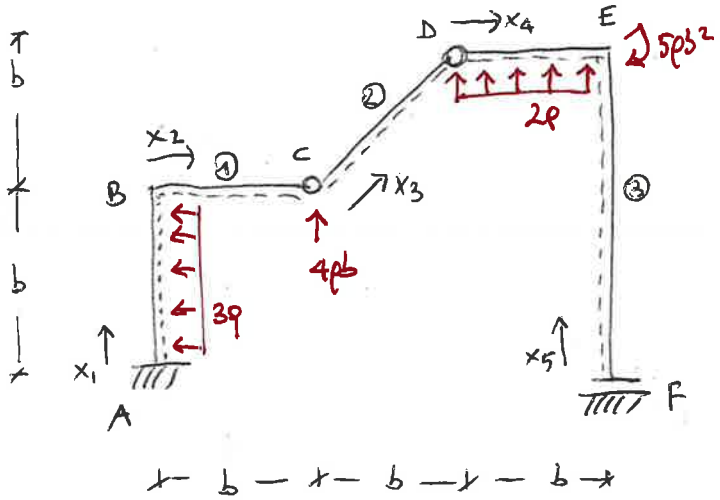
SdC SbA p1 25/06/2025 PROBLEMA 1



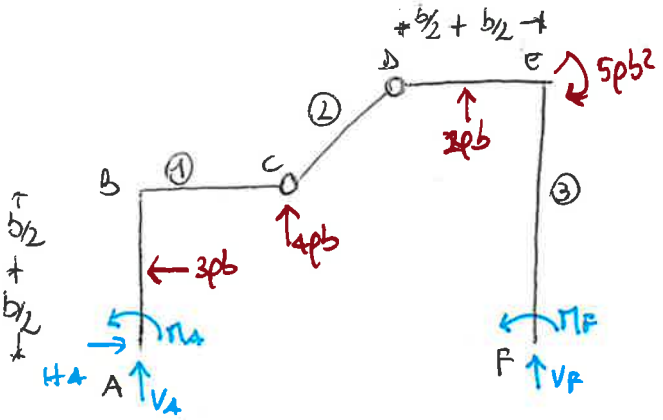
RISOLVERE LA STRUTTURA ISOSTATICA CALCOLANDO LE REAZIONI VINCOLARI, LE EQUAZIONI DELLE AZIONI INTERNE E TRACCIANDO I DIAGRAMMI

GDL = 3×3 = 9

GDV = 3(A) + 2(C) + 2(D) + 2(F) = 9

ARTICOLAZIONE SEMPLICE IN C → CERNIERA
" " " IN D → " "

DIAGRAMMA DI CORPO LIBERO



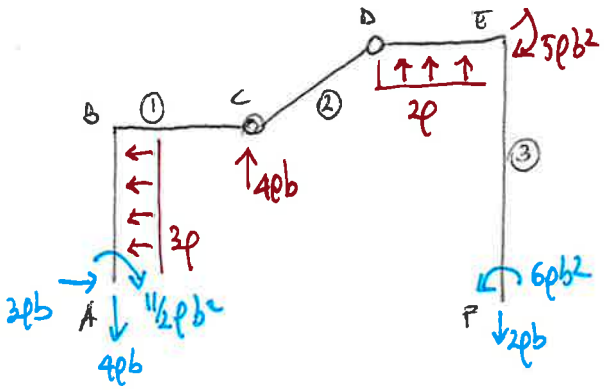
EQUAZIONI CARDINALI:

$$\begin{cases} \rightarrow R_x = 0 \; [1] \; H_A - 3pb = 0 \\ \uparrow R_y = 0 \; [2] \; V_A + V_F + 4pb + 2pb = 0 \\ \circlearrowleft M_{z(A)} = 0 \; [3] \; M_A + M_F + V_F 3b + \frac{3}{2}pb^2 + 4pb^2 + 5pb^2 - 5pb^2 = 0 \end{cases} \quad ①+②+③$$

