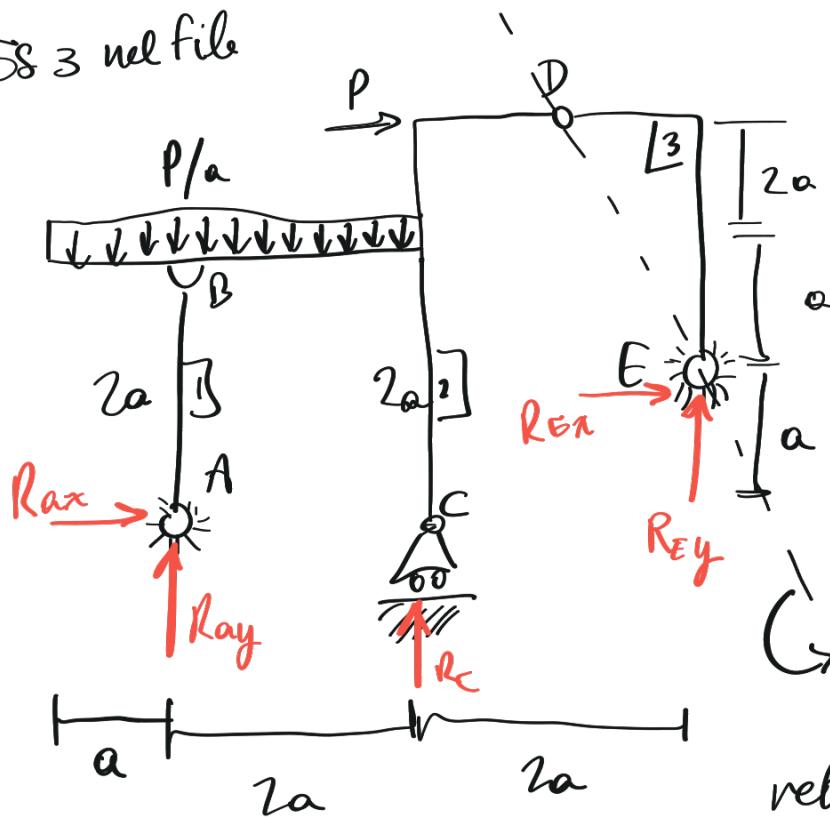


Esercitazione 4 - Non andiamo avanti

ES 3 nel file



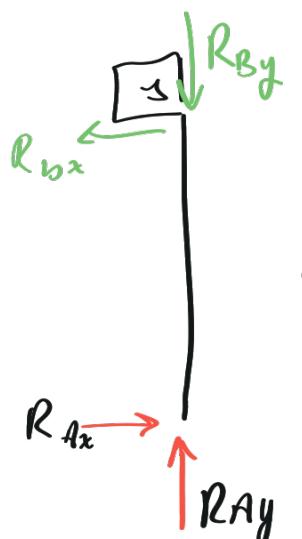
fatto cheko
obliquata, c'è una
relazione tra R_{ay} e R_{Ex}

Obiettivo: Trovare tutte le reazioni vincolate (interne ed esterne)

$$\sum F_x = 0 = P + \cancel{R_{ax}} + R_{Ex} \Rightarrow R_{Ex} = -P$$

$$\sum F_y = 0 = -\underbrace{3P}_{P/a \cdot 3a} + R_{ay} + R_c + \cancel{R_{Ey}} = 3P$$

$$\sum M_A = 0 = R_c \cdot 2a - \cancel{\frac{R_{Ex} \cdot a}{P}} + \cancel{\frac{R_{Ey} \cdot 4a}{3P}} - P \cdot 4a - \frac{3P^2}{2}$$



