow M(x) = -\frac{ql}{4}x + \frac{q\left(x - \frac{l}{4}\right)^2}{2}$

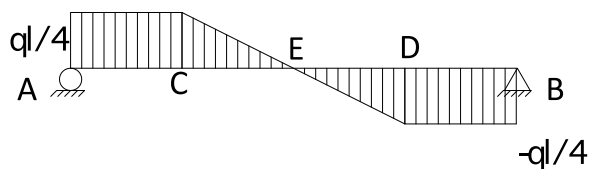
Para $x = l/2 \rightarrow M_E = -\frac{3ql^2}{32}$



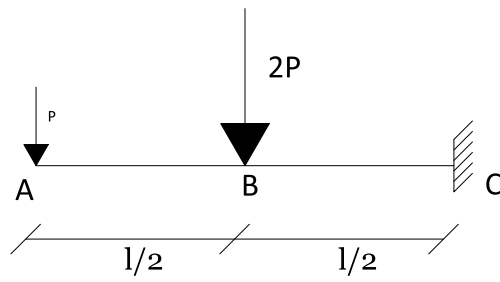
- LEY DE CORTANTES;

- CORTANTES ENTRE A Y C; $Q(x) = \frac{ql}{4}$

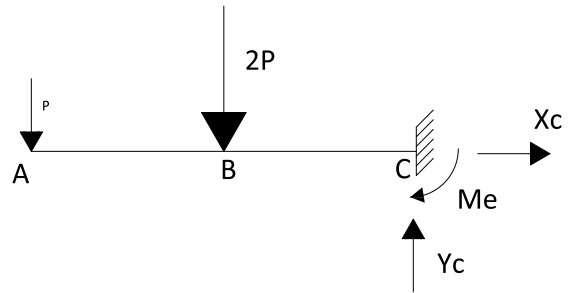
- CORTANTES ENTRE C Y D: $Q(x) = \frac{ql}{4} - qx$



EJERCICIO 4: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



CALCULO DE REACCIONES:

