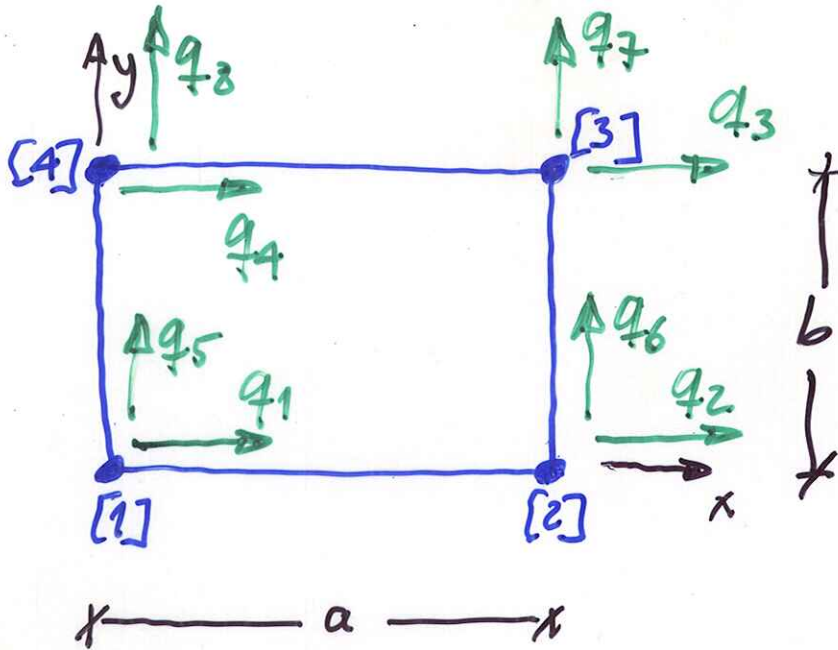


ELEMENTO RECTANGULAR (4 NÓS)



$$u_x(x, y) = \psi_1(x, y) q_1 + \psi_2(x, y) q_2 + \psi_3(x, y) q_3 + \psi_4(x, y) q_4$$

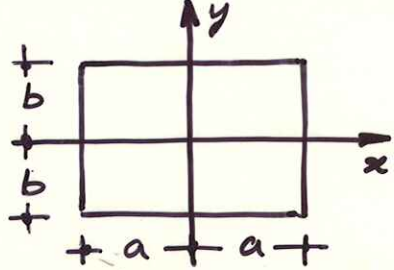
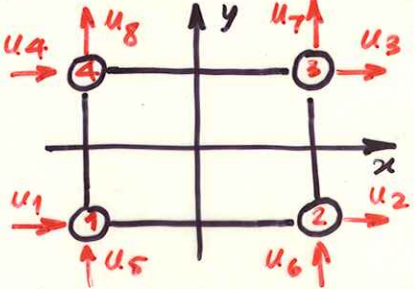
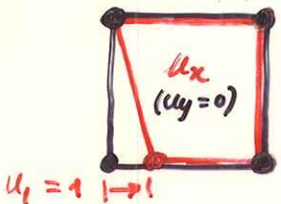
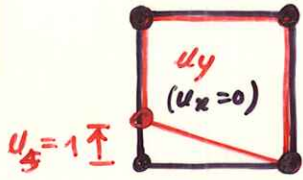
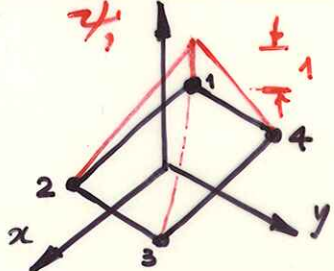
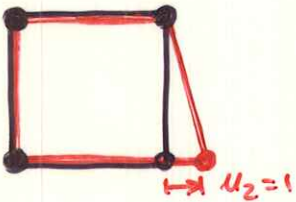
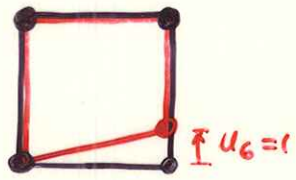
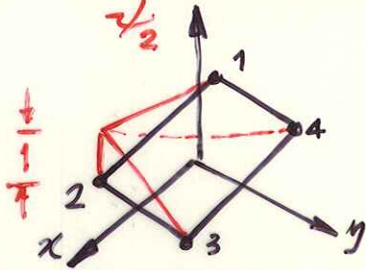
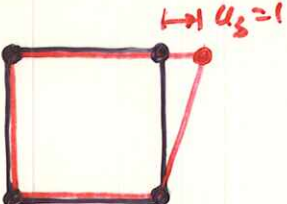
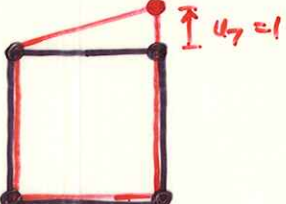
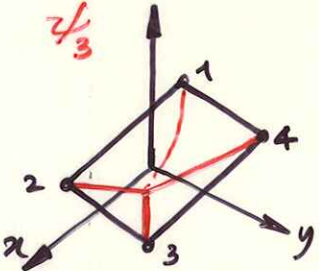
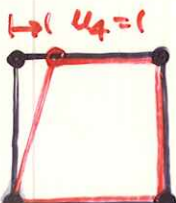

