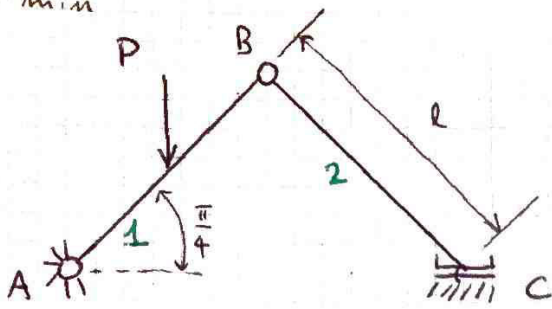


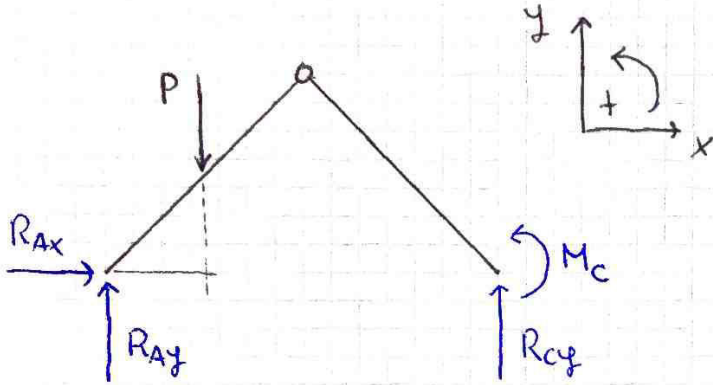
25 min



$$Gdl = 3m = 6$$

$$\sum GdU = 2A + 2B + 2C = 6$$

Anno a tre cerniere non allineate



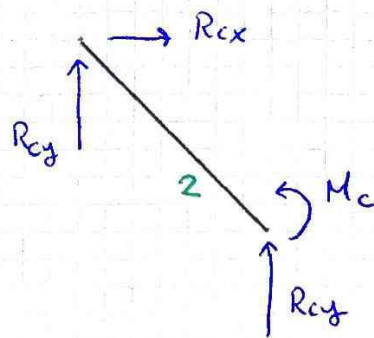
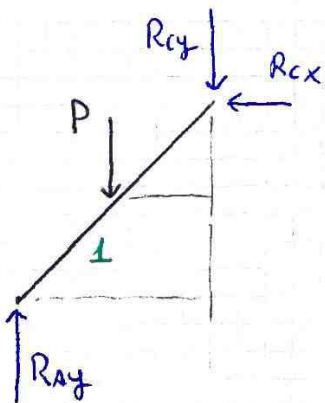
$$\sum F_x = 0 \quad R_{Ax} = 0$$

$$\sum F_y = 0 \quad R_{Ay} + R_{Cy} - P = 0 \quad (II) : \text{Inconosciute } R_{Ay}, R_{Cy}$$

$$\sum M_A = 0 \quad -P \frac{l}{2} \frac{\sqrt{2}}{2} + R_{Cy} 2l \frac{\sqrt{2}}{2} + M_C = 0$$

$$M_C + R_{Cy} \sqrt{2} l - P \frac{\sqrt{2}}{4} l = 0 \quad (III) : \text{Inconosciute } M_C, R_{Cy}$$

→ 3 incognite e 2 equazioni



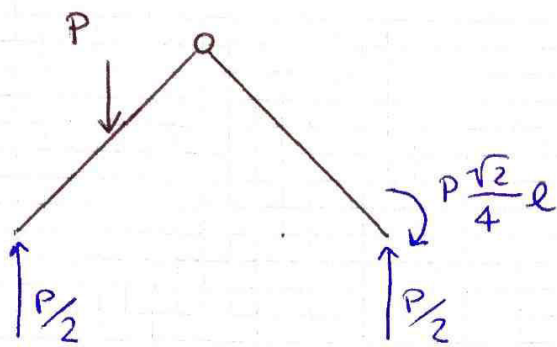
È opportuno fare il ~~calcolo~~ calcolo $\sum M = 0$ sulla struttura 1 e punto C
 ↳ Avremo un'equazione in una sola incognita