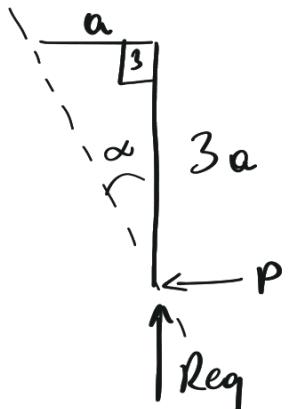
Non ci sono condizioni a quinde
lungo x

R_{Ax}

$$\sum M_B = 0 = R_{Ax} \cdot 2a$$

$$\Rightarrow R_{Ax} = 0 \Rightarrow R_{Bx} = 0$$

→ Bielle sconica



$$l = \sqrt{9a^2 + a^2} \quad a = \sqrt{10}a$$

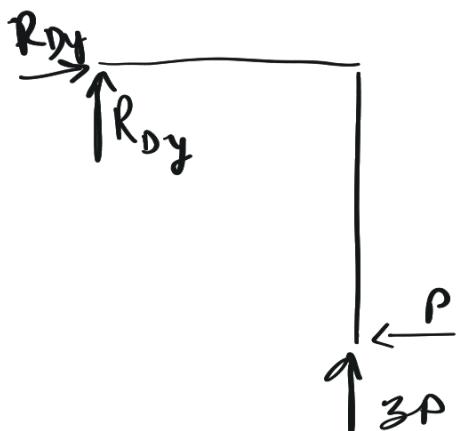
$$\cos \alpha = \frac{3a}{\sqrt{10}a}$$

$$R_E = \frac{P}{\sin \alpha}$$

$$R_Ey = \frac{P}{\sin \alpha} \cos \alpha$$

$$= \frac{P}{\tan \alpha} = 3P$$

$$\sum M_0 \Rightarrow R_c = \frac{-15}{4}P \Rightarrow R_Ey = \frac{15}{4}P$$

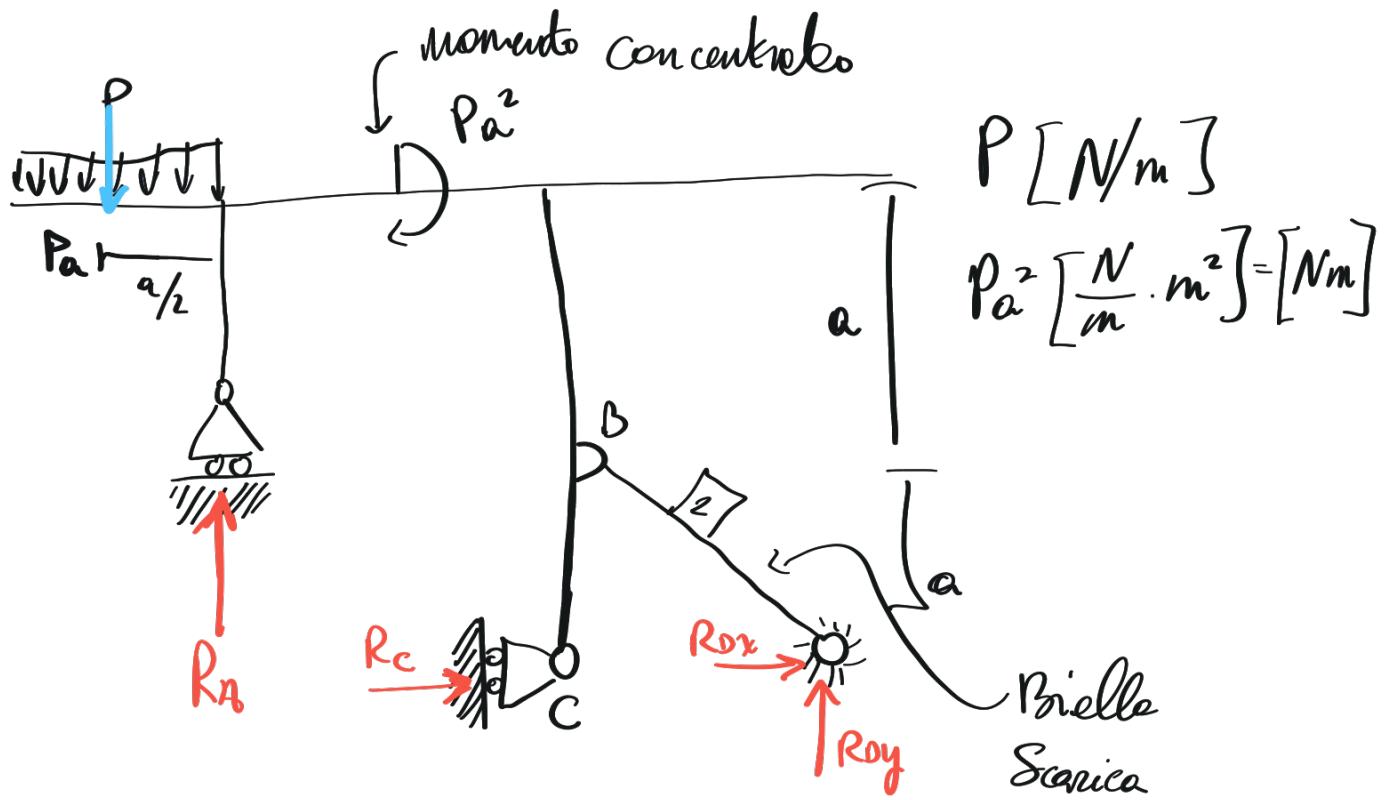


