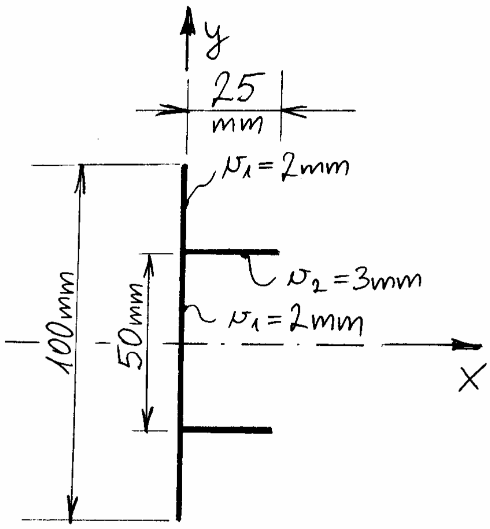
Vázszerkezetek PÓT ZH 2008. 05. 16.

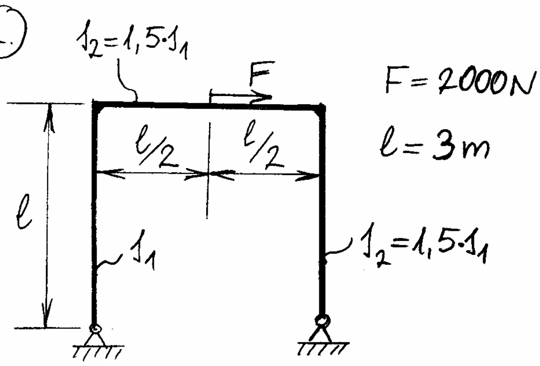
(1.)



a, Határozza meg a vázolt keresztmetszet nyírási középpontjának helyét az xy koordinátarendszerben!

b, Rajzolja fel a keresztmetszet ω^* cikkterület függvényét és tüntesse fel a jellemző értékeket!

(2.)

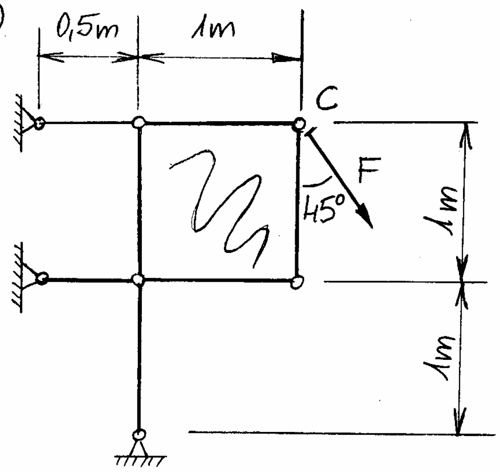


$F = 2000N$

$\ell = 3m$

Határozza meg a tartó hajlító nyomatéki igénybevételi ábráját erőmódszerrel!
A jellegzetes értékeket tüntesse fel!

(3.)

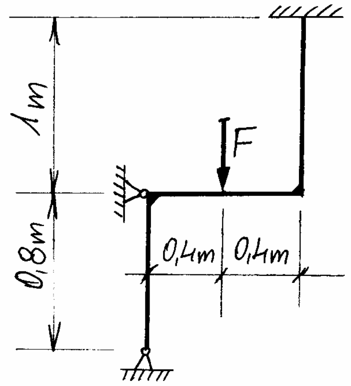


$A = 10\ mm^2$ $E = 210GPa$ $F = 7071N$

$v = 0{,}8\ mm$ $G = 80GPa$

Számítsa ki a „C" pont vízszintes elmozdulását!

(4.)



