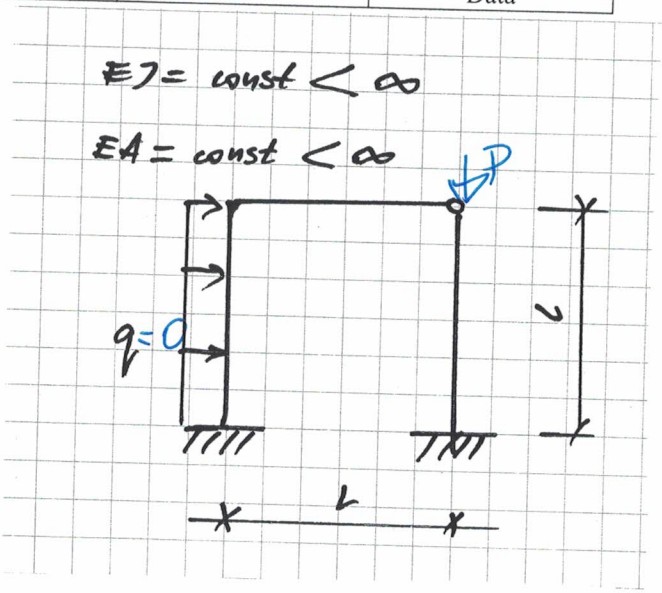
Egzamin pisemny z Mechaniki Konstrukcji I, 8 II 2023 r.

NAZWISKO imię				
Grupa	Data zaliczenia ćwiczeń		Numer albumu	
Ocena zadania 1	Ocena zadania 2	Ocena zadania 3	Ocena z egzaminu	Ocena łączna Data

Zadanie 1

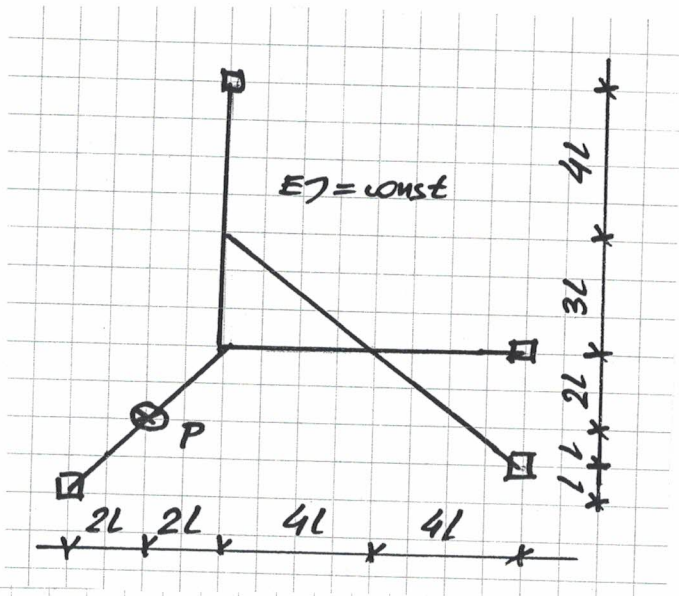
Dana jest rama płaska obciążona jak na rysunku; zapisać układ równań macierzowej metody przemieszczeń.
(For the given frame write down the equations of the displacement method in its matrix version)