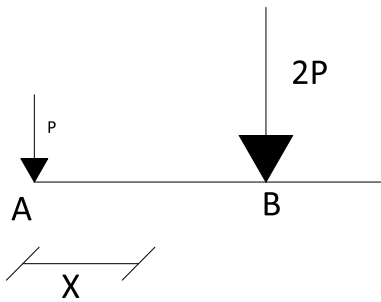


$$\sum F_x = 0 \rightarrow X_c = 0$$

$$\sum F_y = 0 \rightarrow Y_c = 3P$$

$$\sum M_c = 0 \rightarrow pl + 2 \frac{pl}{2} = M_c \rightarrow M_c = 2pl$$

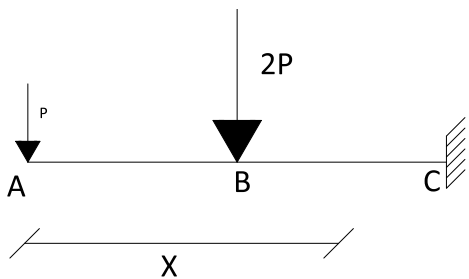
• LEY DE FLECTORES, \curvearrowright



$$M_A^B(x) = Px \text{ (lineal)}$$

$$X=0 \rightarrow M_A=0$$

$$X=l/2 \rightarrow M_B = Pl/2$$

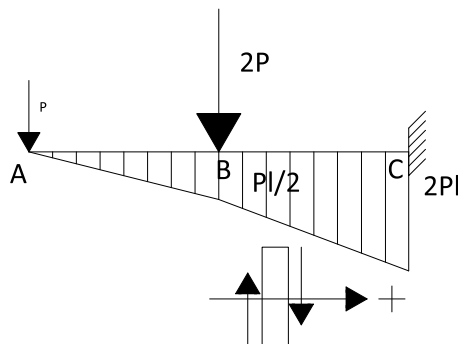


$$M_B^C(x) = Px + 2P(x - l/2) = 3Px - Pl$$

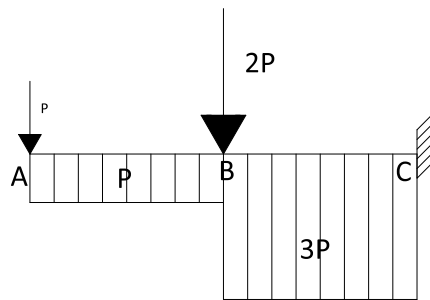
$$M(x) = 3Px - Pl$$

$$M_B = 3P \frac{l}{2} - Pl = P \frac{l}{2}$$

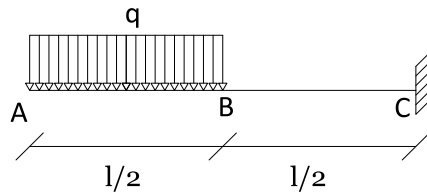
$$M_C = 3Pl - Pl = 2Pl$$



- LEY DE CORTANTES;



EJERCICIO 5: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



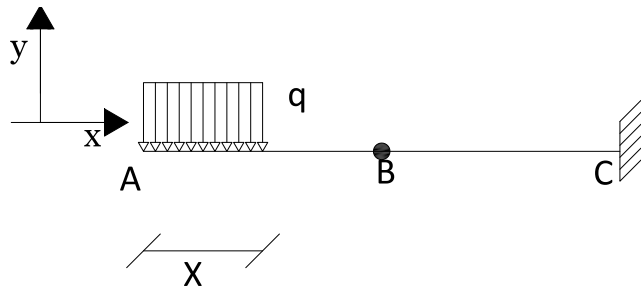
CALCULO DE REACCIONES:

$$\sum F_y = 0 \rightarrow Y_c = q \frac{l}{2}$$

$$\sum M_c = 0 \rightarrow q \frac{1}{2} \left(\frac{l}{2} + \frac{l}{4} \right) = M_c \rightarrow M_c = 3q \frac{l^2}{8}$$

- LEY DE FLECTORES,

ENTRE A Y B:

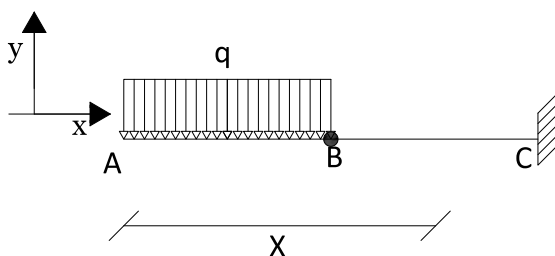


$$M_A^B(x) = qx \frac{x}{2} = q \frac{x^2}{2} \text{ (parábola) } \alpha$$

$$X=0 \rightarrow M_A=0$$

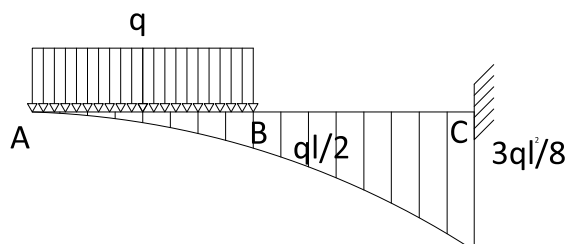
$$X=l/2 \rightarrow M_B = \frac{q}{2} \left(\frac{l}{2} \right)^2 = \frac{ql^2}{8}$$

ENTRE B Y C:

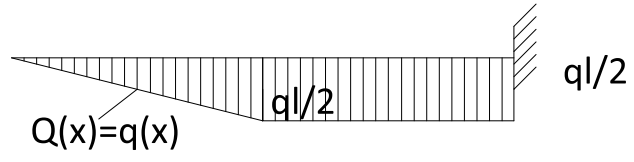
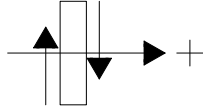


$$M_B^C(x) = q \frac{l}{2} \left(-\frac{l}{4} + x \right) = \frac{-ql^2}{8} + q \frac{lx}{2} \text{ (lineal)}$$

