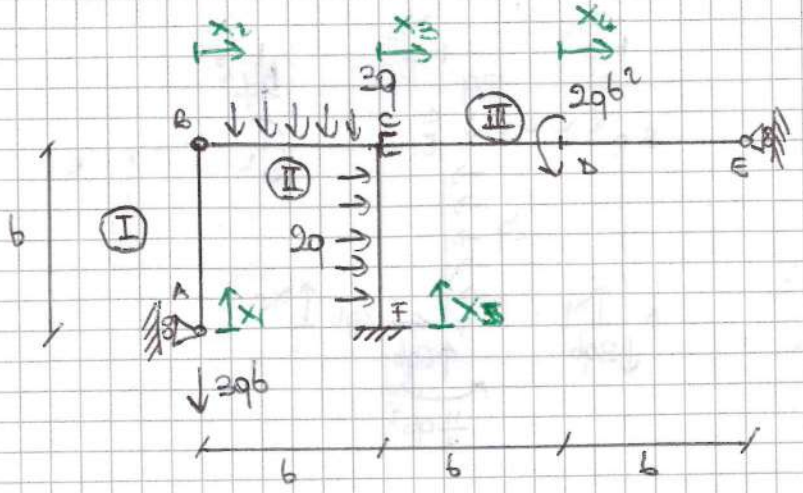
ESERCIZIO 1 _ TRACCIA 2 _ ESAME STATICA 06.06.2013

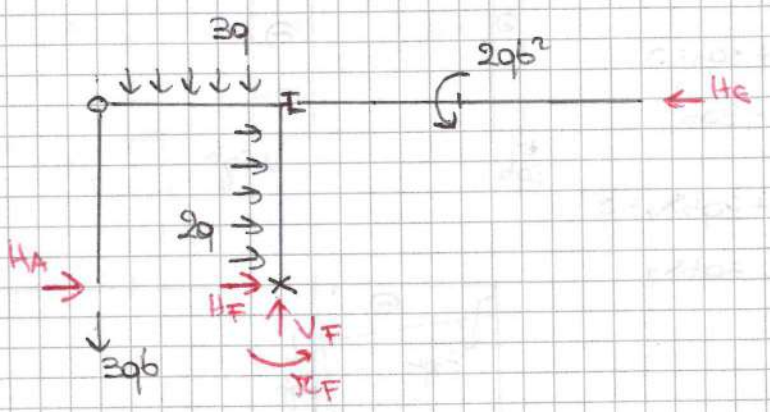


STRUTTURA ISOSTATICA

GDL = 3(I) + 3(II) + 3(III) = 9

GDV = 1(A) + 2(B) + 2(C) + 1(E) + 3(F) = 9

GDL = GDV



$$\begin{cases} R_x = 0 \\ R_y = 0 \\ M_{z(F)} = 0 \end{cases}$$

eq. aux

$$\begin{cases} M_{z(B)}^{(I)} = 0 \\ R_x^{(III)} = 0 \end{cases}$$

$$\begin{cases} H_A + 2qb + H_F - H_E = 0 \Rightarrow H_F = -2qb \\ 3qb + 3qb - V_F = 0 \Rightarrow V_F = 6qb \\ M_F + 3qb^2 + 3qb^2 - 2q\frac{b^2}{2} - 2qb^2 + H_E b = 0 \Rightarrow M_F + 4qb^2 + \frac{3}{2}qb^2 = 0 \quad M_F = -\frac{11}{2}qb^2 \end{cases}$$

eq. aux

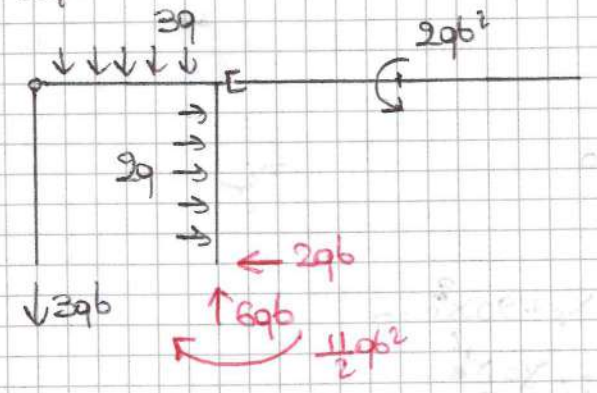
$$\begin{cases} H_A b = 0 \Rightarrow H_A = 0 \\ H_E = 0 \Rightarrow H_E = 0 \end{cases}$$