Zadanie 2

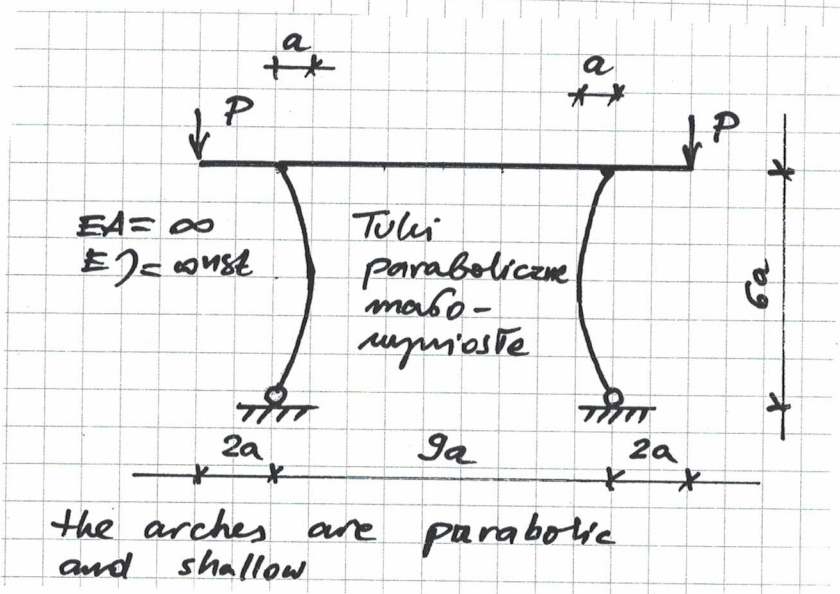
Dany jest ruszt przegubowy, obciążony jak na rysunku. Sporządzić wykres momentów zginających.

(There is given a system of beams, loaded as shown in the figure. Find the diagram of the bending moments).

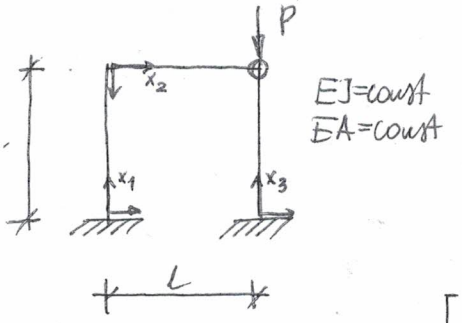


Zadanie 3.

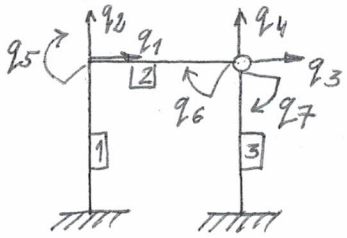
Znaleźć rozkład momentów zginających w danym ramołuku *(Find the diagram of the bending moments in a given archframe).*



Egzamin nr 1 — 8.I.2015 — zadanie 1



EJ=const
EA=const



$$q = \begin{bmatrix} q_1 \\ q_2 \\ \vdots \\ q_7 \end{bmatrix}$$

$$\Delta = \mathbb{B} q \qquad \mathbb{B} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

$$^*\chi = {}^*\mathbb{B} q \qquad {}^*\mathbb{B} = \begin{bmatrix} -\frac{1}{l} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{l} & 0 & \frac{1}{l} & 1 & 0 & 0 \\ 0 & 0 & -\frac{1}{l} & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\chi^* = \mathbb{B}^* q \qquad \mathbb{B}^* = \begin{bmatrix} -\frac{1}{l} & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & -\frac{1}{l} & 0 & \frac{1}{l} & 0 & 1 & 0 \\ 0 & 0 & -\frac{1}{l} & 0 & 0 & 0 & 1 \end{bmatrix}$$

$$N = \mathbb{E} \Delta \qquad \mathbb{E} = \begin{bmatrix} \frac{EA}{l} & 0 & 0 \\ 0 & \frac{EA}{l} & 0 \\ 0 & 0 & \frac{EA}{l} \end{bmatrix}$$

$$^*\phi = \mathbb{D}(2\,{}^*\chi + \chi^*)$$

$$\phi^* = \mathbb{D}({}^*\chi + 2\chi^*)$$

$$\mathbb{D} = \begin{bmatrix} \frac{2EJ}{l} & 0 & 0 \\ 0 & \frac{2EJ}{l} & 0 \\ 0 & 0 & \frac{2EJ}{l} \end{bmatrix}$$