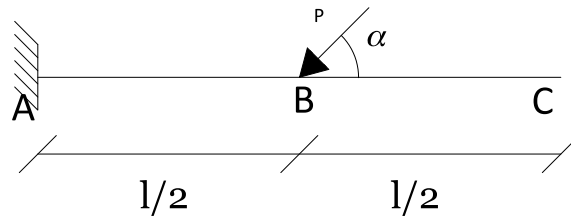
$$x=l \rightarrow M_c = \frac{-ql^2}{8} + \frac{ql^2}{2} = \frac{3ql^2}{8}$$



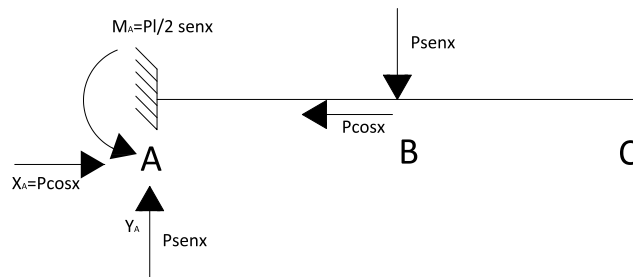
- LEY DE CORTANTES;



EJERCICIO 6: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



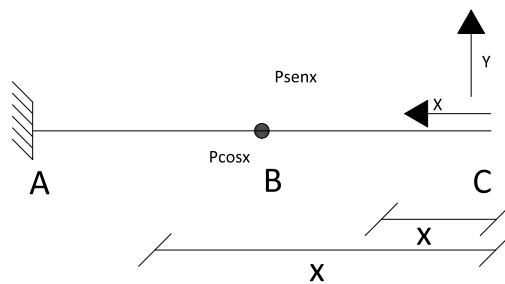
CALCULO DE REACCIONES:



- LEY DE FLECTORES; $\curvearrowright +$

$$M_C^B(x) = 0$$

$$M_B^A(x) = P \text{sen} \alpha \left(x - \frac{l}{2}\right) \rightarrow M_{B(x=l/2)} = 0; M_{A(x=l)} = \frac{Pl}{2} \text{sen} \alpha$$



- LEY DE CORTANTES;

$$Q_C^B(x) = 0$$

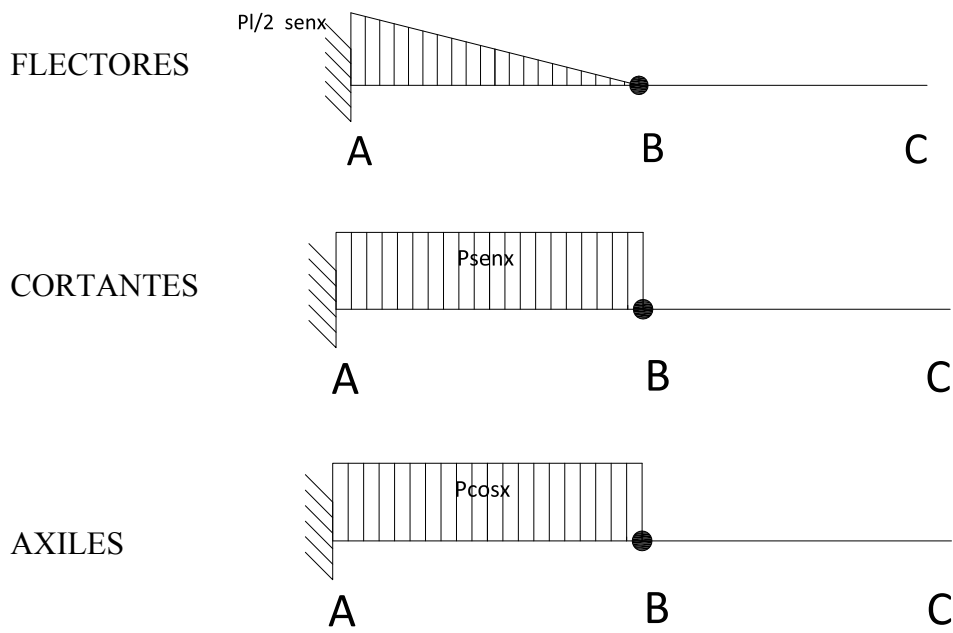
$$Q_B^A(x) = P \text{sen} \alpha$$

- LEY DE AXILES;