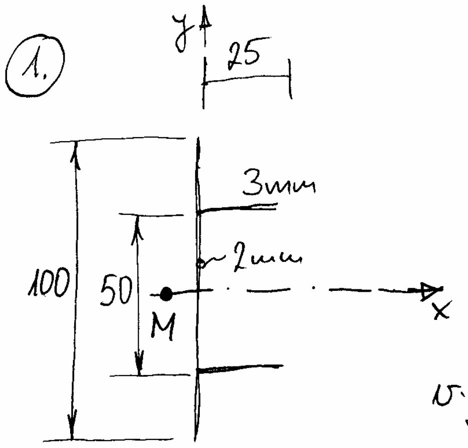
$IE = áll.$

$AE = \infty$

$F = 3kN$

Mozgásmódszerrel határozza meg a tartó hajlítónyomatéki igénybevételi ábráját! Tüntesse fel a jellemző értékeket!

1.



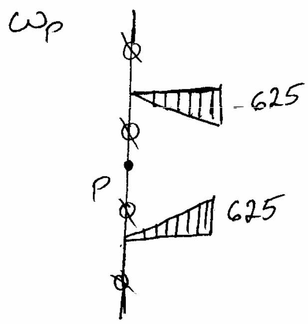
$$\xi_M = \frac{1}{I_x}\int \omega_p \cdot y \cdot v \, du$$

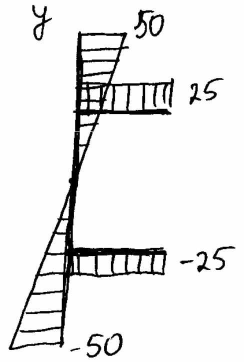
$$I_x = 2\cdot 100\cdot\left(0^2+\frac{100^2}{12}\right)+2\cdot\left[3\cdot 25\cdot\left(25^2+\frac{0^2}{12}\right)\right] =$$

$$= 166\,666{,}67 + 93\,750 = 260\,416{,}67 \ mm^4$$

$$v\int \omega_p \cdot y \, du = \left[3\cdot -\frac{625\cdot 25}{2}\cdot 25\right]\cdot 2 = -1\,171\,875 \ mm^5$$

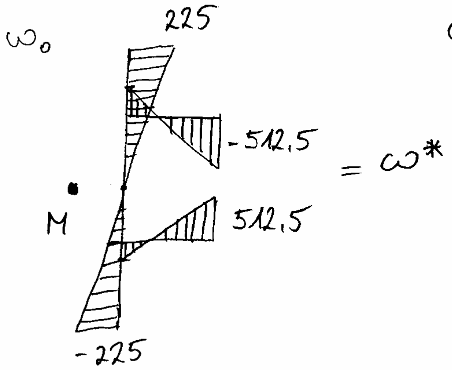
$$\xi_M = -\frac{1\,171\,875}{260\,416{,}67} = -4{,}5 \ mm$$





$M(-4{,}5\ ;\ 0)$

$$G = \int \omega_p \cdot v \, du = 0$$



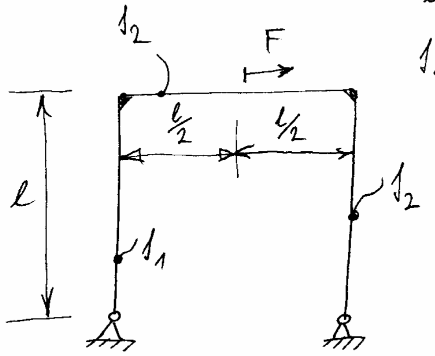
$$\omega^* = \omega_0 - \frac{G}{A} = \omega_0$$

2.

$F = 2000\,N$

$l = 3\,m$

$I_2 = 1{,}5\, I_1$



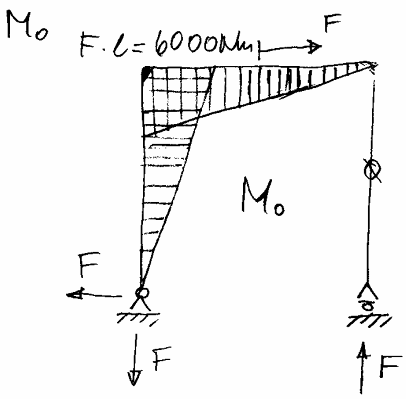
$$\delta_{11} = \int \frac{m_1 \cdot m_1}{IE}\,du = \frac{1}{I_1E}\cdot\frac{l^2}{2}\cdot\frac{2}{3}l + \frac{1}{I_2E}\,l^3 + \frac{1}{I_2E}\,\frac{l^2}{2}\cdot\frac{2}{3}l =$$