$$\sum F_x = 0 = -P + R_{Dx} \Rightarrow R_{Dx} = P$$

$$\sum F_y = 0 = 3P + R_{Dy}$$

$$\Rightarrow R_{Dy} = -3P$$

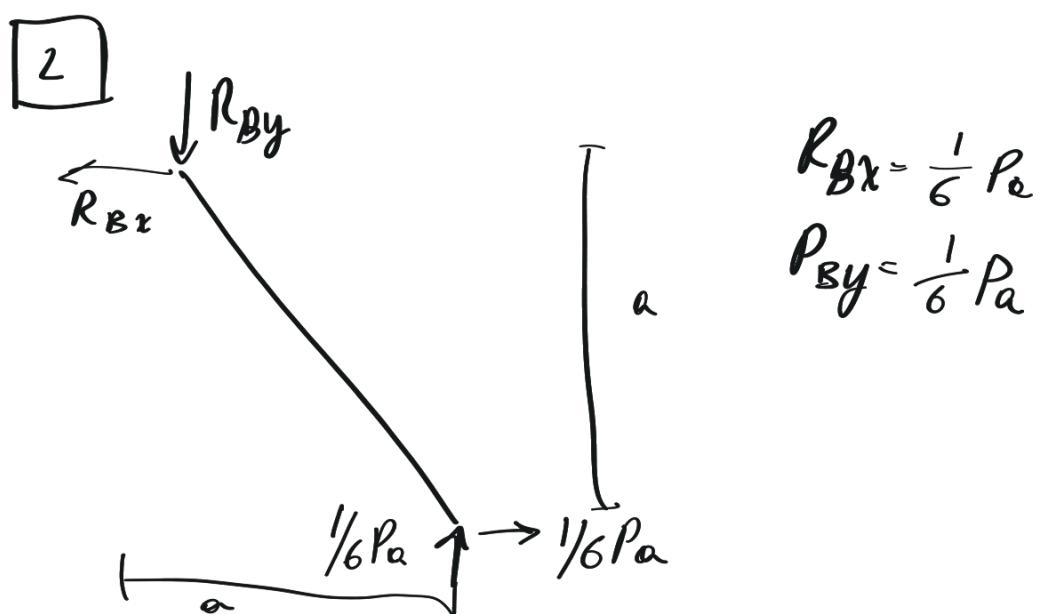
Non ci sono equilibrio al

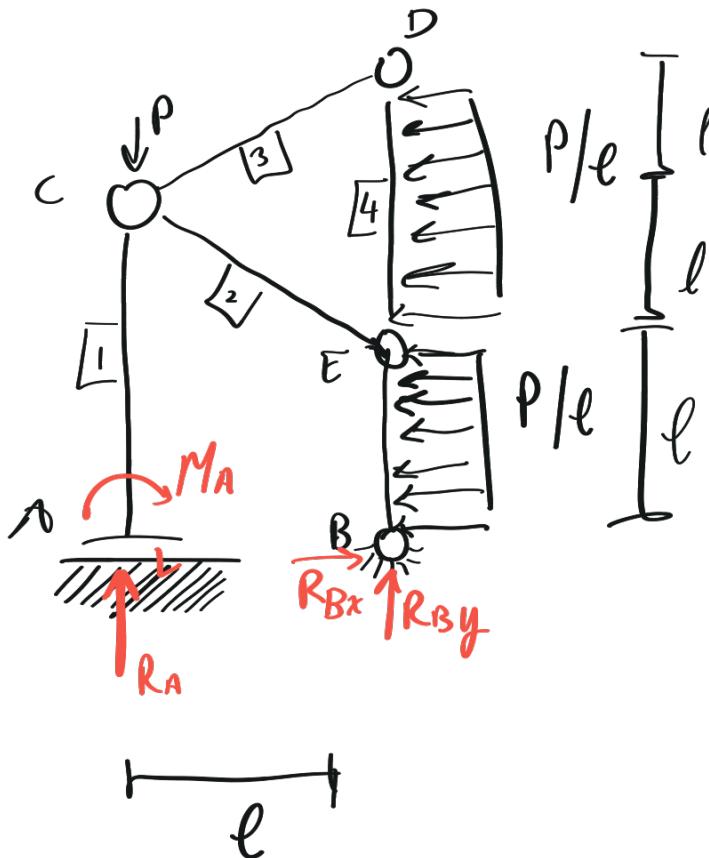


$$\sum F_x = 0 \leftarrow R_C + R_{Dx} \Rightarrow R_C = -R_{Dx} = -\frac{1}{6} Pa$$

$$\sum F_y = 0 = R_{Dy} + R_A - P \cdot a \Rightarrow R_{Dy} = R_{Dx} + Pa + \frac{5}{6} Pa = \frac{11}{6} Pa$$

$$\sum M^D = 0 = -Pa^2 + Pa^2 \cdot \frac{7}{2} - 3a R_A \Rightarrow R_A = \frac{5}{6} Pa$$