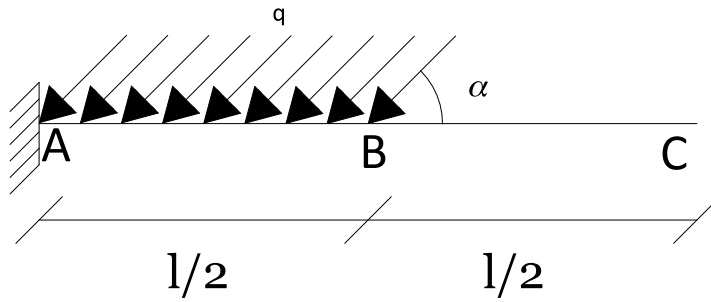
$$N_C^B(x) = 0$$

$$N_B^A(x) = P \cos \alpha$$

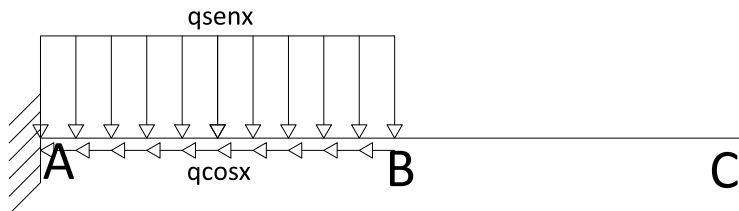
POR TANTO;



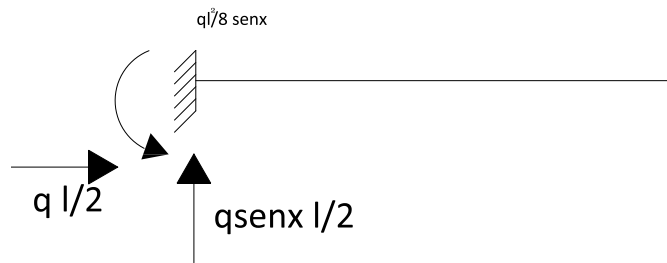
EJERCICIO 7: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



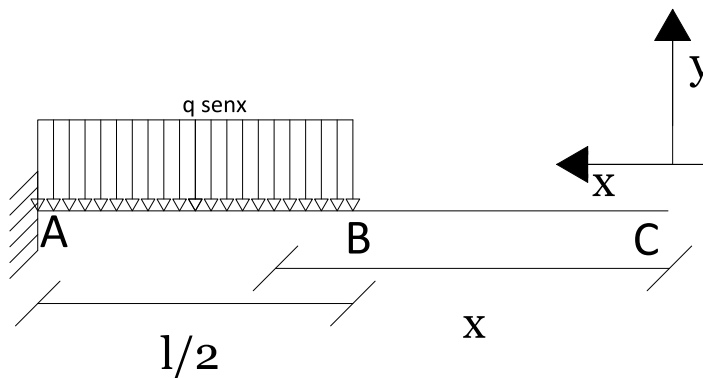
DESCOMPONEMOS LAS FUERZAS;



REACCIONES;



• LEY DE FLECTORES;



$$M_C^B(x) = 0$$

$$M_B^C(x) = P \operatorname{sen} \alpha \left(x - \frac{l}{2}\right) \cdot \left(x - \frac{l}{2}\right) / 2 = q \frac{\left(x - \frac{l}{2}\right)^2}{2} \operatorname{sen} \alpha$$