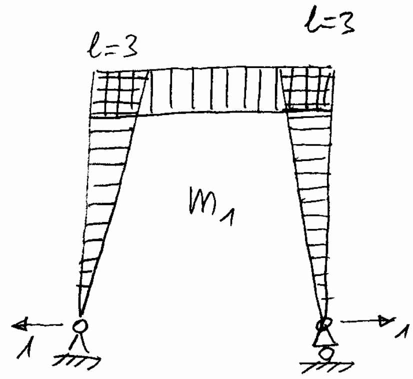
$$= \frac{1}{I_1E}\left[\frac{l^3}{3} + \frac{2}{3}l^3 + \frac{2l^3}{9}\right] = \frac{11}{9}l^3$$

$$\delta_{10} = \int \frac{M_0 \cdot m_1}{IE}\,du = \frac{1}{I_1E}\left[\frac{Fl^2}{2}\cdot\frac{2}{3}\cdot l\right] + \frac{1}{I_2E}\left[\frac{Fl^2}{2}\cdot l\right] =$$

$$= \frac{1}{I_1E}\left[\frac{Fl^3}{3} + \frac{Fl^3}{3}\right] =$$

$$= \frac{1}{I_1E}\cdot\frac{2Fl^3}{3}$$

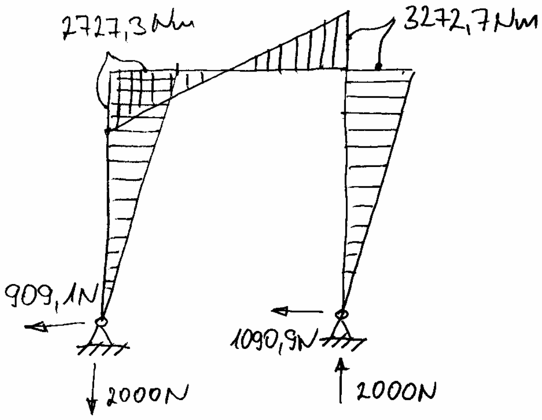




$$\delta_{10} + x_1 \cdot \delta_{11} = 0$$

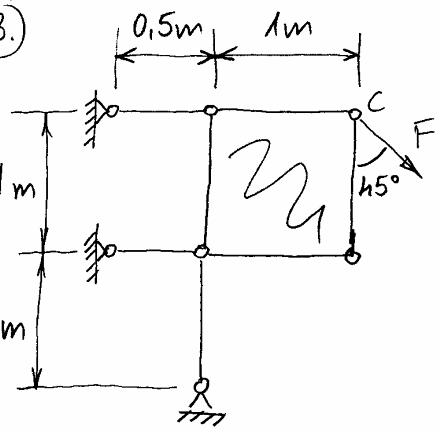
$$x_1 = -\frac{\delta_{10}}{\delta_{11}} = \frac{-2Fl^3 \cdot 9}{3 \cdot 11 \cdot l^3} =$$

