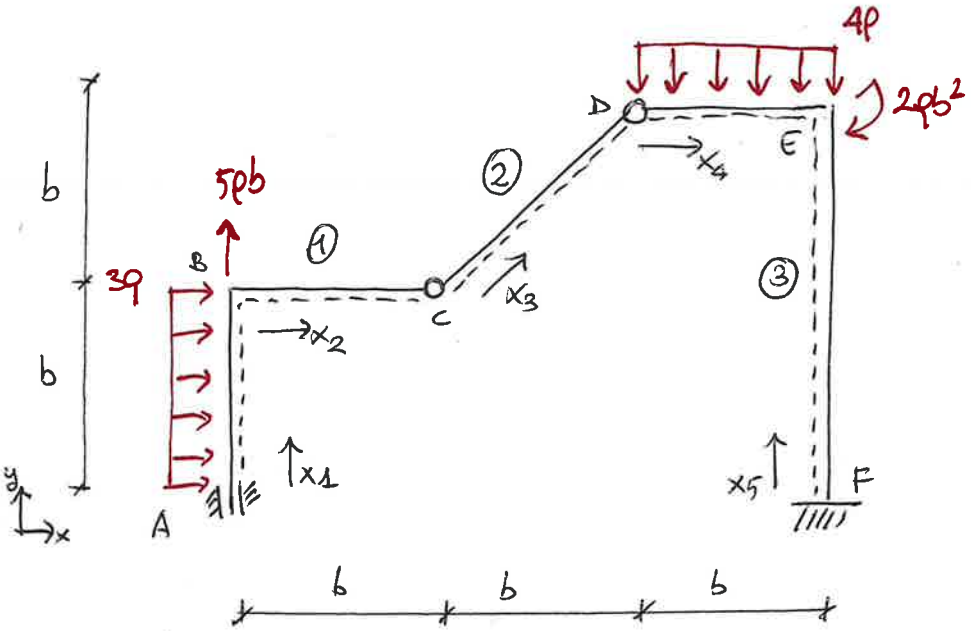
SdC SdA p1 03/07/2025 PROBLEMA 1 TESTO 2 ①

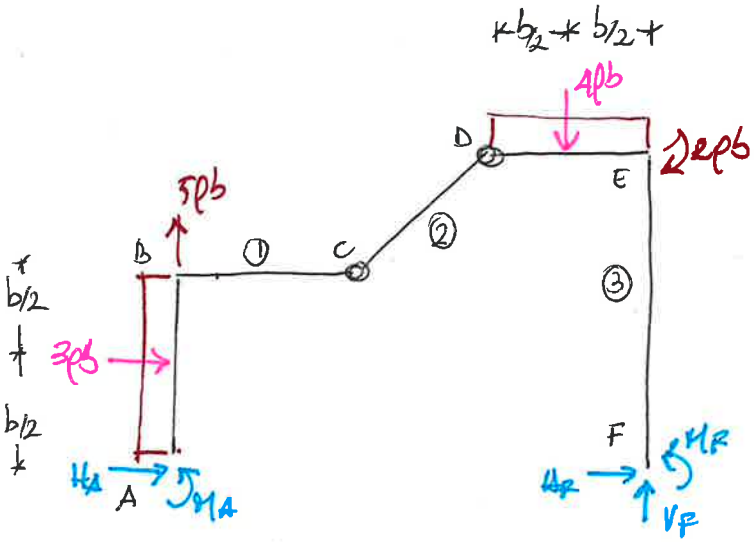


RISOLVERE LA STRUTTURA ISOSTATICA CALCOLANDO LE REAZIONI VINCOLARI, LE EQUAZIONI DELLE AZIONI INTERNE E TRACCIANDO I DIAGRAMMI

GDL = 3×3 = 9

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

DIAGRAMMA DI CORPO LIBERO:



EQUAZIONI CARDINALI ①+②+③

[1] $\rightarrow R_x = 0$ $\quad H_A + H_F + 3pb = 0$

[2] $\uparrow R_y = 0$ $\quad V_F + 5pb - 4pb = 0$ $\quad \boxed{V_F = -pb}$

[3] $\circlearrowleft M_A = 0$ $\quad M_A + M_F - \frac{3}{2}pb^2 - 15pb^2 + 2pb^2 + -2pb^2 = 0$

EQUAZIONI AUSILIARIE

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

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

[4] $M_{z(C)}^{①} = 0$ $\quad M_A + H_A b + \frac{3}{2}pb^2 - 5pb^2 = 0$

[5] $M_{z(D)}^{(1+2)} = 0$ $\quad M_A + H_A 2b + \frac{9}{2}pb^2 - 10pb^2 = 0$

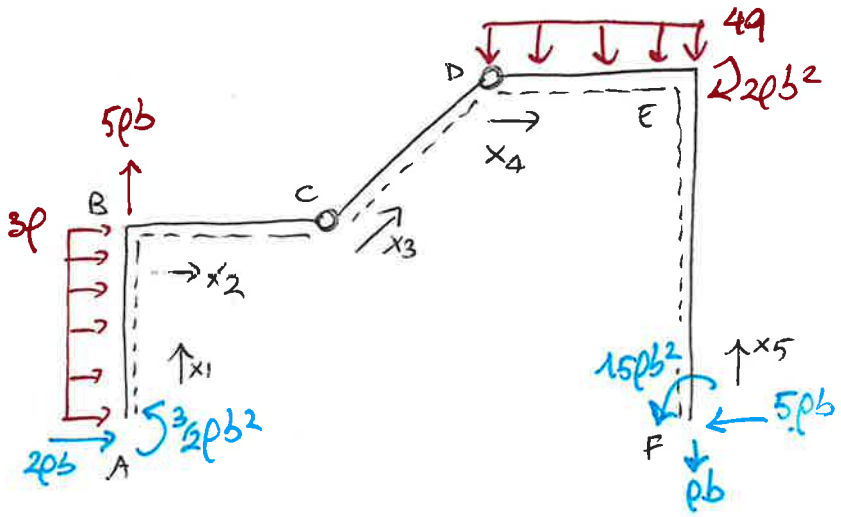
[4] $M_A = -H_A b + \frac{7}{2}\rho b^2$

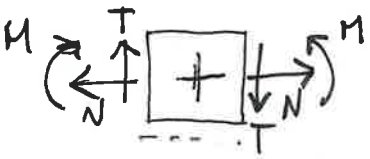
[5] $(-H_A b + \frac{7}{2}\rho b^2) + H_A 2b - \frac{11}{2}\rho b^2 = 0$ $\quad H_A b = 2\rho b^2$ $\quad \boxed{H_A = 2\rho b}$

[4] $M_A = -(2\rho b)b + \frac{7}{2}\rho b^2$ $\quad \boxed{M_A = \frac{3}{2}\rho b^2}$

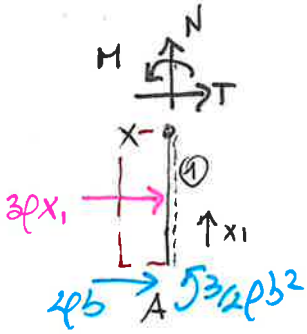
[1] $2\rho b + H_F + 3\rho b = 0$ $\quad \boxed{H_F = -5\rho b}$

[3] $\frac{3}{2}\rho b^2 + M_F - \frac{33}{2}\rho b^2 = 0$ $\quad \boxed{M_F = 15\rho b^2}$





A → B $\quad 0 < x_1 < b$



$\uparrow R_{\parallel} = 0$ $\quad \boxed{N(x_1) = 0}$

$\rightarrow R_{\perp} = 0$ $\quad T(x_1) + 2\rho b + 3\rho x_1 = 0$ $\quad \boxed{T(x_1) = -2\rho b - 3\rho x_1}$