REAZIONI VINCOLARI

$H_A = 0$ $\quad V_F = 6qb$

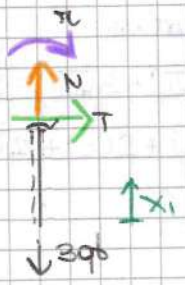
$H_E = 0$ $\quad M_F = -\frac{11}{2}qb^2$

$H_F = -2qb$



AZIONI INTERNE

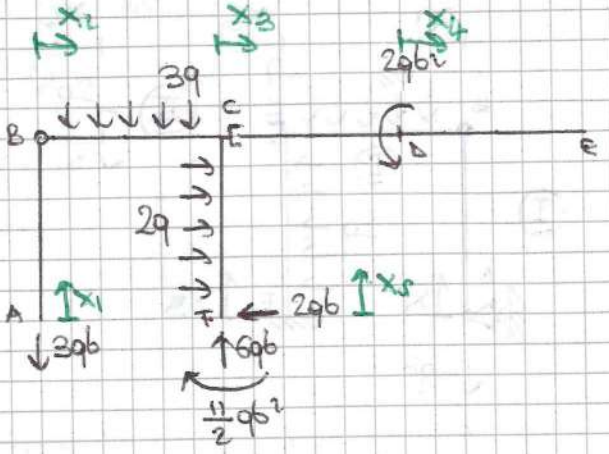
A→B $\quad 0 \le x_1 \le b$



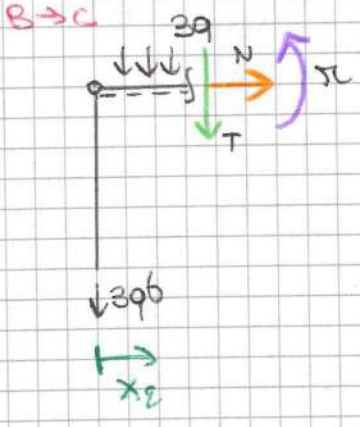
$N(x_1) = 3qb$

$T(x_1) = 0$

$\pi(x_1) = 0$



B→C $\quad 0 \le x_2 \le b$



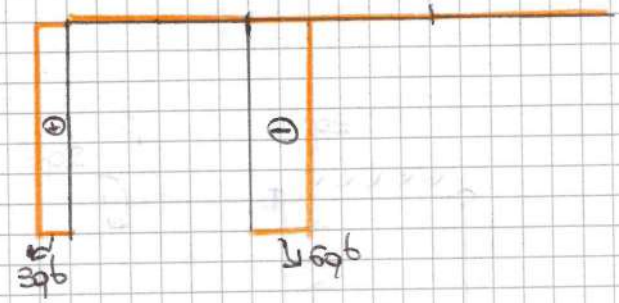
$N(x_2) = 0$

$T(x_2) + 3qx_2 + 3qb = 0$

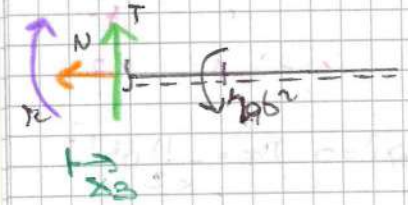
$T(x_2) = -3qx_2 - 3qb$

$\pi(x_2) + 3q\frac{x_2^2}{2} + 3qbx_2 = 0$

$\pi(x_2) = -3q\frac{x_2^2}{2} - 3qbx_2$