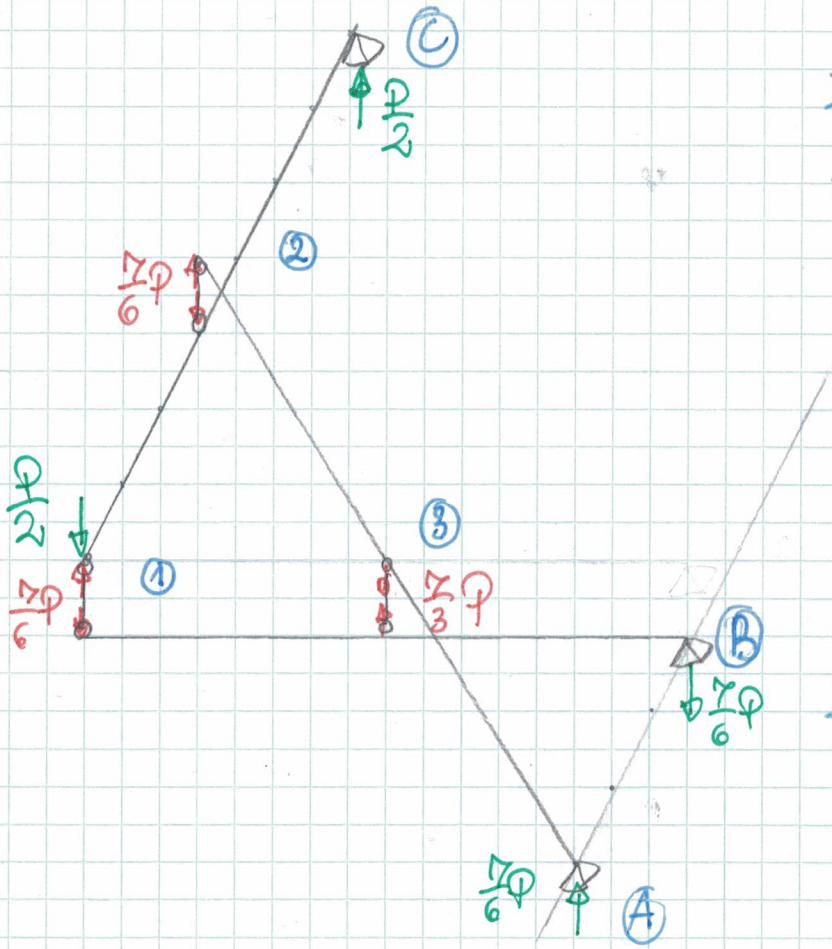
$$Q = \begin{bmatrix} 0 \\ 0 \\ 0 \\ -P \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\mathbb{K} q = Q$$

$$\mathbb{K} = \mathbb{B}^T \mathbb{E} \mathbb{B} + 2({}^*\mathbb{B})^T \mathbb{D}\, {}^*\mathbb{B} + ({}^*\mathbb{B})^T \mathbb{D} \mathbb{B}^* + (\mathbb{B}^*)^T \mathbb{D}\, {}^*\mathbb{B} + 2(\mathbb{B}^*)^T \mathbb{D} \mathbb{B}^*$$

Opracował Jan Perczyński

Egzamin MK1 8 II 2023 ZADANIE 2.