- LEY DE CORTANTES;

$$Q_C^B(x) = 0$$

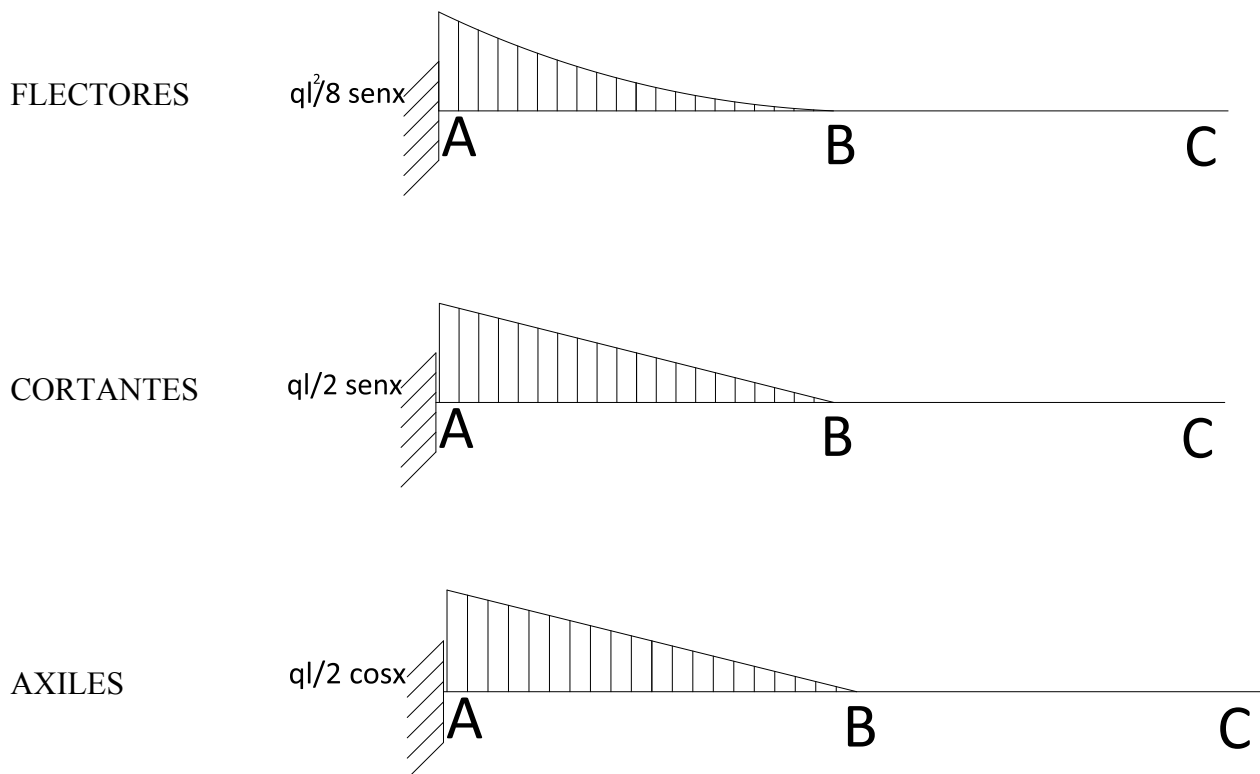
$$Q_B^A(x) = q \left(x - \frac{l}{2}\right) \operatorname{sen} \alpha$$

- LEY DE AXILES;

$$N_C^B(x) = 0$$

$$N_B^A(x) = q \left(x - \frac{l}{2}\right) \cos \alpha$$

POR TANTO;



EJERCICIO 8: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



REACCIONES;



$$\sum F_x = 0 \rightarrow X_A = X_B = 0$$

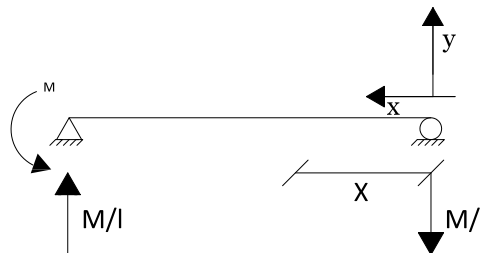
$$\sum F_y = 0 \rightarrow Y_A + Y_B = 0 \rightarrow Y_A = -Y_B$$

$$\sum M_B = 0 \rightarrow M - Y_A l = 0 \rightarrow Y_A = M/l \rightarrow Y_B = -\frac{M}{l}$$