$$\sum M_B = 0$$

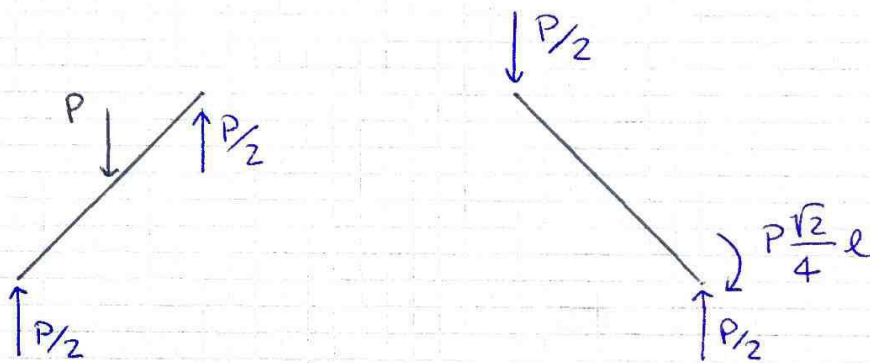
$$P \frac{l}{2} \frac{\sqrt{2}}{2} - R_{Ay} l \frac{\sqrt{2}}{2} = 0 \quad R_{Ay} = \frac{P}{2}$$

$$(II) \rightarrow R_{Cy} = P - R_{Ay} = P - \frac{P}{2} = \frac{P}{2}$$

$$(III) \rightarrow M_C = P \frac{\sqrt{2}}{4} l - R_{Cy} \sqrt{2} l = P \frac{\sqrt{2}}{4} l - \frac{P}{2} \sqrt{2} l = -P \frac{\sqrt{2}}{4} l$$



Posso mettere in luce anche le reazioni della cerniera interna:

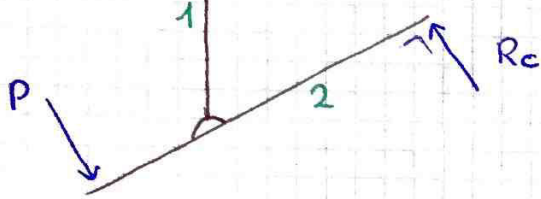
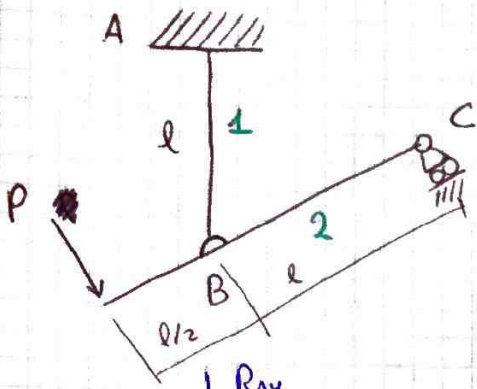


$$GdL = 3m = 6$$

$$\sum GdL = 3_A + 2_B + 1_C = 6$$

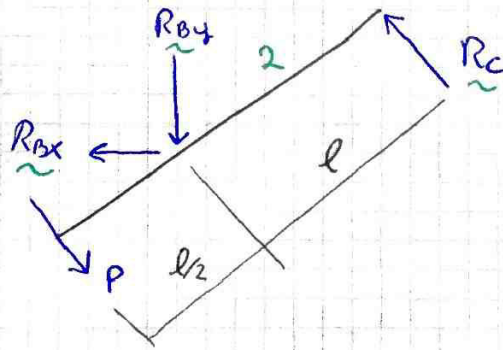
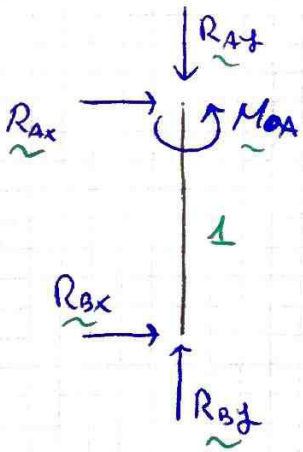
Carina ben vincolata a terra