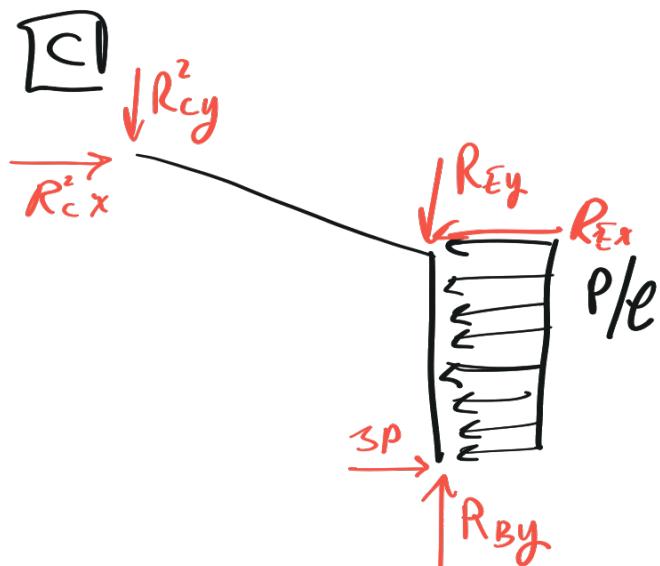


$$\sum F_x = R_{Bx} - \cancel{2P} - \cancel{P} \Rightarrow R_{Bx} = 3P$$

$$P/l \cdot 2l = P/l \cdot l$$

$$\sum F_y = 0 = R_A + R_{By} - P$$

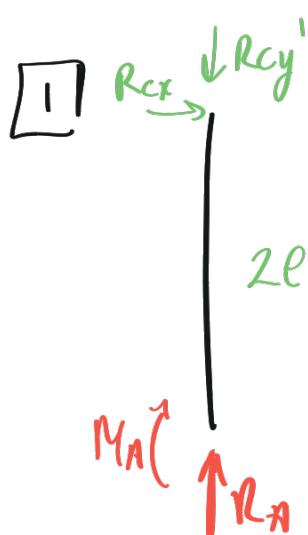
$$\sum M^B = 0 = -M_A - R_A l + Pl + Pl/2 + 4Pl$$



$$\sum F_x = 3P - P - R_{Ex} + R_Cx^2 \Rightarrow R_{Cx}^2 = P$$

$$\sum F_y = 0 = R_B - R_Ey - R_{Cy}^2 \Rightarrow R_{Ey} = -P$$

$$\sum M = 0 = R_{Cyl}l - R_{Cx}^2l - \frac{Pl}{2} + 3Pe \Rightarrow R_{Cy}^2 = -\frac{7}{2}P$$



$$\sum F_x = 0 = R_Cx$$

$$\sum M^C = 0 = M_A$$

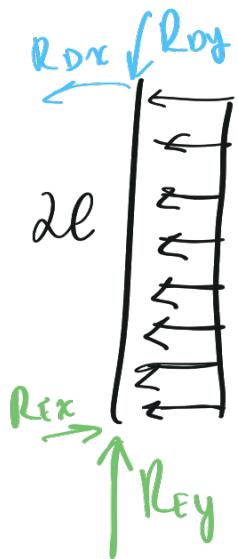
$$\sum F_y = 0 = R_A - R_A'$$

$$\sum M^B = Pl + M_A - R_A l + 4Pl$$

$$+ \frac{Pl}{2} \Rightarrow R_A = \frac{11}{2}P = R_A'$$

$$R_A = \frac{11}{2}P = R_A'$$

14



$$\sum M_O = 2Pl + R_E \cdot 2l \Rightarrow R_{Ex} = P$$

$$\sum F_x = 0 = -2P - R_{Dx} + P \Rightarrow R_{Dx} = -P$$

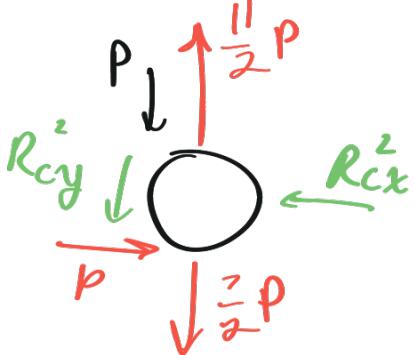
$$\sum F_y = 0 = -P + R_A + R_{By} \Rightarrow R_{By} = P - R_A$$