$\sum M^{A-B} = 0$

$\frac{P}{2} \cdot 8l - R_C \cdot 8l = 0$

$R_C = \frac{P}{2}$

$\sum M^{②} = 0$

$\frac{P}{2} \cdot 4l + \frac{P}{2} \cdot 3l - R_1 \cdot 3l = 0$

$R_1 = \frac{7}{6} P$

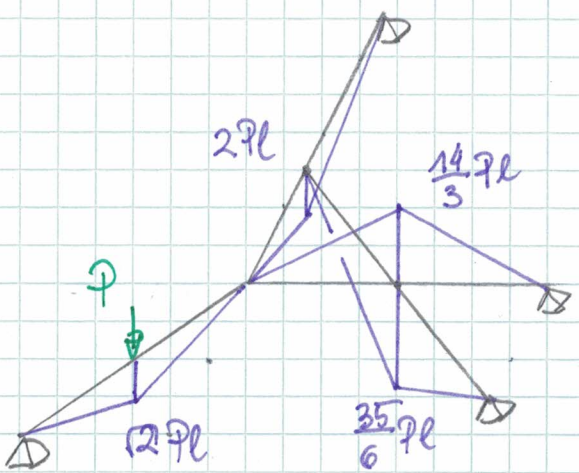
$\sum F_2 = 0$ - belka ① - C

$R_2 = -\frac{7}{6} P$

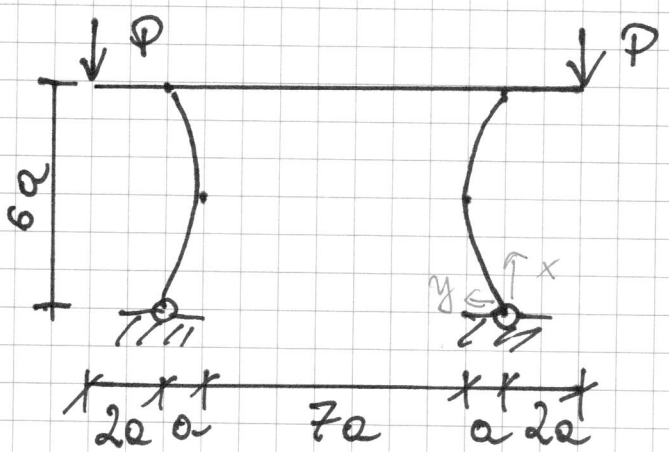
$\sum M^{1-B} = 0$ $\quad \frac{P}{2} \cdot 7l - R_4 \cdot 3l = 0$ $\quad R_4 = \frac{7}{6} P$

$\sum F_x = 0$ $\quad R_B = -\frac{7}{6} P$

$\sum F_2 = 0$ - belka ② - ③ $\quad R_3 = -\frac{7}{3} P$



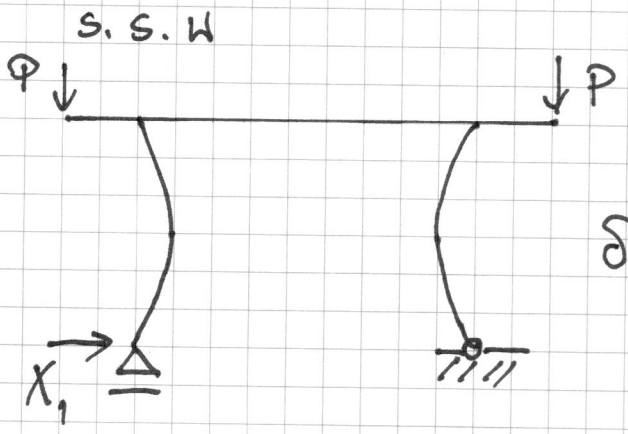
ZAD. 3. MK1 08.02.2023r. - szkic rozwiązania