→ Struttura isostatica



4 incognite e 3 equazioni -

→ conviene risolvere la struttura



Asta 2:

$$\sum M_B = 0 \quad P \frac{l}{2} + R_C l = 0 \quad R_C = -\frac{P}{2}$$

$$\sum F_x = 0 \quad P \cos \frac{\pi}{4} - R_{Bx} - R_C \cos \frac{\pi}{4} = 0$$

$$P \frac{\sqrt{2}}{2} - R_{Bx} + \frac{P}{2} \frac{\sqrt{2}}{2} = 0 \rightarrow R_{Bx} = \frac{P \sqrt{2} \cdot 3}{4} = \frac{3}{4} \sqrt{2} P$$

$$\sum F_y = 0 \quad -P \frac{\sqrt{2}}{2} - R_{By} + R_C \frac{\sqrt{2}}{2} = 0$$

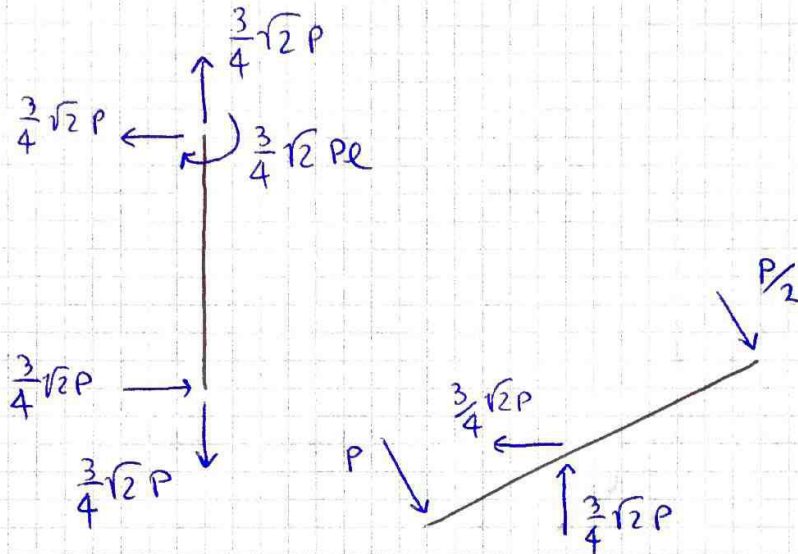
$$R_{By} = -\frac{P}{2}\sqrt{2} - \frac{P}{2}\frac{\sqrt{2}}{2} = -\frac{3}{4}\sqrt{2}P$$

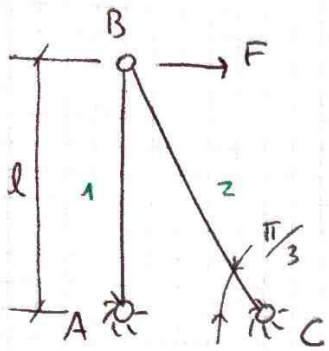
ASTA 1:

$$\sum F_x = 0 \quad R_{Ax} + R_{Bx} = 0 \rightarrow R_{Ax} = -R_{Bx} = -\frac{3}{4}\sqrt{2}P$$

$$\sum F_y = 0 \quad R_{By} - R_{Ay} = 0 \rightarrow R_{Ay} = R_{By} = -\frac{3}{4}\sqrt{2}P$$

$$\sum M_B = 0 \quad M_A - R_{Ax}l = 0 \rightarrow M_A = R_{Ax}l = -\frac{3}{4}\sqrt{2}Pl$$