$$\begin{aligned} \sum F_y = 0 &= R_Ey - R_Dy \Rightarrow R_Ey \\ &= -P \end{aligned}$$

metre arka

$$= -\frac{q}{2}P$$

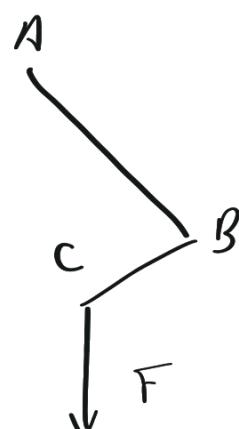
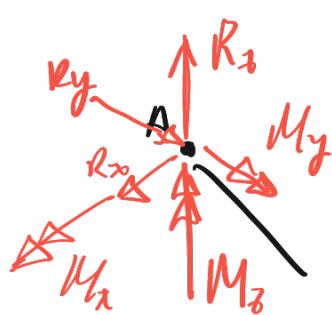
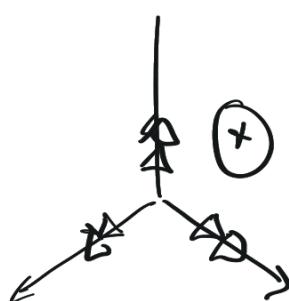
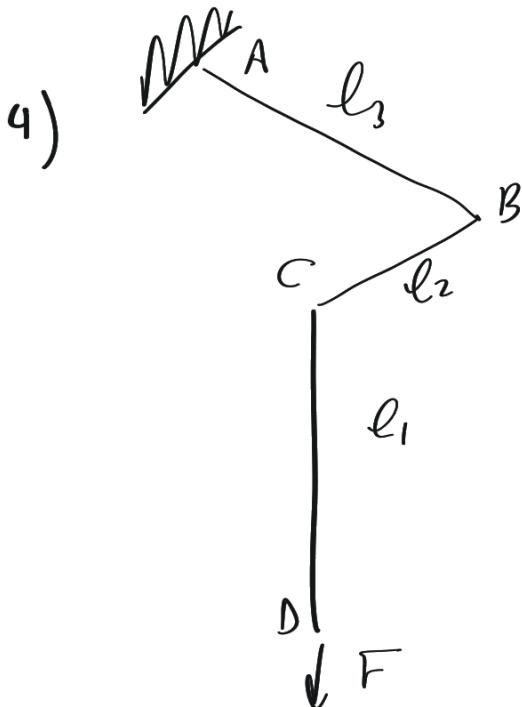
Equilibrio al nodo