POR TANTO;



• LEY DE FLECTORES;



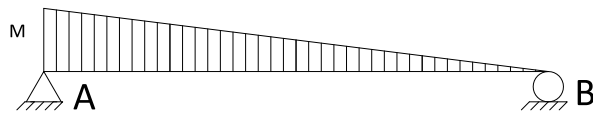
$$M_B^A(x) = -\frac{Ml}{2} \rightarrow M_{A(x=l)} = -M ; M_{B(x=0)} = 0$$

- LEY DE CORTANTES;

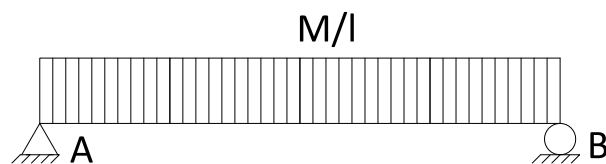
$$Q_B^A(x) = \frac{M}{l} \text{ (constante)}$$

POR TANTO;

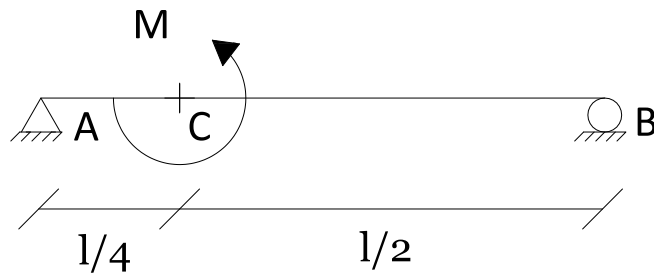
FLECTORES



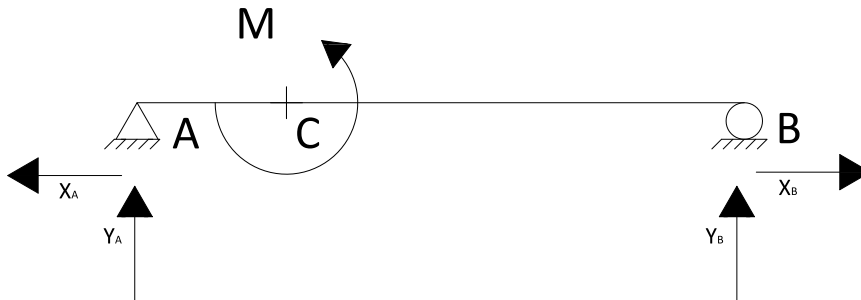
CORTANTES



EJERCICIO 9: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



REACCIONES;



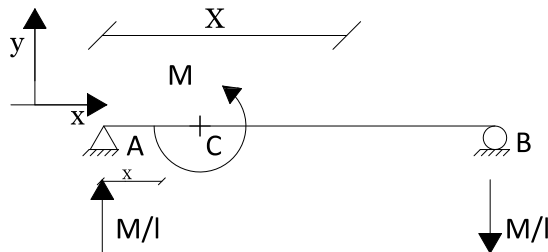
$$\sum F_x = 0 \rightarrow X_A = X_B = 0$$

$$\sum F_y = 0 \rightarrow Y_A + Y_B = 0 \rightarrow Y_A = -Y_B$$

$$\sum M_B = 0 \rightarrow -Y_A l + M = 0 \rightarrow Y_A = M/l$$

$$\sum M_A = 0 \rightarrow -Y_B l + M = 0 \rightarrow Y_B = -\frac{M}{l}$$

• LEY DE FLECTORES;

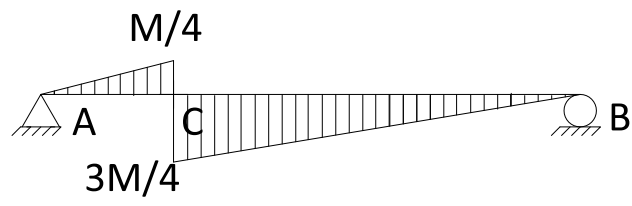


$$M_A^C(x) = -\frac{M}{l} \cdot X \quad \text{---} \quad M_{c(x=l/4)} = \frac{M}{4}$$