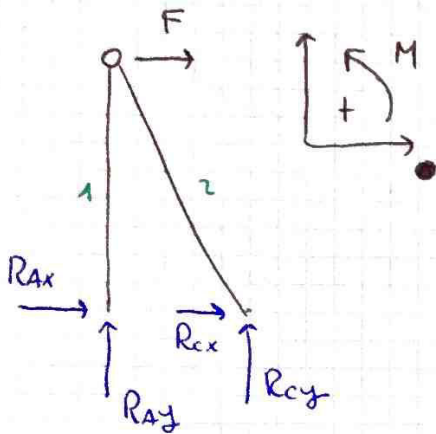




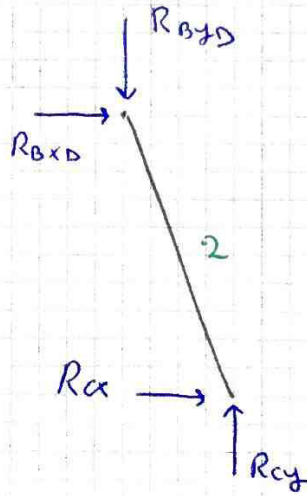
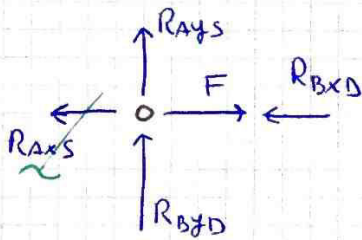
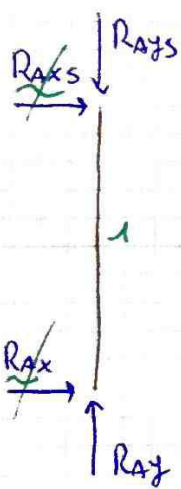
$$GdL = 6$$

$$\sum GdL = 2A + 2B + 2C = 6$$

Arco a tre
Cerniere non
allineate



Per questo tipo di strutture
si può iniziare a simulare
la struttura in modo furbo,
in modo tale da mettere subito
in luce il fatto che l'asta
A-B è un'asta bielle trasmette
solo azioni assiali



Asta 1

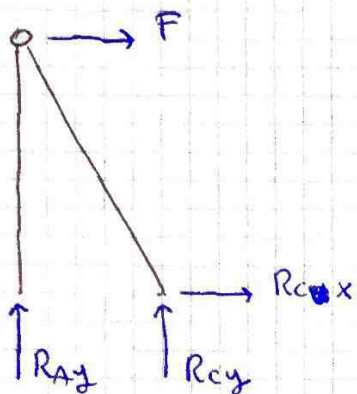
$$\sum M_B = 0$$

$$R_{Ax} \cdot l = 0 \rightarrow R_{Ax} = 0$$

$$\sum F_x = 0$$

$$R_{Ax} + R_{AxS} = 0 \rightarrow R_{AxS} = 0$$

A questo punto possiamo fare l'equilibrio per l'intero sistema



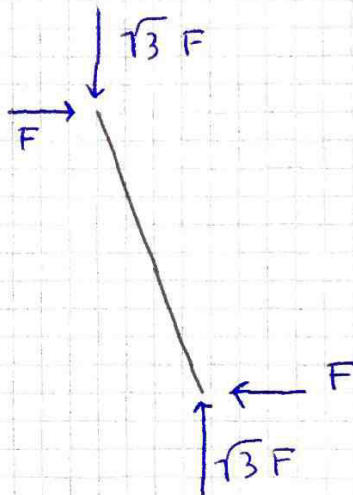
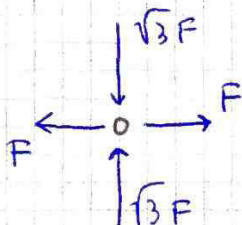
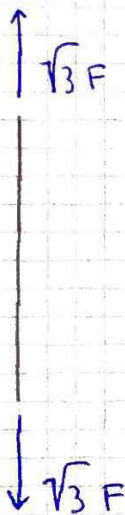
$$\sum F_x = 0 \quad F + R_{Cx} = 0 \quad R_{Cx} = -F$$