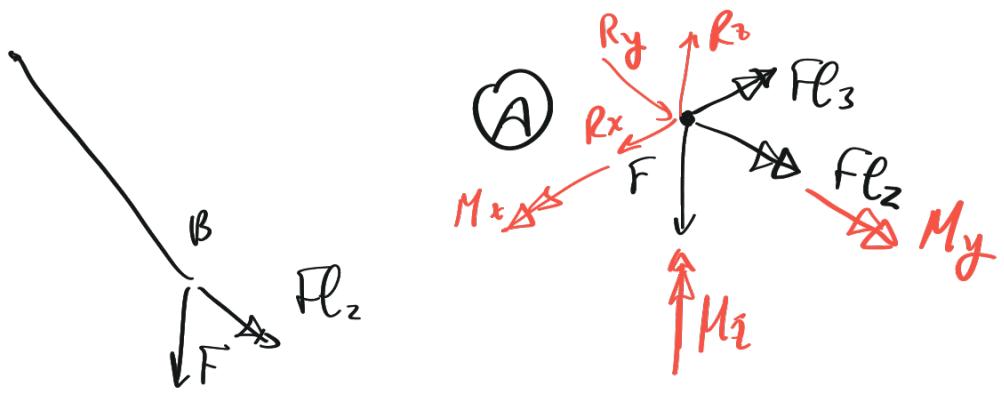


$$\sum F_y = 0 = \frac{11}{2}P - \frac{7}{2}P - P - R_{Cy}^z$$

$$\Rightarrow R_{Cy}^z = P$$

$$\sum F_x = 0 = P - R_{Cx}^z \Rightarrow R_{Cx}^z = P$$





$$\sum F_x = 0 = R_x$$

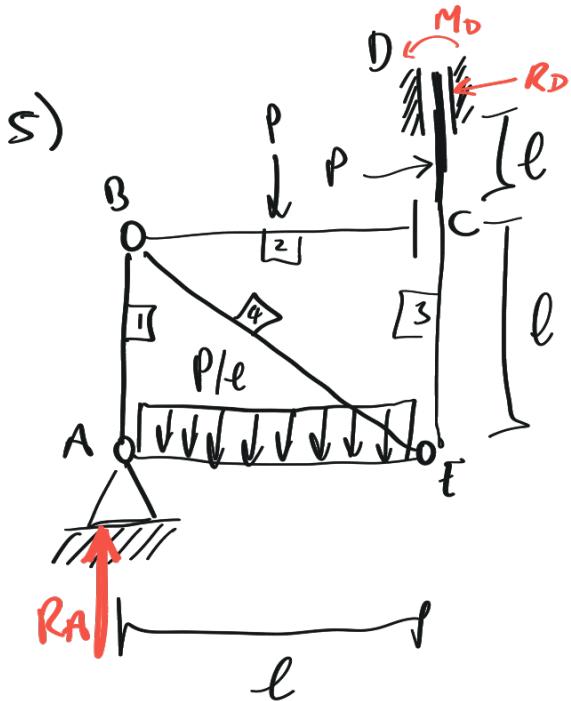
$$\sum F_y = R_y = 0$$

$$\sum_i F_i = R_z - F = 0 \Rightarrow R_z = F$$

$$\sum M_x = M_x - Fl_3 = 0 \Rightarrow M_x = Fl_3$$

$$\sum M_y = 0 = M_y + Fl_2 \Rightarrow M_y = -Fl_2$$

$$\sum M_z = 0 = M_z$$

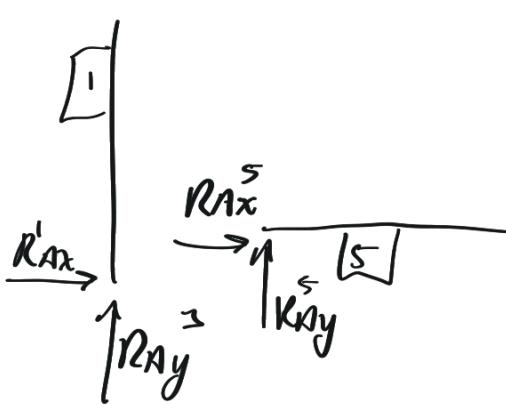
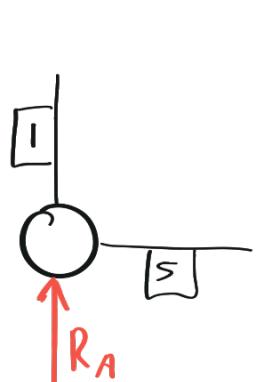


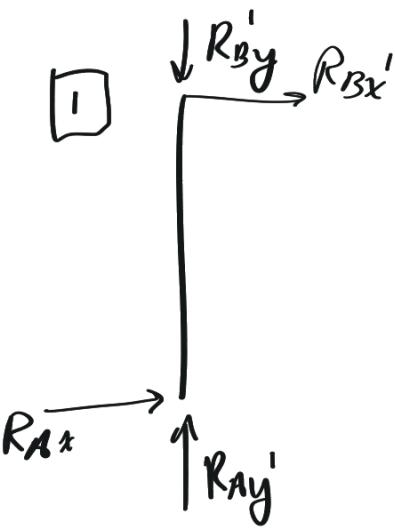
$$\sum F_x = 0 = p - R_D \Rightarrow R_D = p$$

$$\sum F_y = 0 = -P - \frac{P}{e} \cdot l + R_R \Rightarrow R_R = 2P$$

$$\sum M_D = 0 = M_D + \frac{P_l}{z} + \frac{P_L}{z} - 2 P_e$$

$$+ \frac{P l}{2} \xrightarrow{\alpha} M_0 = \frac{P l}{2}$$





Bilba Scizza

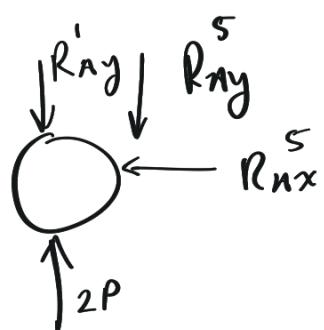
$$\sum M_B = 0 = R_{Ax}' l \Rightarrow R_{Ax}' = 0$$

$$\sum F_x = 0 = R_{Bx}$$

$$\sum F_y = 0 = \frac{3}{2} - R_{By}$$

$$\Rightarrow R_{By} = \frac{3}{2} P$$

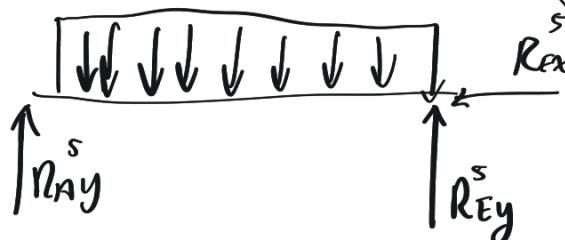
(A)