$$= \frac{-6}{11}\cdot F = -1090{,}91\,N$$



$$M = M_0 + x_1 \cdot m_1$$

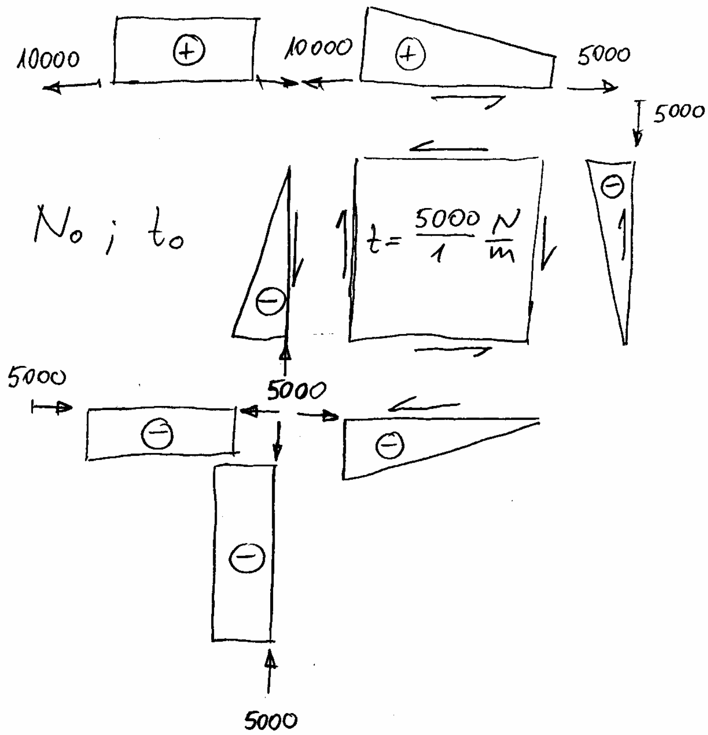
3.



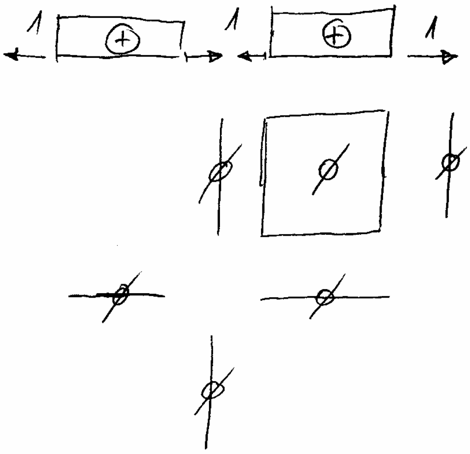
$A = 10\ mm^2 \quad E = 210\,GPa \quad F = 7071\,N$

$\nu = 0{,}8\,mm \quad G = 80\,GPa$

N_0 ; t_0



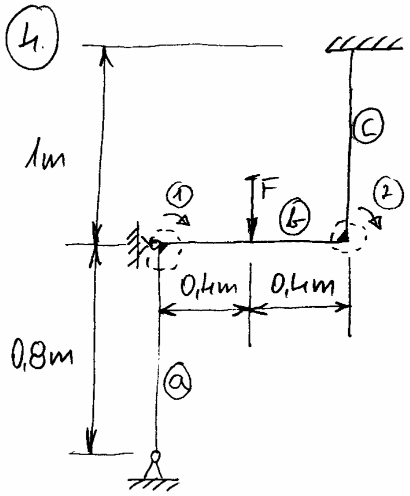
n_1, t_1



$$x_C = \int \frac{N_0 \cdot n_1}{AE}\,dx + \int \frac{t_0 \cdot t_1}{\nu \cdot G} \cdot dA =$$

$$= \frac{1}{AE}\left[10000 \cdot 0{,}5 \cdot 1 + \frac{1}{6}\left(10000 + 4 \cdot 7500 + 5000\right)\right] + \frac{1}{\nu \cdot G} \cdot 0 \cdot 1^2 =$$

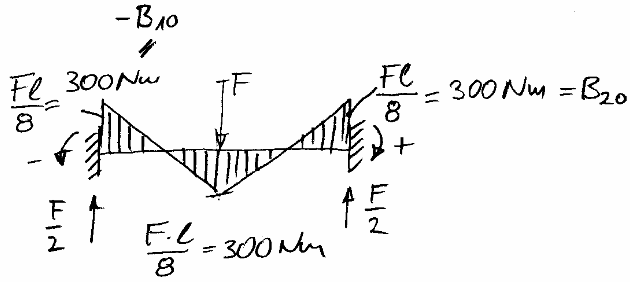
$$= \frac{12500}{AE} = \frac{12500}{10 \cdot 10^{-6} \cdot 2{,}1 \cdot 10^{11}} = 0{,}005952\,m = \underline{\underline{5{,}952\,mm}}$$