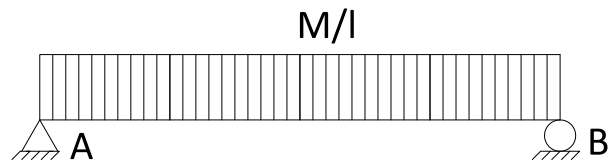
$$M_C^B(x) = -\frac{M}{l} \cdot X + M \quad \text{---} \quad M_{c(x=l/4)} = \frac{M}{l} \cdot \frac{l}{4} + M = \frac{M}{4} + M = \frac{5M}{4}$$

POR TANTO;

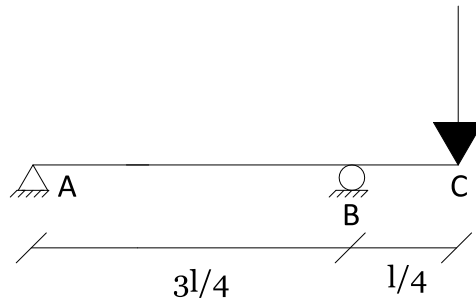
FLECTORES



CORTANTES



EJERCICIO 10: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.



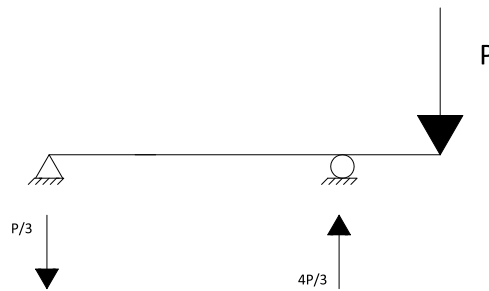
REACCIONES;

$$\sum F_x = 0 \rightarrow X_A + X_B = 0 \rightarrow X_A = X_B = 0$$

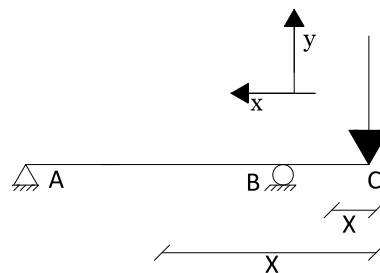
$$\sum F_y = 0 \rightarrow Y_A + Y_B = P$$

$$\sum M_A = 0 \rightarrow -Pl + Y_B \cdot 3\frac{l}{4} = 0 \rightarrow Y_B = \frac{4P}{3}; Y_A = -\frac{P}{3}$$

LUEGO;



• LEY DE FLECTORES;



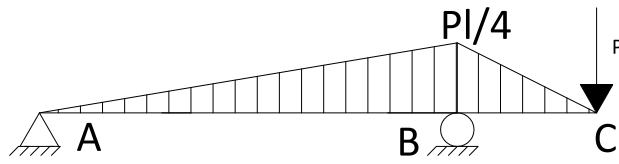
$$M_C^B(x) = -\frac{P}{X}; M_{B(x=l/4)} = -\frac{Pl}{4}$$

$$M_B^A(x) = -Px + \frac{4}{3}P(X - \frac{l}{4}) = \frac{Px}{3} - P\frac{l}{3}$$

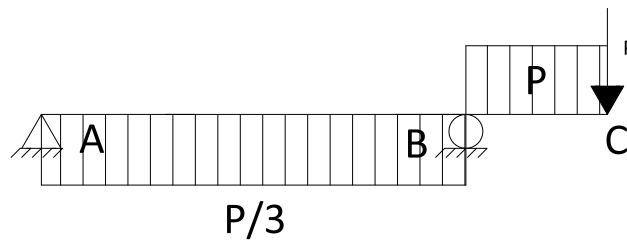
$$M_{B(x=l/4)} = -\frac{Pl}{4}; M_{A(x=l)} = 0$$

POR TANTO;