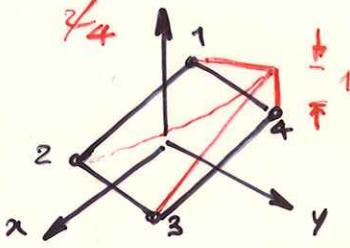
$$u_y(x, y) = \psi_1(x, y) q_5 + \psi_2(x, y) q_6 + \psi_3(x, y) q_7 + \psi_4(x, y) q_8$$

$$\psi_1(x, y) = \left(1 - \frac{x}{a}\right) \left(1 - \frac{y}{b}\right)$$

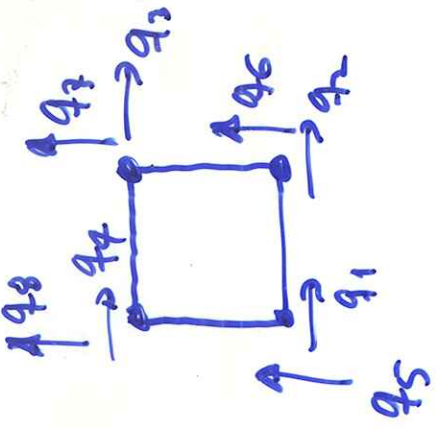
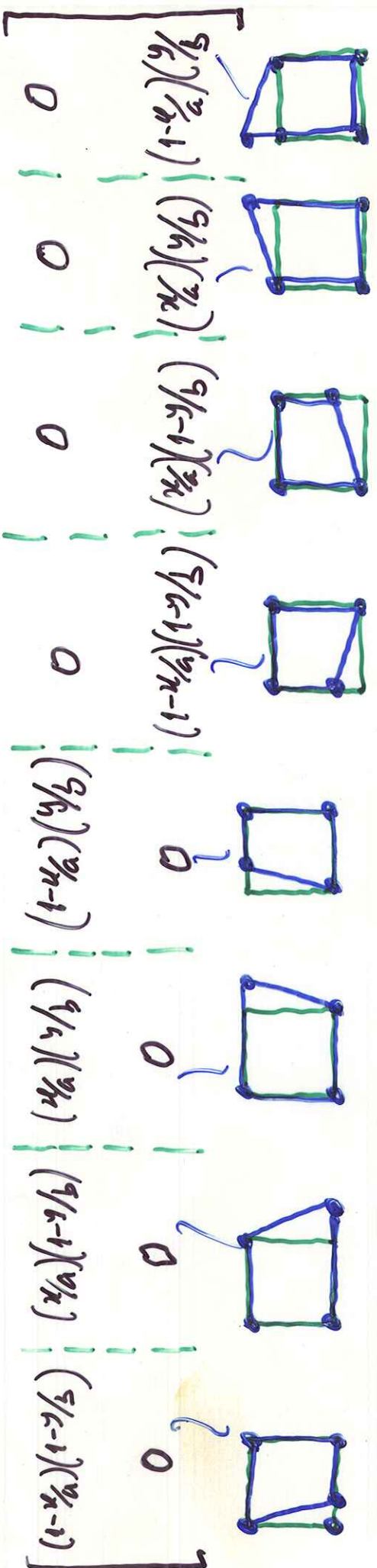
$$\psi_2(x, y) = \left(\frac{x}{a}\right) \left(1 - \frac{y}{b}\right)$$

$$\psi_3(x, y) = \left(\frac{x}{a}\right) \left(\frac{y}{b}\right)$$

$$\psi_4(x, y) = \left(1 - \frac{x}{a}\right) \left(\frac{y}{b}\right)$$

ELEMENTO Q4	$u_x = \sum_{i=1}^4 \psi_i \cdot u_i$	$u_y = \sum_{i=1}^4 \psi_i \cdot u_{i+4}$
1 $x \quad y$ $x^2 \quad xy \quad y^2$	$u - \text{BILINEAR } (xy)$ $\Sigma_5 - \text{LINEAR}$	
$\psi_1 = \frac{1}{4}(1-x/a)(1-y/b)$	$\psi_2 = \frac{1}{4}(1+x/a)(1-y/b)$	
$\psi_3 = \frac{1}{4}(1+x/a)(1+y/b)$	$\psi_4 = \frac{1}{4}(1-x/a)(1+y/b)$	
		
		
		
		

ψ_i VARIA LINEARMENTE NOS BORDOS (T3 E Q4)