$\boxed{H_A = 3pb}$

EQ. AUSILIARIE: $M_{z(C)}^{①} = 0$ oppure $M_{z(C)}^{(2+3)} = 0$

$M_{z(D)}^{(1+2)} = 0$ oppure $M_{z(D)}^{(3)} = 0$



$$\begin{cases} M_{z(C)}^{(2+3)} = 0 \; [4] \; 3pb^2 - 5pb^2 + M_F + V_F 2b = 0 \\ M_{z(D)}^{(3)} = 0 \; [5] \; pb^2 - 5pb^2 + M_F + V_F b = 0 \end{cases}$$

[5] $M_F = 4pb^2 - V_F b$

[4] $V_F 2b + 4pb^2 - V_F b - 2pb^2 = 0$

$V_F b/2 = -2pb^2$ $\boxed{V_F = -2pb}$

[5] $M_F = 4pb^2 - (-2pb)b =$ $\boxed{M_F = 6pb^2}$

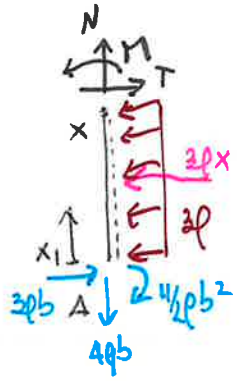
[2] $V_A = -6pb - V_F = -6pb - (-2pb)$ $\boxed{V_A = -4pb}$

[3] $M_A = -M_F - V_F 3b - \frac{3}{2}pb^2 + 4pb^2 =$

$= -6pb^2 - (-2pb)3b - \frac{3}{2}pb^2 - \frac{8}{2}pb^2 =$

$= -6pb^2 + 6pb^2 - \frac{11}{2}pb^2$ $\boxed{M_A = -\frac{11}{2}pb^2}$

A → B $0 < x_1 < b$



$\uparrow R_{\parallel} = 0 \quad -4\rho b + N(x_1) = 0 \quad \boxed{N(x_1) = 4\rho b}$

$\rightarrow R_{\perp} = 0 \quad 3\rho b - 3\rho x_1 + T(x_1) = 0 \quad \boxed{T(x_1) = -3\rho b + 3\rho x_1}$

$x_1 = 0 \quad T(x_1) = -3\rho b$

$x_1 = b \quad T(x_1) = 0$

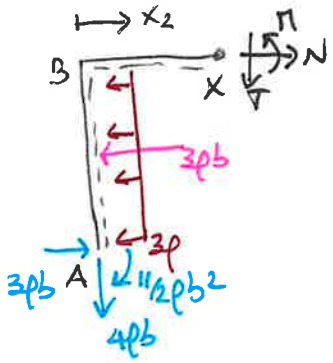
$\curvearrowleft \Pi_z(x) = 0 \quad +3\rho b x_1 - 11/2\rho b^2 - \frac{3}{2}\rho x_1^2 + M(x_1) = 0$

$\boxed{M(x_1) = 11/2\rho b^2 - 3\rho b x_1 + \frac{3}{2}\rho x_1^2}$

$x_1 = 0 \quad M(x_1) = 11/2\rho b^2$

$x_1 = b \quad M(x_1) = 4\rho b^2$

B → C $0 < x_2 < b$



$\rightarrow R_{\parallel} = 0 \quad 3\rho b - 3\rho b + N(x_2) = 0 \quad \boxed{N(x_2) = 0}$

$\uparrow R_{\perp} = 0 \quad -4\rho b - T(x_2) = 0 \quad \boxed{T(x_2) = -4\rho b}$