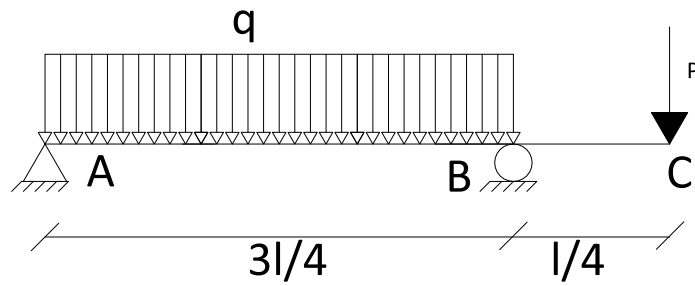
FLECTORES



CORTANTES



EJERCICIO 11: CALCULAR LAS LEYES DE FLECTORES Y CORTANTES.

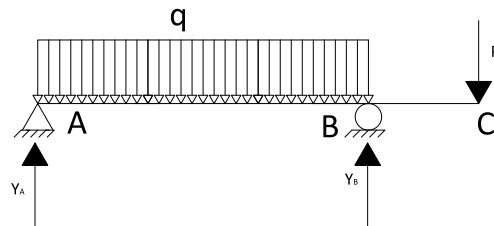


REACCIONES;

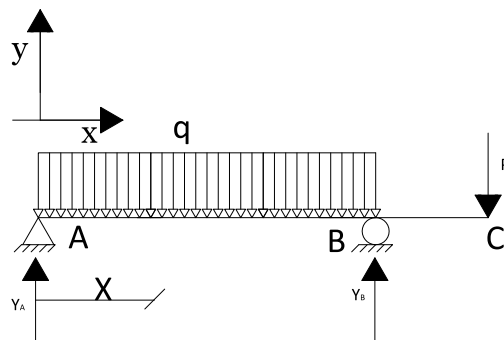
$$\sum F_x = 0 \rightarrow X_A = X_B = 0$$

$$\sum F_y = 0 \rightarrow Y_A + Y_B = P + \frac{3ql}{4}$$

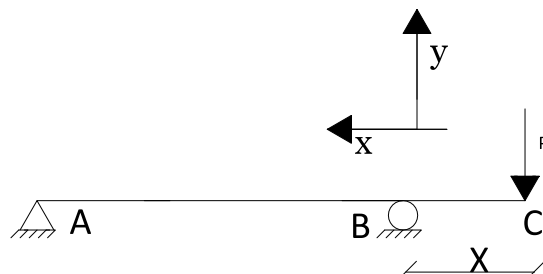
$$\sum M_A = 0 = P \cdot l - Pl + Y_B \cdot \frac{3l}{4} - \frac{q3l}{4} \cdot \frac{3l}{8} = 0 \rightarrow Y_B = \frac{4P}{3} + q \frac{l}{3}; Y_A = -\frac{P}{3} + \frac{5ql}{8}$$



• LEY DE FLECTORES;

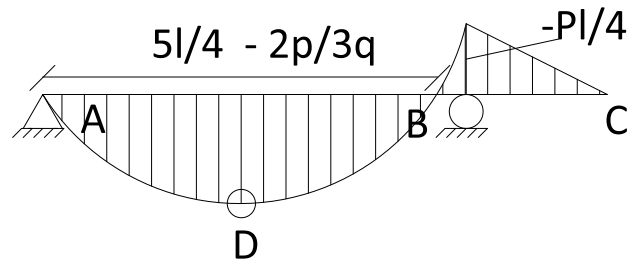


$$M_A^B(x) = -Y_A x + \frac{qx^2}{2} = \frac{Px}{3} - \frac{5ql}{8}x + \frac{qx^2}{2}$$



$$M_C^B(x) = -Px$$

FLECTORES



$$M(x) = 0 = X\left(\frac{P}{3} - \frac{5ql}{8} + \frac{qx}{2}\right) = 0$$

$$x = 0$$

$$x = \frac{5l}{4} - \frac{2p}{3q}$$

$$\text{MOMENTO MÁXIMO } (M'(x) = 0), \text{ PARA } x = \frac{5l}{4} - \frac{2p}{3q}$$

CORTANTES