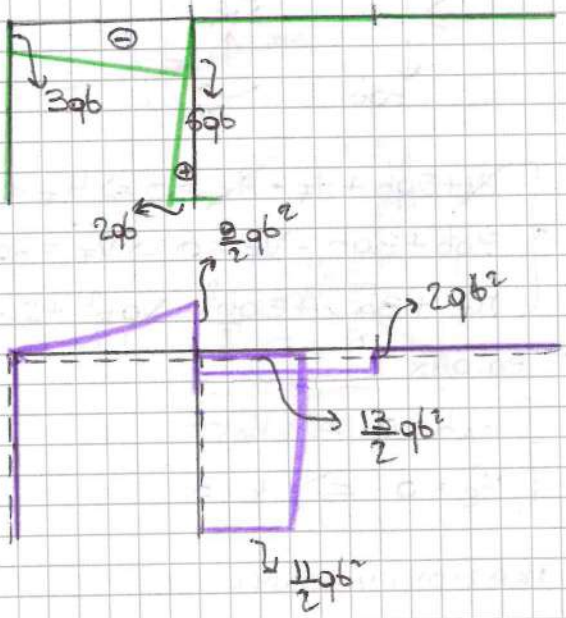
D→C $\quad 0 \le x_3 \le b$



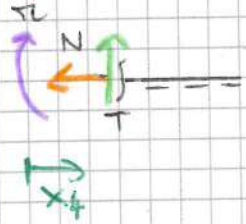
$N(x_3) = 0$

$T(x_3) = 0$

$\pi(x_3) = 2qb^2$



E→D $\quad 0 \le x_4 \le b$

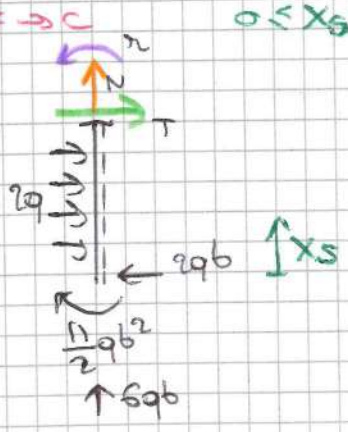


$N(x_4) = 0$

$T(x_4) = 0$

$\pi(x_4) = 0$

F→C $\quad 0 \le x_5 \le b$



$N(x_5) = -6qb$

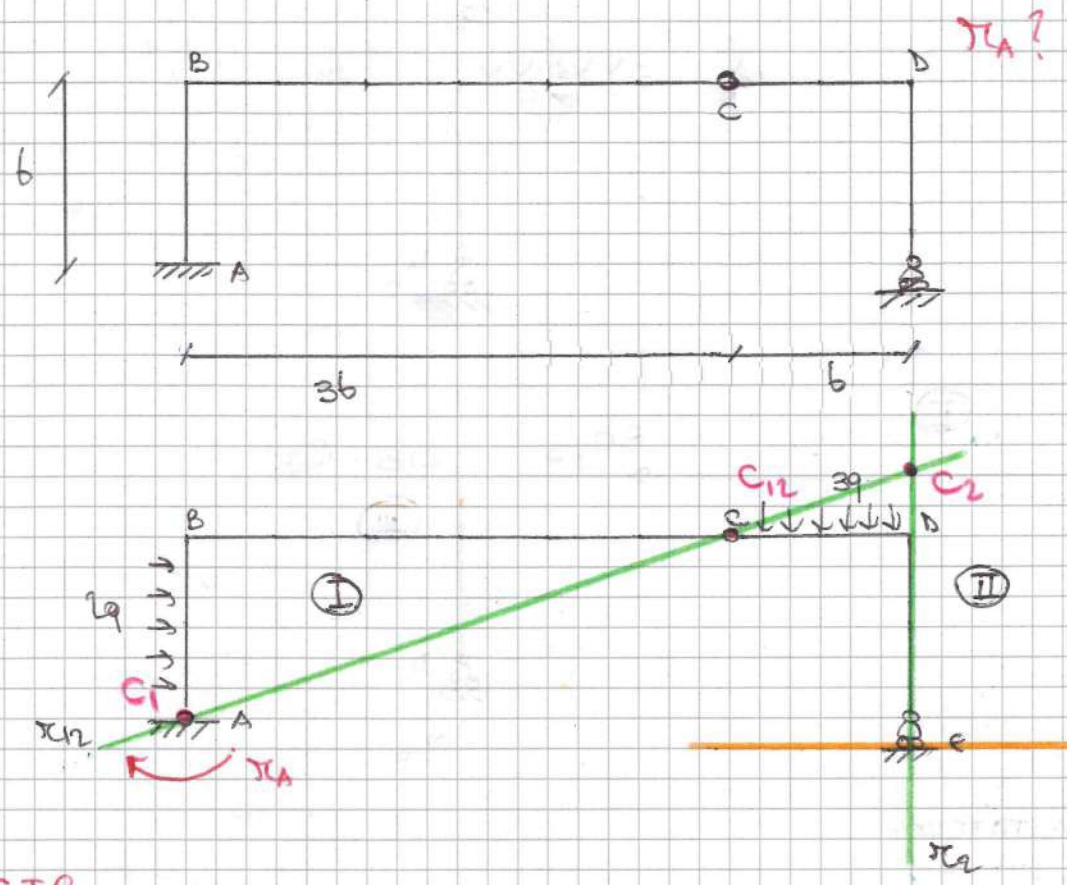
$T(x_5) - 2qb + 2qx_5 = 0$

$T(x_5) = 2qb - 2qx_5$

$\pi(x_5) - \frac{11}{2}qb^2 - 2qbx_5 + 2q\frac{x_5^2}{2} = 0$

$\pi(x_5) = \frac{11}{2}qb^2 + 2qbx_5 - 8q\frac{x_5^2}{8}$