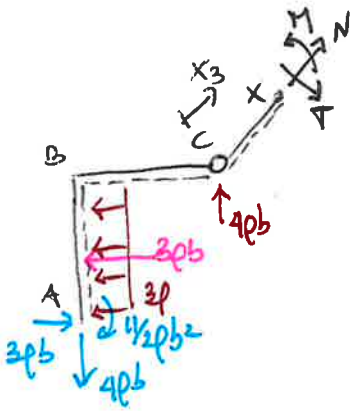
$\curvearrowleft \Pi_z(x) = 0 \quad \underbrace{-11/2\rho b^2 + 3\rho b^2 - \frac{3}{2}\rho b^2}_{-4\rho b^2} + 4\rho b x_2 + M(x_2) = 0$

$\boxed{M(x_2) = 4\rho b^2 - 4\rho b x_2}$

$x_2 = 0 \quad M(x_2) = 4\rho b^2$

$x_2 = b \quad M(x_2) = 0$

C → D $0 < x_3 < \sqrt{2}b$

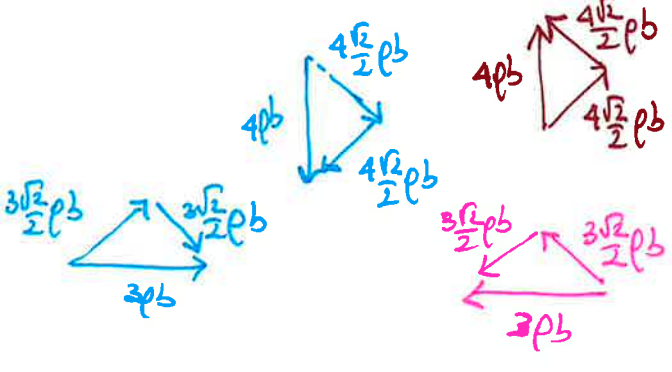


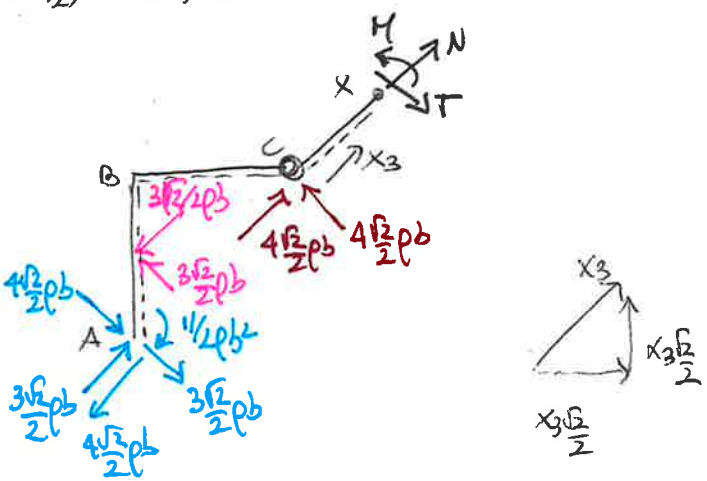
$\nearrow R_{\parallel} = 0 \quad \frac{3\sqrt{2}}{2}\rho b - 4\frac{\sqrt{2}}{2}\rho b - 3\frac{\sqrt{2}}{2}\rho b + 4\frac{\sqrt{2}}{2}\rho b + N(x_3) = 0 \quad \boxed{N(x_3) = 0}$

$\nwarrow R_{\perp} = 0 \quad -4\frac{\sqrt{2}}{2}\rho b - 3\frac{\sqrt{2}}{2}\rho b + 3\frac{\sqrt{2}}{2}\rho b + 4\frac{\sqrt{2}}{2}\rho b - T(x_3) = 0 \quad \boxed{T(x_3) = 0}$

$\curvearrowleft \Pi_z(x) = 0 \quad -11/2\rho b^2 + 3\rho b\left(b + x_3\frac{\sqrt{2}}{2}\right) + 4\rho b\left(b + x_3\frac{\sqrt{2}}{2}\right) - 3\rho b\left(b + x_3\frac{\sqrt{2}}{2}\right) +$