$x_1 = 0 \quad T = -2\rho b$

$x_1 = b \quad T = -5\rho b$

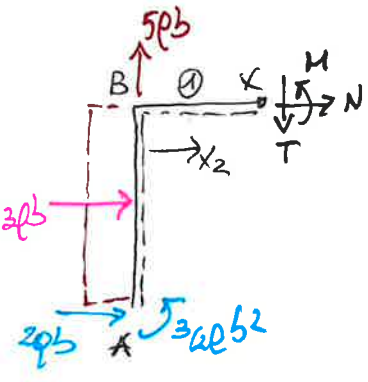
$\curvearrowright M_{z(x)} = 0$ $\quad M(x_1) + \frac{3}{2}\rho b^2 + 2\rho b x_1 + \frac{3}{2}\rho x_1^2 = 0$

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

$x_1 = 0 \quad M = -\frac{3}{2}\rho b^2$

$x_1 = b \quad M = -5\rho b^2$

B → C $\quad 0 < x_2 < b$



$\rightarrow R_{\parallel} = 0$ $\quad N(x_1) + 3\rho b + 2\rho b = 0$ $\quad \boxed{N(x_2) = -5\rho b}$

$\uparrow R_{\perp} = 0$ $\quad -T(x_1) + 5\rho b = 0$ $\quad \boxed{T(x_2) = 5\rho b}$

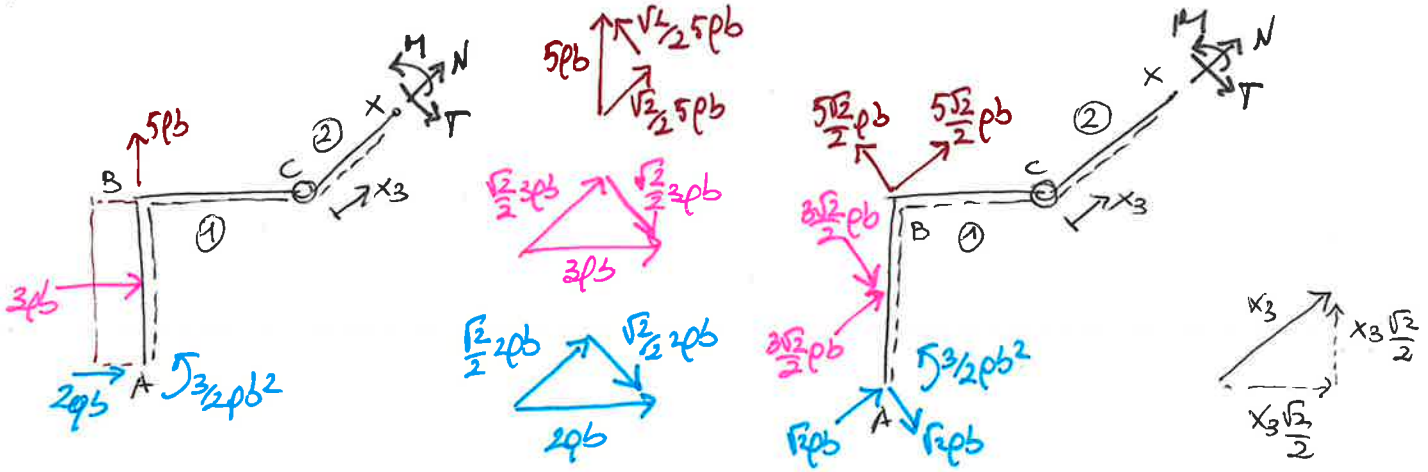
$\curvearrowright M_{z(x)} = 0$ $\quad M(x_1) + \underbrace{\frac{3}{2}\rho b^2 + 2\rho b^2 + \frac{3}{2}\rho b^2}_{+5\rho b^2} - 5\rho b x_2 = 0$