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

$$\sum F_y = 0 = 2P - \frac{P}{2} - R_{Ay} \Rightarrow R_{Ay} = \frac{3}{2} P$$

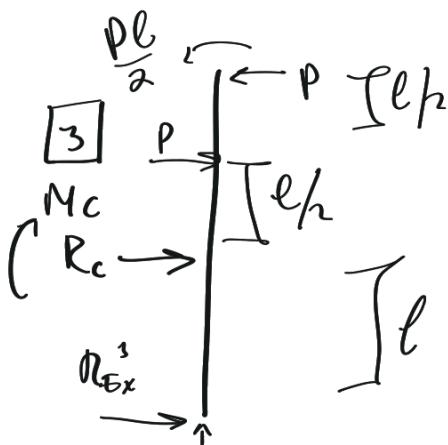
(S)



$$\sum F_x = 0 = R_{Ex}$$

$$\sum M_E = 0 = \frac{Pl}{2} - R_{Ay}^S l \Rightarrow R_{Ay}^S = P/2$$

$$\sum F_y = 0 = \frac{P}{2} - P + R_{Ey} \Rightarrow R_{Ey} = \frac{P}{2}$$



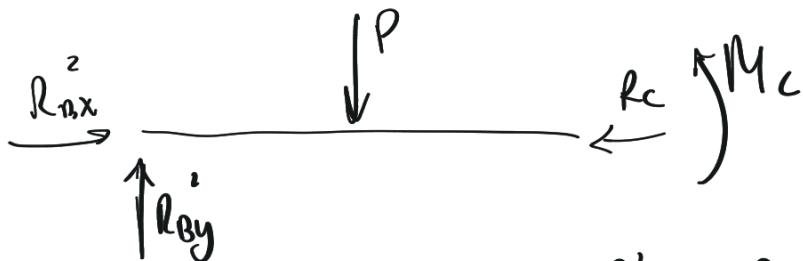
$$\sum F_y = 0 = R_{Ey}$$

$$\sum F_x = 0 = -P + P + R_c + R_{Ex}$$

$$\sum M_C = 0 = \frac{Pl}{2} + 2Pl - 3l^2 - R_c l - M_C$$

$$K_{By}^3 \Rightarrow R_c < \frac{P}{2}$$

2

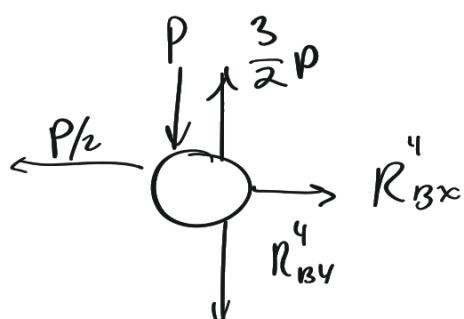


$$\sum F_y = 0 = R_{By}^2 - P \Rightarrow R_{By}^2 = P$$

$$\sum M_B = 0 = -\frac{P\ell}{2} + M_c \Rightarrow M_c = \frac{P\ell}{2}$$

$$\sum F_x = 0 = R_{Bx}^2 - \frac{P}{2} \Rightarrow R_{Bx}^2 = \frac{P}{2}$$

B

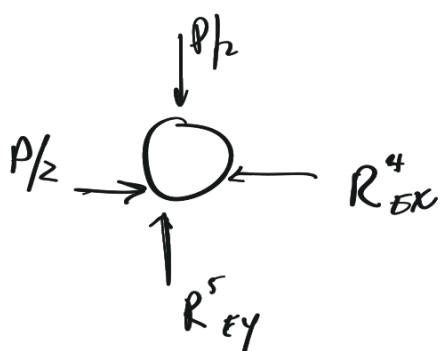


$$\sum F_x = 0 = R_{Bx}^5 - P/2 \Rightarrow R_{Bx}^4 = P/2$$

$$\sum F_y = 0 = R_{By}^4 - P + \frac{3}{2}P \Rightarrow R_{By}^4 = P/2$$

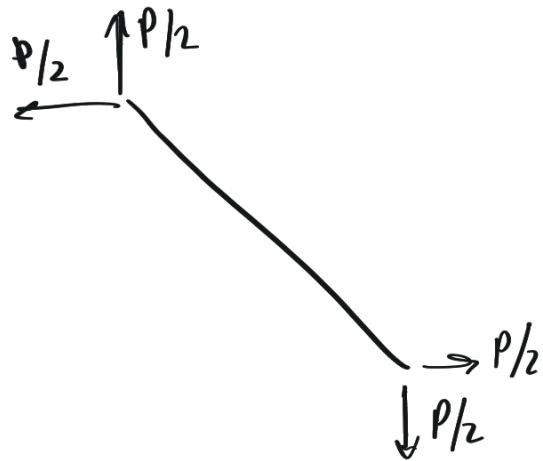