$- 4\rho b\left(x_3\frac{\sqrt{2}}{2}\right) + M(x_3) = 0$





C → D $\quad 0 < x_3 < \sqrt{2}b$

3) $M_{tz}(x) = 0 \quad -11/2\rho b^2 + 3\rho b^2 + 3\frac{\sqrt{2}}{2}\rho b x_3 + 4\rho b^2 + 4\frac{\sqrt{2}}{2}\rho b x_3 - 3/2\rho b^2 - 3\frac{\sqrt{2}}{2}\rho b x_3 - 4\frac{\sqrt{2}}{2}\rho b x_3 +$

$+ M(x_3) = 0$

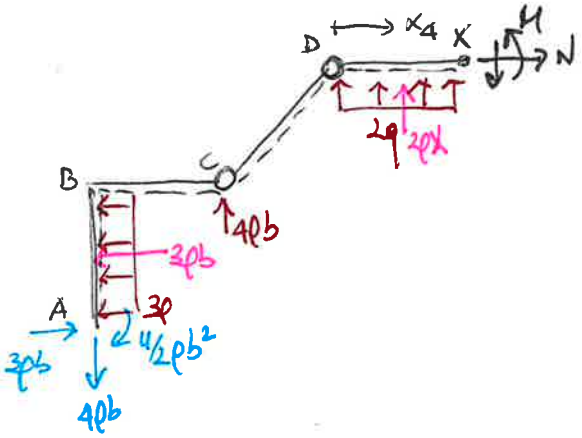
$-11/2\rho b^2 + 6/2\rho b^2 + 8/2\rho b^2 - 3/2\rho b^2 + M(x_3) = 0 \quad \left(\frac{-11+6+8-3}{2}\right)\rho b^2 + M(x_3) = 0$

0

$\boxed{M(x_3) = 0}$

N.B. C.V.D. IL MOMENTO CD È 1 BIELLA! $T = 0$ E $M = 0$

D → E $\quad 0 < x_4 < b$



$\rightarrow R_{//} = 0 \quad 3\rho b - 3\rho b + N(x_4) = 0 \quad \boxed{N(x_4) = 0}$

$\uparrow R_{\perp} = 0 \quad -4\rho b + 4\rho b + 2\rho x_4 - T(x_4) = 0 \quad \boxed{T(x_4) = 2\rho x_4}$ *

$\circlearrowleft \Pi_z(x) = 0 \quad -11/2\rho b^2 + 6\rho b^2 + 4\rho b(2b + x_4) - \frac{9}{2}\rho b^2 +$

$- 4\rho b(b + x_4) - \rho x_4^2 + \Pi(x_4) = 0$

$-11/2\rho b^2 + 6\rho b^2 + 8\rho b^2 + 4\rho b x_4 - 8/2\rho b^2 - 4\rho b^2 +$

$- 4\rho b x_4 - \rho x_4^2 + \Pi(x_4) = 0$

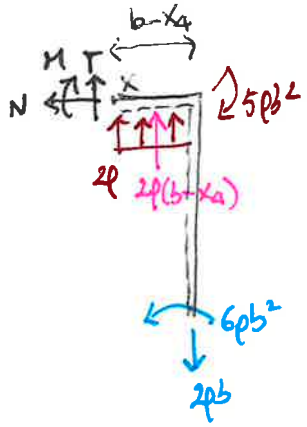
$-11/2\rho b^2 + 12/2\rho b^2 + 16/2\rho b^2 - 8/2\rho b^2 - 8/2\rho b^2 - \rho x_4^2 + \Pi(x_4) = 0$

0

$\boxed{\Pi(x_4) = \rho x_4^2}$ *

*NB. OVVIO, DALLA BIELLA $T = 0$ E $M = 0$!