$\boxed{M(x_2) = -5\rho b^2 + 5\rho b x_2}$

$x_2 = 0 \quad M = -5\rho b^2$

$x_2 = b \quad M = 0$

C → D $\quad 0 < x_3 < \sqrt{2}b$



$\nearrow R_{//} = 0 \qquad N(x_3) + \sqrt{2}pb + \frac{3\sqrt{2}}{2}pb + \frac{5\sqrt{2}}{2}pb = 0 \qquad \boxed{N(x_3) = 5\sqrt{2}\,pb}$

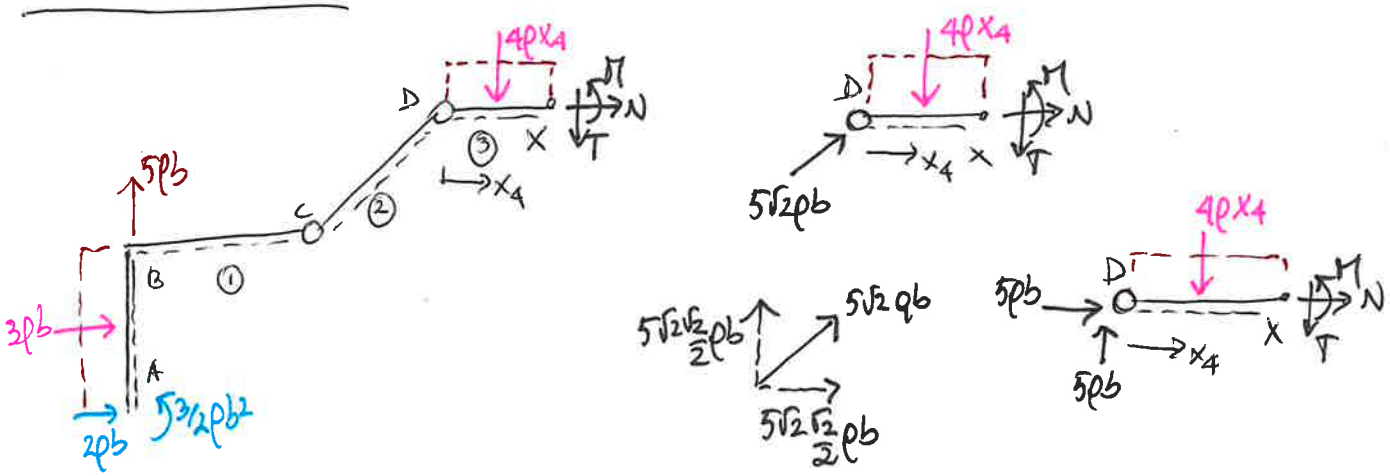
N.B. CD È 1 BIELLA → $T = 0$ E $M = 0$

$\nwarrow R_{\perp} = 0 \qquad -T(x_3) - \sqrt{2}pb - \frac{3\sqrt{2}}{2}pb + \frac{5\sqrt{2}}{2}pb = 0 \qquad \boxed{T(x_3) = 0}$ c.v.d.

$\curvearrowright M_{z(x)} = 0 \qquad M(x_3) + \frac{3}{2}pb^2 + 2pb\left(b + x_3\frac{\sqrt{2}}{2}\right) + 3pb\left(\frac{b}{2} + x_3\frac{\sqrt{2}}{2}\right) - 5pb\left(b + x_3\frac{\sqrt{2}}{2}\right) = 0$

$M(x_3) + \frac{3}{2}pb^2 + 2pb^2 + \sqrt{2}pbx_3 + \frac{3}{2}pb^2 + \frac{3\sqrt{2}}{2}pbx_3 - 5pb^2 - \frac{5\sqrt{2}}{2}pbx_3 = 0 \qquad \boxed{M(x_3) = 0}$ c.v.d.