Ha seno pendile 45° e la bella carica

E

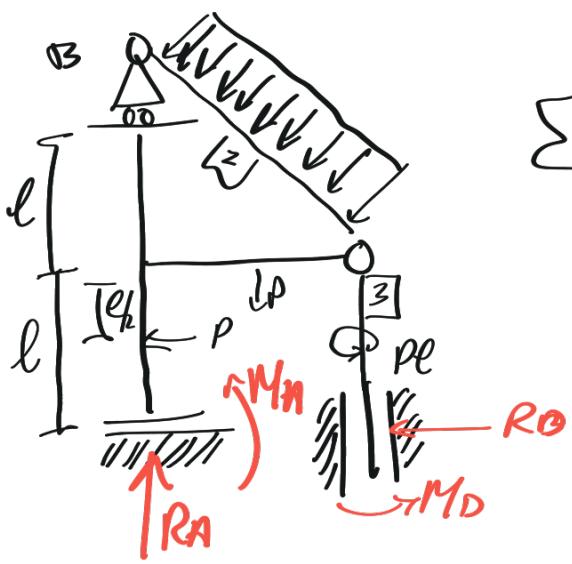


$$\sum F_x = 0 = \frac{P}{2} - R_{Ex}^4 \Rightarrow R_{Ex}^4 = P/2$$

$$\sum F_y = 0 = R_{Ey}^5 - \frac{P}{2} \Rightarrow R_{Ey}^4 = P/2$$



6)



$$\sum F_x = 0 = -P - R_D \Rightarrow R_D = -2P$$

$$|l|_z = \sqrt{l^2 + l^2} = l\sqrt{2}$$

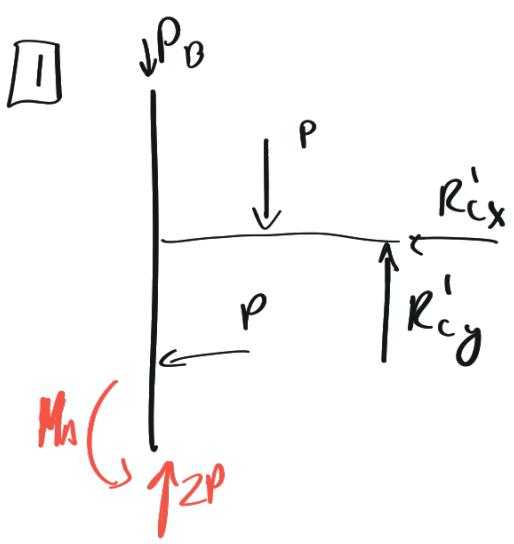
$$Q = \frac{P}{l} l\sqrt{2} = P \frac{\sqrt{2}\sqrt{2}}{2} = P$$

$$\sum F_y = 0 = R_A - P - P \Rightarrow R_A = 2P$$

$$\sum M_A = 0 = M_A + M_D + Pl + \frac{Pl}{2} - \frac{Pl}{2}$$

$$+ \frac{3}{2} l P - \frac{Pl}{2}$$

$$\Rightarrow M_A + M_D + 2Pl = 0$$



$$\sum F_x = 0 = R_{Cx}' + P \Rightarrow R_{Cx}' = -P$$

$$\sum F_y = 0 = 2P - P - R_B + R_{Cy}' \Rightarrow R_B = P$$

$$\sum M_A = 0 = M_A - 2Pl + \cancel{\frac{Pl}{2}} - \cancel{\frac{Pl}{2}} + R_B l$$

$$\Rightarrow R_{Cy}' = 0$$



$$\sum F_y = 0 = R_{C_y}^3$$

$$\sum F_x = 0 = zP - R_{C_x}^3 \Rightarrow R_{C_x}^3 = 2P$$

$$\sum M_c = 0 = M_A + Pl + 2Pe \Rightarrow M_D = -3Pe$$

$$M_A + M_D + 2Pe = 0 \Rightarrow M_A = -2Pe + 3Pe = Pe$$