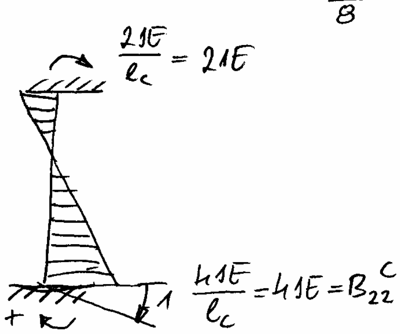


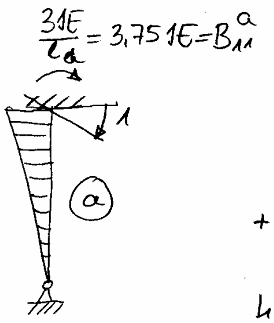
$1E = \text{áll.}$

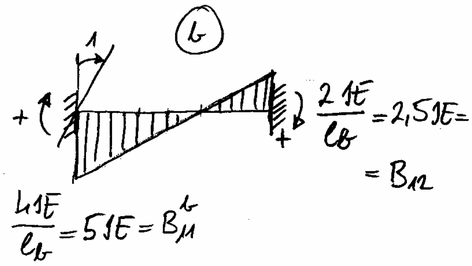
$AE = \infty$

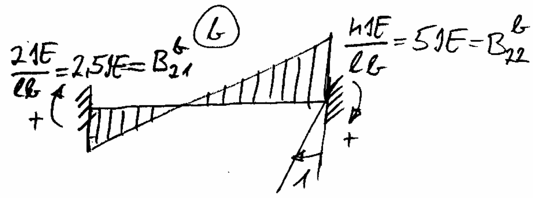
$F = 3\,kN$











$B_{10} = -300\,Nm$

$B_{20} = 300\,Nm$

$B_{11} = B_{11}^{a} + B_{11}^{b} = 3{,}75\,IE + 5IE = 8{,}75\,IE$

$B_{21} = 2{,}5\,IE$

$B_{12} = 2{,}5\,IE$

$B_{22} = B_{22}^{b} + B_{22}^{c} =$

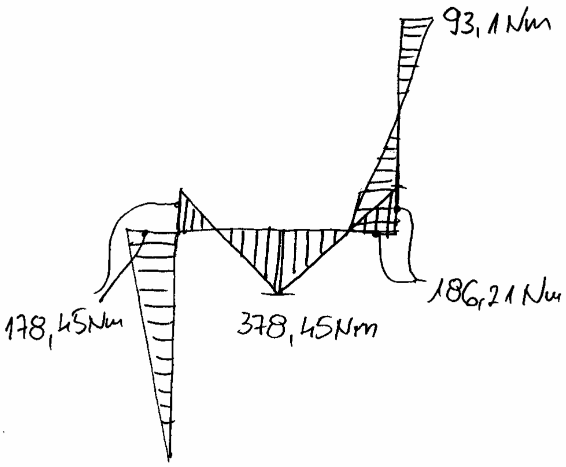
$= 5IE + 4IE = 9IE$

$$8{,}75\,IE \cdot \varphi_1 + 2{,}5\,IE \cdot \varphi_2 = 300$$

$$2{,}5\,IE \cdot \varphi_1 + 9IE \cdot \varphi_2 = -300$$

$$\varphi_1 = \frac{47{,}586}{IE}$$

$$\varphi_2 = \frac{-46{,}552}{IE}$$



$$M = M_0 + \varphi_1 \cdot m_1 + \varphi_2 \cdot m_2$$