$$y(x) = \frac{4a}{36a^2} \cdot x \cdot (6a - x) = \frac{x}{9a}(6a - x)$$

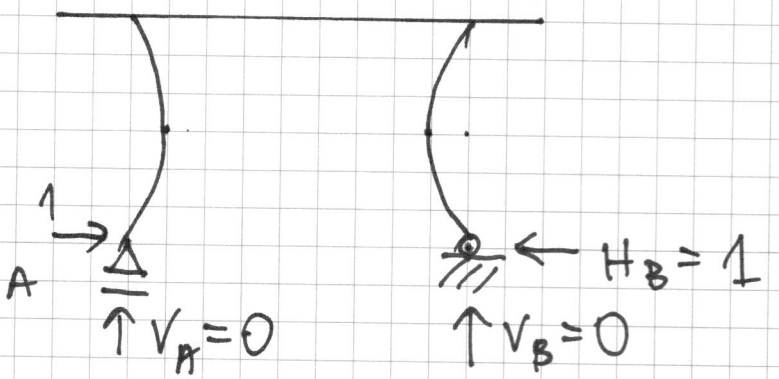
$$y(\xi) = 4a\,\xi\,(1 - \xi)$$

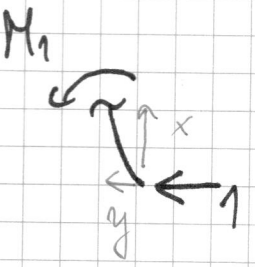
$$\xi = \frac{x}{6a}$$



$$\delta_{11} X_1 + \delta_{10} = 0$$

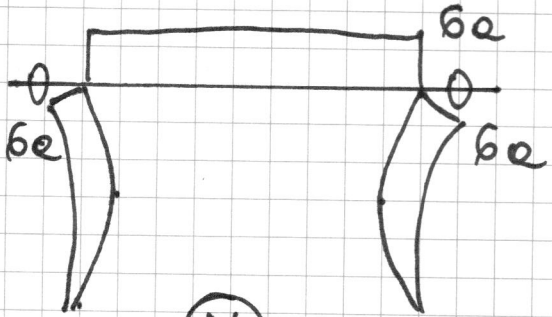
Stan $X_1 = 1$





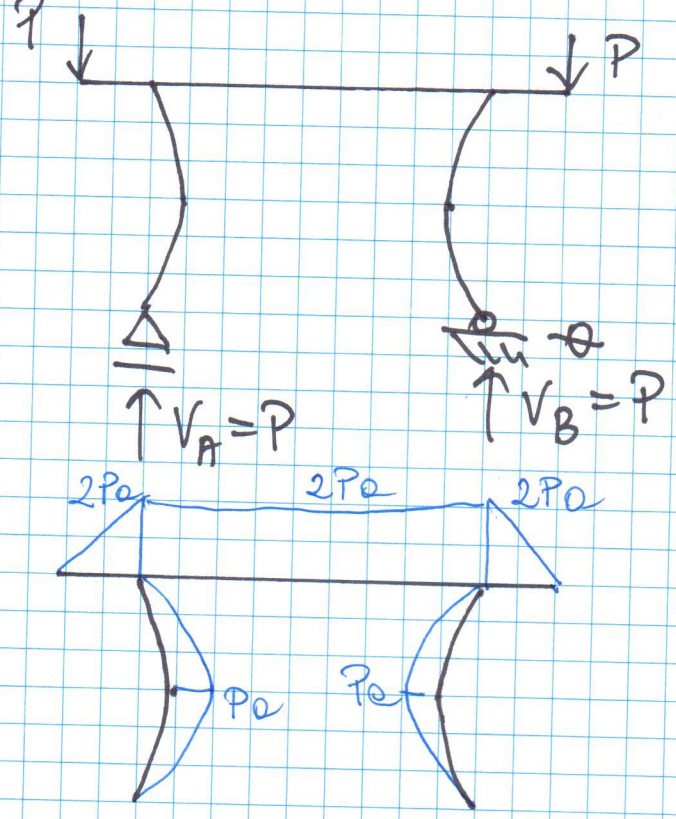
$x \in \langle 0, 6a \rangle$

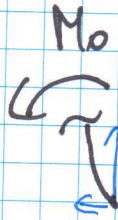
$M_1(x) = 1 \cdot x$



M_1

Stem „0"





$$M_0(x) = -P \cdot y = -P\frac{x}{3a}(6a - x)$$

M_0

$$\delta_{11} = \int \frac{M_1^2}{EJ}\,ds = \frac{1}{EJ}\left\{6a \cdot 3a \cdot 6a + 2\int_0^{6a} (x)^2\,dx\right\} =$$

$$= 468\,\frac{a^3}{EJ}$$

$$\delta_{10} = \int \frac{M_1 M_0}{EJ}\,dx = \frac{1}{EJ}\left\{6a \cdot 3a \cdot 2Pa + 2\int_0^{6a} x\left[-\frac{Px}{3a}(6a - x)\right]dx\right\} =$$

$$= 84\,\frac{Pa^3}{EJ}$$

$$X_1 = -\frac{\delta_{10}}{\delta_{11}} = -0{,}179\,P$$

$$M = M_1 \cdot X_1 + M_0$$