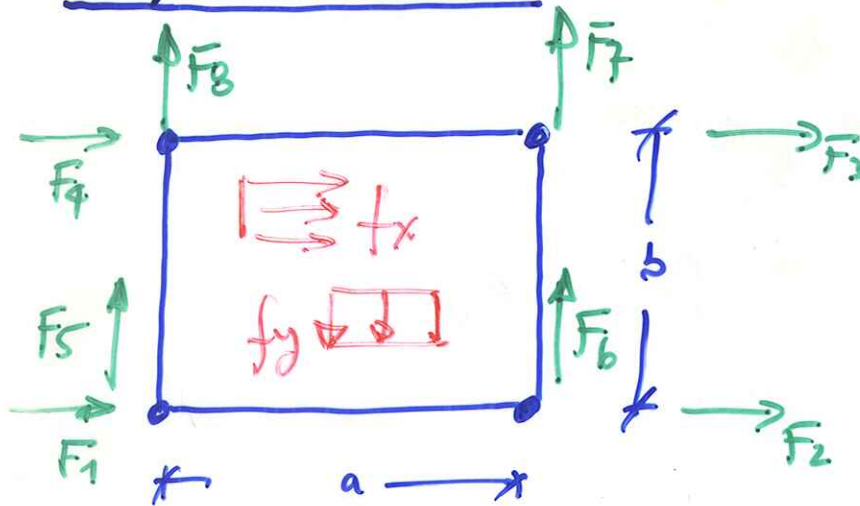


$$\begin{bmatrix} q_8 \\ \vdots \\ q_1 \end{bmatrix}$$

$$\begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix} = \begin{bmatrix} \psi_1 & \psi_2 & \psi_3 & \psi_4 & 0 & 0 & 0 & \psi_4 \\ 0 & 0 & 0 & 0 & \psi_1 & \psi_2 & \psi_3 & \psi_4 \end{bmatrix}$$

[A]

FORÇAS DE MASSA



$$\begin{bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \\ \hline F_5 \\ F_6 \\ F_7 \\ F_8 \end{bmatrix} = \int_0^a \int_0^b \begin{bmatrix} \psi_1(x,y) f_x(x,y) \\ \psi_2(x,y) f_x(x,y) \\ \psi_3(x,y) f_x(x,y) \\ \psi_4(x,y) f_x(x,y) \\ \hline \psi_1(x,y) f_y(x,y) \\ \psi_2(x,y) f_y(x,y) \\ \psi_3(x,y) f_y(x,y) \\ \psi_4(x,y) f_y(x,y) \end{bmatrix} dy dx$$

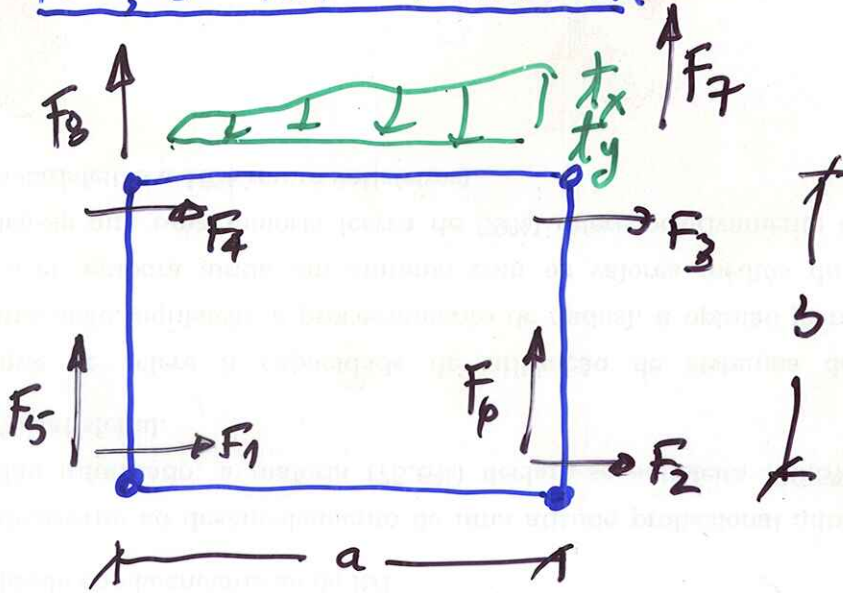
CASO PARTICULAR:

$$f_x \equiv \text{const.}$$

$$f_y \equiv \text{const.}$$

$$\begin{bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \\ \hline F_5 \\ F_6 \\ F_7 \\ F_8 \end{bmatrix} = \begin{bmatrix} f_x ab/4 \\ f_x ab/4 \\ f_x ab/4 \\ f_x ab/4 \\ \hline f_y ab/4 \\ f_y ab/4 \\ f_y ab/4 \\ f_y ab/4 \end{bmatrix}$$

FORÇAS NA FRONTEIRA



$$\begin{bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \\ F_5 \\ F_6 \\ F_7 \\ F_8 \end{bmatrix} = \int_0^a \begin{bmatrix} \bar{\Psi}_1(x,b) t_x \\ \bar{\Psi}_2(x,b) t_x \\ \bar{\Psi}_3(x,b) t_x \\ \bar{\Psi}_4(x,b) t_x \\ \bar{\Psi}_1(x,b) t_y \\ \bar{\Psi}_2(x,b) t_y \\ \bar{\Psi}_3(x,b) t_y \\ \bar{\Psi}_4(x,b) t_y \end{bmatrix} dx$$

CASO PARTICULAR