ESERCIZIO 2 - TRACCIA 2 - STATICA 06.06.2023

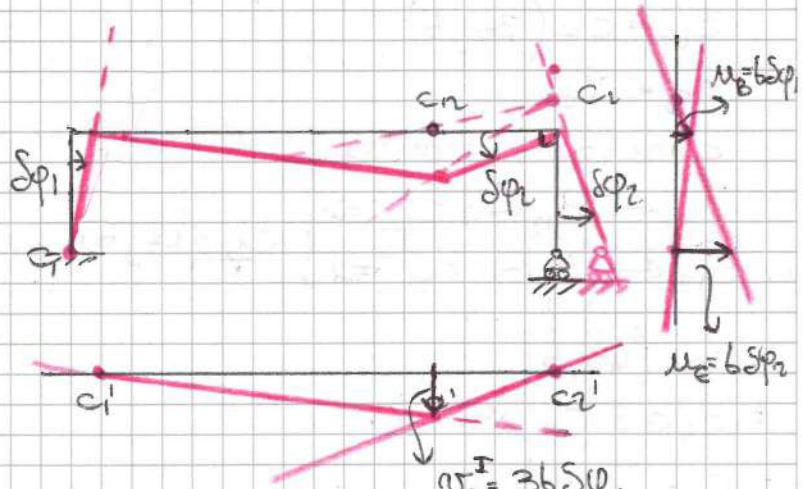


CIR

$C_1 = A = (0;0)$

$C_2 \in r_2$

$C_{12} = C = (3b; b)$



CONDIZIONE CINEMATICA

$C_1 \leftrightarrow C_{12} \leftrightarrow C_2 \Rightarrow C_2 \in r_{12}$

$C_2 = \left(4b; \frac{4}{3}b\right)$

$v_C^I = 3b\delta\varphi_1$

$v_C^{II} = b\delta\varphi_2$

$v_C^I = v_C^{II} \Rightarrow \delta\varphi_2 = 3\delta\varphi$

PLV

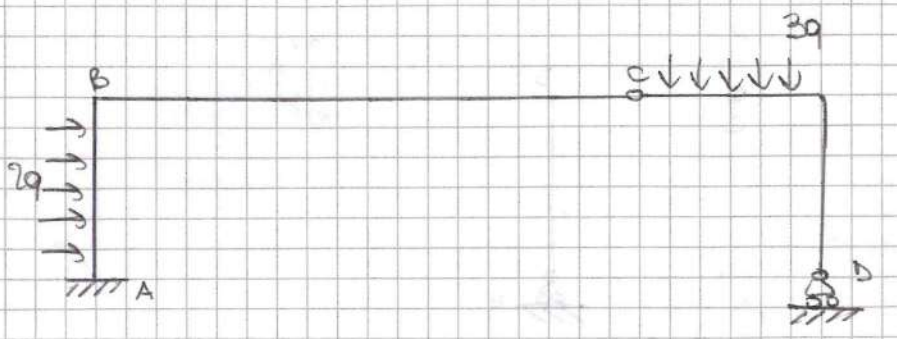
$r_A\delta\varphi_1 + 2q(b)\left(\frac{b}{2}\delta\varphi_1\right) + 3q(b)\left(\frac{b}{2}\delta\varphi_2\right) = 0$