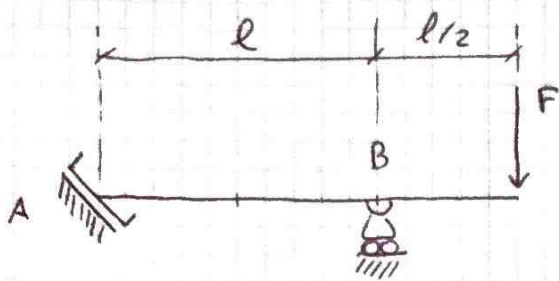
$$\sum M_C = 0 \quad -Fl - R_{Ay} \frac{l}{\sqrt{3}} = 0$$

$$\left[\tan \frac{\pi}{3} = \sqrt{3} = \frac{l}{AC} \right]$$

$$R_{Ay} = -Fl \frac{\sqrt{3}}{l} = -\sqrt{3}F$$

$$\sum F_y = 0 \quad R_{Ay} + R_{Cy} = 0 \quad R_{Cy} = \sqrt{3}F$$





$$Gdl = 3$$

$$\sum GdV = 2A + 1B = 0$$

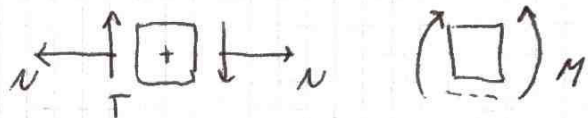
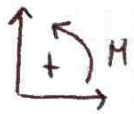


$$\sum F_x = 0 \quad R_A \cos \frac{\pi}{4} = 0 \rightarrow R_A = 0$$

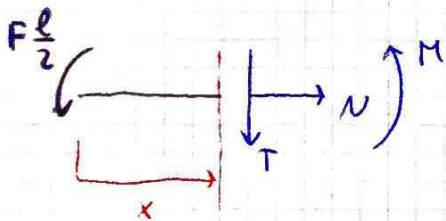
$$\sum F_y = 0 \quad R_{B,y} - F = 0 \rightarrow R_{B,y} = F$$

$$\sum M_B = 0 \quad -M_A - F \frac{l}{2} = 0$$

$$M_A = -F \frac{l}{2}$$



Tramo A-B

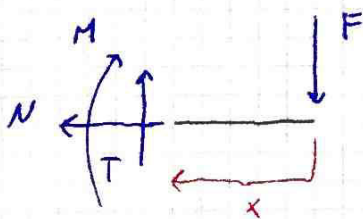


$$N = 0$$

$$T = 0$$

$$M + F \frac{l}{2} = 0 \quad M = -F \frac{l}{2}$$

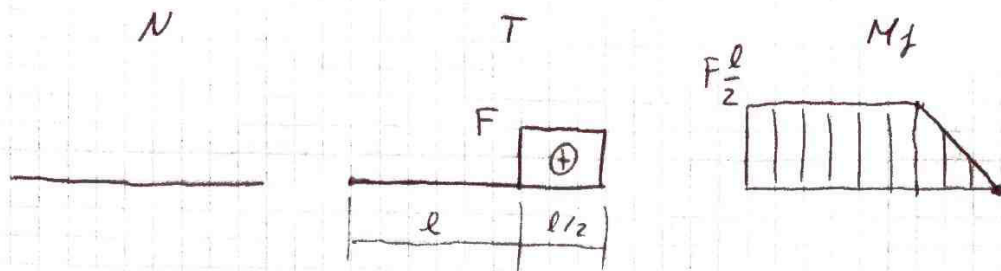
Tramo BC



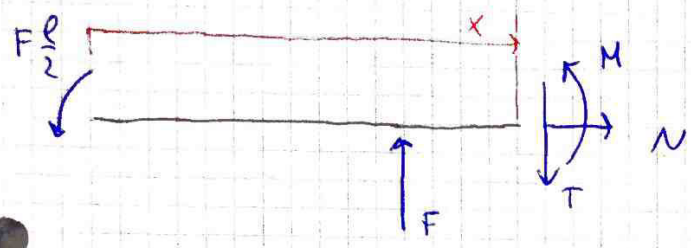
$$N = 0$$

$$T = F$$

$$-M - Fx = 0 \quad M = -Fx$$



A scopo esemplificativo si analizza il tratto B-C:



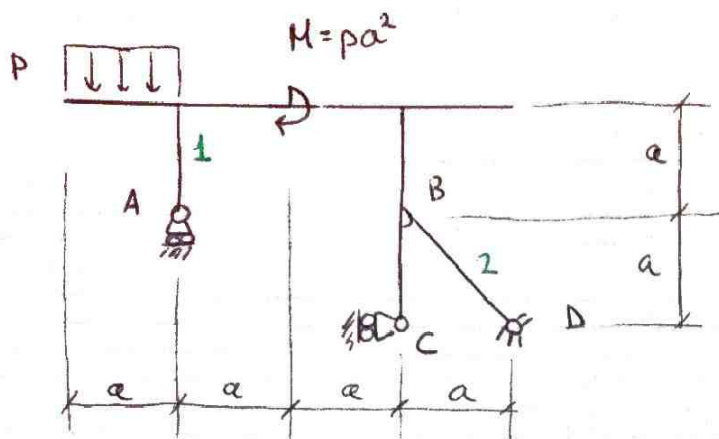
$$N = 0$$

$$T = F$$

$$M - F(x - l) + F \frac{l}{2} = 0 \quad M = F(x - l) - F \frac{l}{2}$$

$$x = l \rightarrow M = -F \frac{l}{2}$$

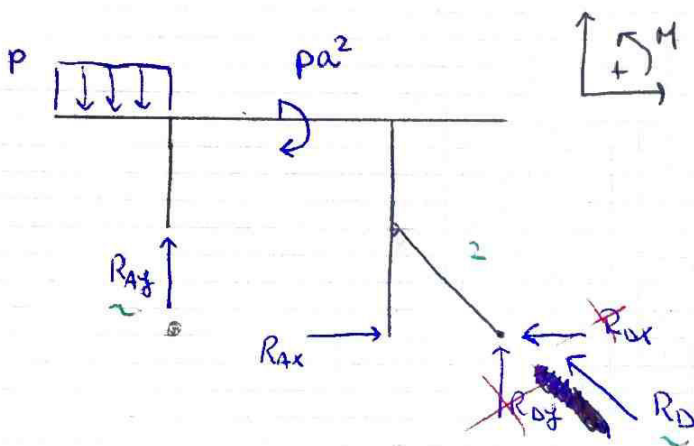
$$x = l + \frac{l}{2} \rightarrow M = F(l + \frac{l}{2} - l) - F \frac{l}{2} = 0$$



$$Gdl = 6$$

$$\sum Gdl = 1_A + 2_B + 1_C + 2_D = 6$$

Anno a 3 cerniere
non allineate



l'asta 2 è una biella

$$R_{Dx} = R_{Dy}$$

Non serve spessare la struttura

~~ΣMD = 0~~

"Portata finta" in D, R_D e R_{Ax} non hanno momento

$$Pa \frac{7}{2}a - Pa^2 - R_{Ay} 3a = 0 \quad R_{Ay} = \frac{7}{6}Pa - \frac{1}{3}Pa = \frac{5}{6}Pa$$

$$\sum F_y = 0 \quad R_{Ay} - Pa + R_D \frac{\sqrt{2}}{2} = 0 \quad R_D = \left(Pa - R_{Ay} \right) \frac{2}{\sqrt{2}} = \left(Pa - \frac{5}{6}Pa \right) \frac{2}{\sqrt{2}} = \frac{1}{3\sqrt{2}} Pa$$

$$\sum F_x = 0 \quad R_{Ax} - R_D \frac{\sqrt{2}}{2} = 0 \quad R_{Ax} = R_D \frac{\sqrt{2}}{2} = \frac{1}{3\sqrt{2}} \frac{\sqrt{2}}{2} Pa = \frac{1}{6} Pa$$