D → E $\quad 0 < x_4 < b$



$\rightarrow R_{//} = 0 \qquad N(x_4) + 5pb = 0 \qquad \boxed{N(x_4) = -5pb}$

$\uparrow R_{\perp} = 0 \qquad -T(x_4) + 5pb - 4px_4 = 0 \qquad \boxed{T(x_4) = 5pb - 4px_4}$

$x_4 = 0 \quad T = 5pb$

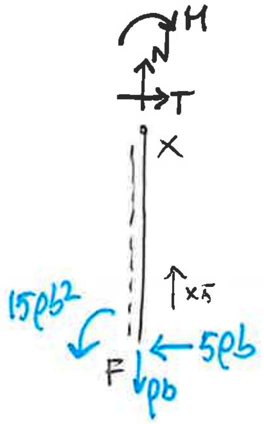
$x_4 = b \quad T = pb$

$\curvearrowright M_{z(x)} = 0 \qquad M(x_4) - 5pbx_4 + 2px_4^2 = 0 \qquad \boxed{M(x_4) = 5pbx_4 - 2px_4^2}$

$x_4 = 0 \quad M = 0$

$x_4 = b \quad M = 3pb^2$

F → E $0 < x_5 < 2b$ (IV)



$\uparrow R_{\parallel} = 0 \qquad N(x_5) - pb = 0 \qquad N(x_5) = pb$

$\rightarrow R_{\perp} = 0 \qquad T(x_5) - 5pb = 0 \qquad T(x_5) = 5pb$

$\circlearrowright M_{f(x)} = 0 \qquad -M(x_5) + 15pb^2 - 5pb\,x_5 = 0$

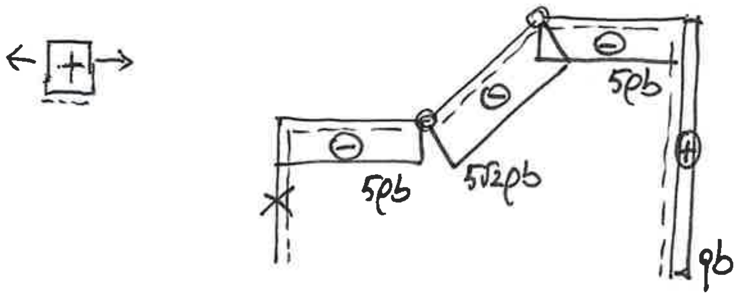
$M(x_5) = 15pb^2 - 5pb\,x_5 \qquad x_5 = 0 \quad M = 15pb^2$

$x_5 = 2b \quad M = 5pb^2$

[N.B. IN E (E) $2pb^2$ CI DEVE ESSERE UN SALTO PARI A $2pb^2$

E INFATTI: D → E $M(E) = 3pb^2$ F → E $M(E) = 5pb^2$]

(N)



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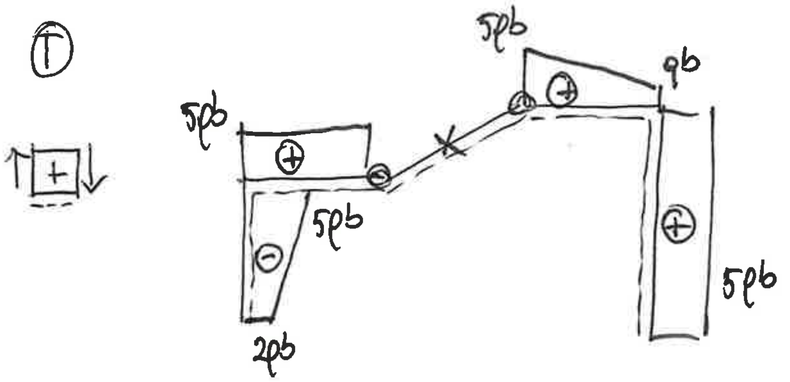

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