N.B. SI PUÒ ANCHE PROCEDERE COSÌ:



$\rightarrow R_{//} = 0 \quad \boxed{N(x_4) = 0}$

$\uparrow R_{\perp} = 0 \quad T(x_4) + 2p(b - x_4) - 2pb = 0 \quad T(x_4) + 2pb - 2px_4 - 2pb = 0$

$\boxed{T(x_4) = 2\rho x_4} \quad \begin{matrix} x=0 \; T(x_4)=0 \\ x=b \; T(x_4)=2pb \end{matrix}$

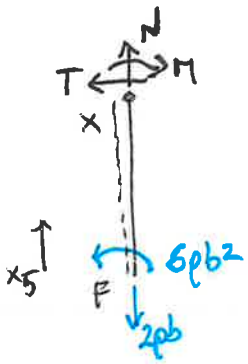
$\circlearrowleft \Pi_z(x) = 0 \quad -M(x_4) + 2p(b - x_4)\left(\frac{b - x_4}{2}\right) - 5\rho b^2 + 6\rho b^2 - 2pb(b - x_4) = 0$

$-M(x_4) + 2p\left(\frac{b^2}{2} - \frac{bx_4}{2} - \frac{bx_4}{2} + \frac{x_4^2}{2}\right) + \rho b^2 - 2\rho b^2 + 2pbx_4 = 0$

$-M(x_4) + \rho b^2 - \rho b x_4 - \rho b x_4 + \rho x_4^2 + \rho b^2 - 2\rho b^2 + 2\rho b x_4 = 0$

$\boxed{M(x_4) = \rho x_4^2} \quad \begin{matrix} x=0 \; M(x_4)=0 \\ x=b \; M(x_4)=\rho b^2 \end{matrix}$

F → E $0 < x_5 < 2b$

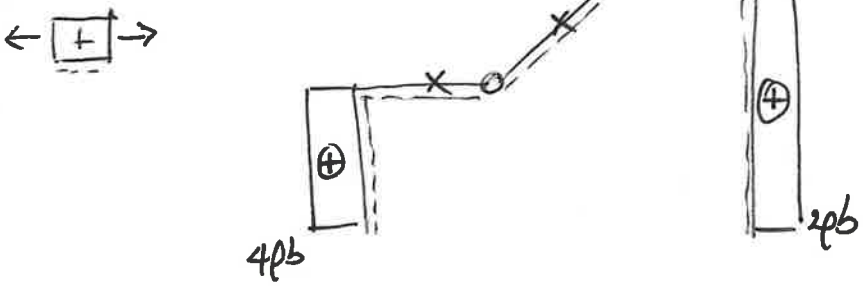


$\uparrow R_{\parallel} = 0$ $-2pb + N(x_5) = 0$ $\boxed{N(x_5) = 2pb}$

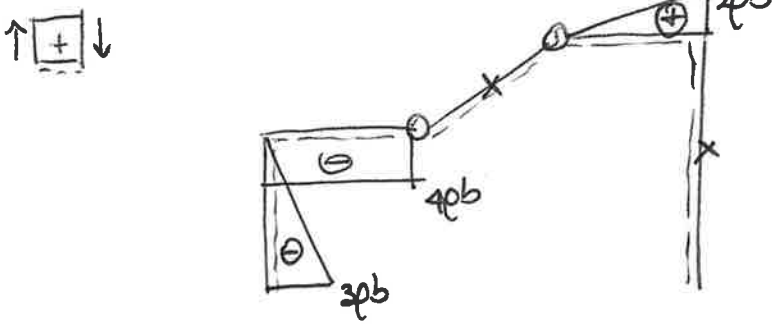
$\rightarrow R_{\perp} = 0$ $\boxed{T(x_5) = 0}$

$\circlearrowleft M_{z(1)} = 0$ $-M(x_5) + 6pb^2 = 0$ $\boxed{M(x_7) = 6pb^2}$

(N)



(T)



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