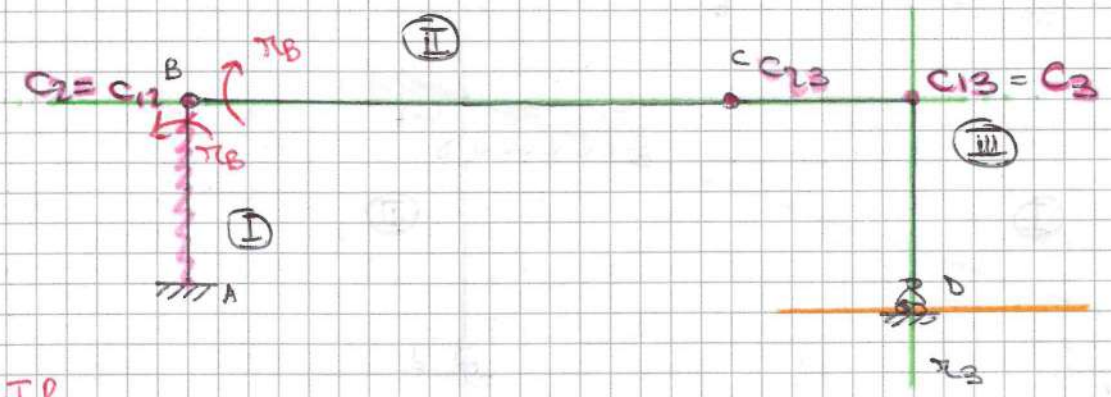
$r_A\delta\varphi_1 + qb^2\delta\varphi_1 + \frac{3}{2}qb^2(3\delta\varphi_1) = 0$

$r_A + qb^2 + \frac{9}{2}qb^2 = 0 \quad r_A = -\frac{11}{2}qb^2$

$v_B = b\delta\varphi_1 \quad v_C = -3b\delta\varphi_1$

$r_B = ?$





CIR

C_1 ✗ ⇒ L'ASTA I RESTA FERMA

$C_{12} = B = (0; b)$

$C_{23} = C = (3b; b)$

$C_3 \in r_3$

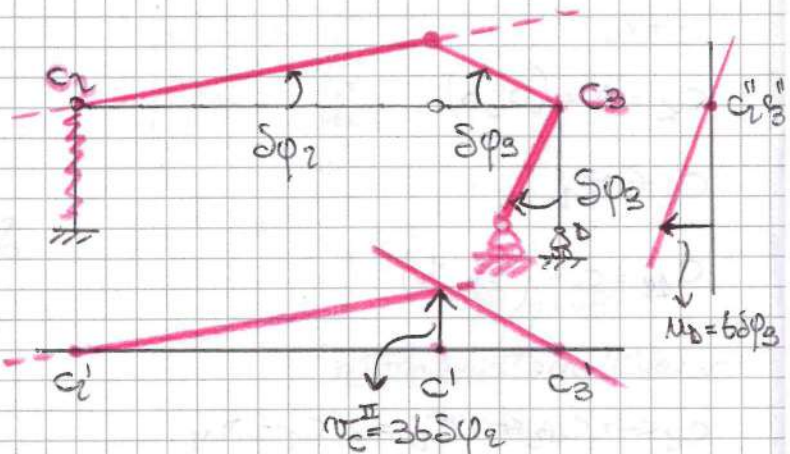
CONDIZIONI CINEMATICHE

$C_{13} \leftrightarrow C_{12} \leftrightarrow C_{23} \Rightarrow$
$C_{13} \leftrightarrow C_1 \leftrightarrow C_3 \Rightarrow$ $\Big\}$ $C_{13}(4b; b)$

$C_3 = (4b; b)$

$C_2 \leftrightarrow C_{23} \leftrightarrow C_3$

$C_2 = (0; b)$



$v_C^{II} = 3b\delta\varphi_2$

$v_C^{III} = b\delta\varphi_3$

$v_C^{II} = v_C^{III}$ $3b\delta\varphi_2 = b\delta\varphi_3$ $\delta\varphi_2 = \frac{1}{3}\delta\varphi_3$

P.L.V

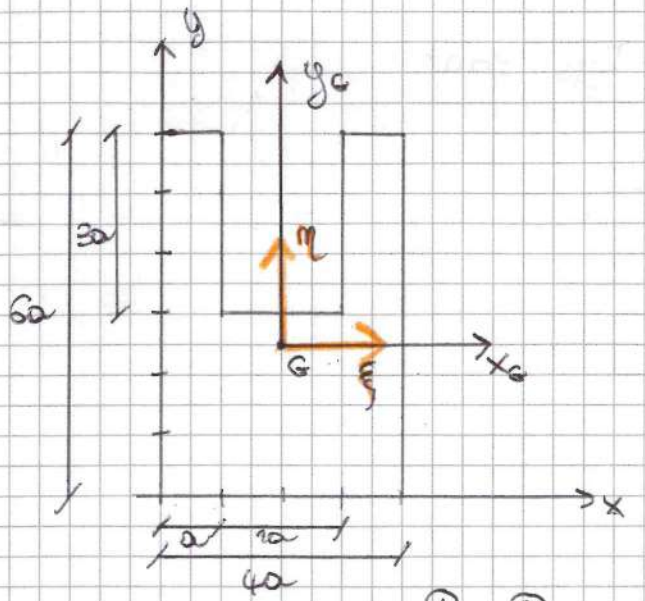
$-r_B \delta\varphi_2 - 3q(b)\left(\frac{b}{2}\delta\varphi_3\right) = 0$

$-r_B \frac{1}{3}\delta\varphi_3 - \frac{3}{2}qb^2\delta\varphi_3 = 0$

$r_B = -\frac{9}{2}qb^2$

$v_D = -b\delta\varphi_3$ $v_C = 3b\delta\varphi_2$

ESERCIZIO 3 - TRACCIA 2 - ESAME STATICA 06.05.2023



$A_{TOT} = 18a^2$

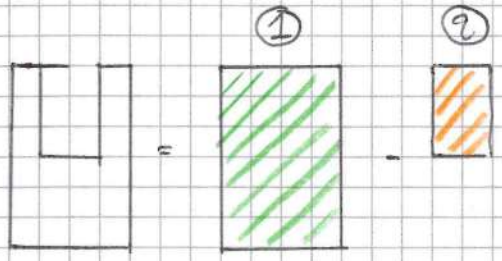
$S_x = 45a^3$

$S_y = 36a^3$

$J_{x_G} = \frac{99}{2}a^4 = 49{,}5\,a^4$

$J_{y_G} = 30a^4$

$S_x = A y_G \Rightarrow S_x = S_x^{①} - S_x^{②}$



$A_1 = 4a \cdot 6a = 24a^2$

$A_2 = 2a \cdot 3a = 6a^2$

$G_1 = (2a;\ 3a)$

$G_2 = (2a;\ \frac{9}{2}a)$

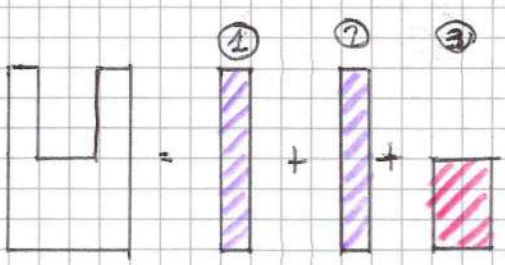
$S_x = A_1 y_{G_1} - A_2 y_{G_2} = 24a^2(3a) - 6a^2(\frac{9}{2}a)$

$= 72a^3 - 27a^3 = 45a^3$

$S_y = A x_G \Rightarrow S_y = S_y^{①} - S_y^{②}$

$S_y = 24a^2(2a) - 6a^2(2a) = 48a^3 - 12a^3 = 36a^3$

$x_G = \frac{S_y}{A} = \frac{36a^3}{18a^2} = 2a \qquad y_G = \frac{S_x}{A} = \frac{45a^3}{18a^2} = 2{,}5\,a$



$J_x = J_x^{①} + J_x^{②} + J_x^{③} = \frac{2b_1h_1^3}{3} + \frac{b_2h_2^3}{3} = 2\left(\frac{a(6a)^3}{3}\right) + \frac{2a(3a)^3}{3} = \frac{432a^4}{3} + \frac{54}{3}a^4 =$

$= \frac{486}{3}a^4 = 162a^4$

$J_{x_G} = J_x - A y_G^2 = 162a^4 - 18a^2(5/2\,a)^2 = 162a^4 - \frac{25}{2}(9)a^4 = \left(162 - \frac{225}{2}\right)a^4 = \frac{99}{2}a^4$

$J_{y_G} = J_{y_{G_1}} - J_{y_{G_2}} = \frac{h_1b_1^3}{12} - \frac{h_2b_2^3}{12} = \frac{6a(4a)^3}{12\cdot 2} - \frac{3a(2a)^3}{12\cdot 4} = \frac{64}{2}a^4 - \frac{8}{4}a^4 = \frac{128-8}{4}a^4 =$

$= \frac{120}{4}a^4 = 30a^4$

$J_{x_G y_G} = 0$

$$tg2\vartheta = \frac{-2J_{xy}}{J_x - J_y} = 0 \qquad tg2\vartheta = 0 \Rightarrow J_x > J_y \Rightarrow \vartheta = 0$$

$$J_\xi = J_{max} = J_x = 49{,}5a^4 \qquad J_\eta = J_{min} = J_y = 30a^4.$$