

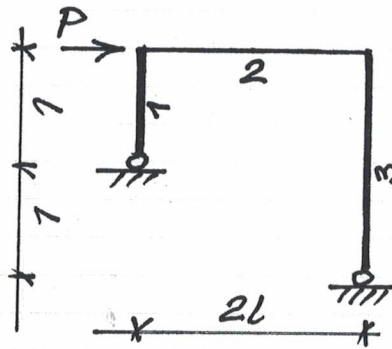
Egzamin pisemny z Mechaniki Konstrukcji I, 2 IX 2025 r.

NAZWISKO Imię				
Prowadzący ćwiczenia, nr grupy, nr indeksu				
ocena zadania 1	ocena zadania 2	ocena zadania 3	ocena egz. pis.	Ocena ostateczna z egzaminu
				Ocena łączna

Zadanie 1.

Znaleźć (metodą sił)
rozkład
momentów
zginających
w danej ramie.

(Construct
(by the force method)
the diagram
of the
bending moments
in the given frame)



$$\frac{EI}{L^2 EA} = \frac{5}{100}$$

$$EA_1 = \infty, EI_1 = 3EI$$

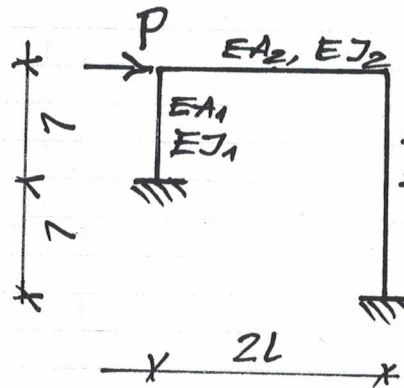
$$EA_2 = EA, EI_2 = EI$$

$$EA_3 = \infty, EI_3 = 3EI$$

Zadanie 2.

Zapisać układ równań
macierzowej
metody przemieszczeń

(Write down the system
of equations
of the displacement method
in the matrix version.)



$$EA_i < \infty$$

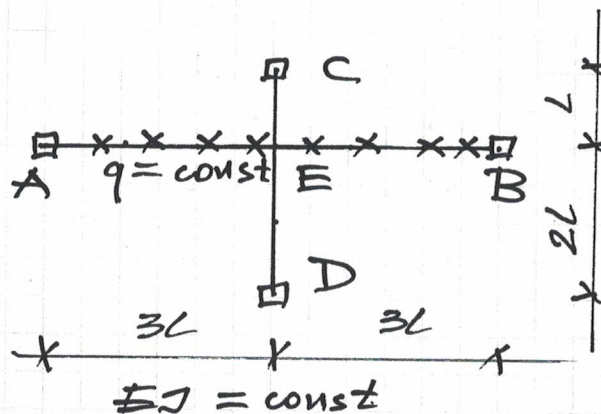
$$EI_i < \infty$$

$$i = 1, 2, 3$$

Zadanie 3

Dany jest
ruszt przegubowy,
znaleźć wykres
funkcji określającej
ugięcie belki AB.

(Given is system
of beams;
construct
the plot of the
deflection function
of the beam AB)

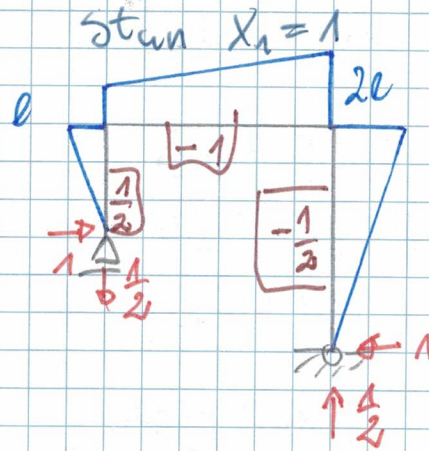
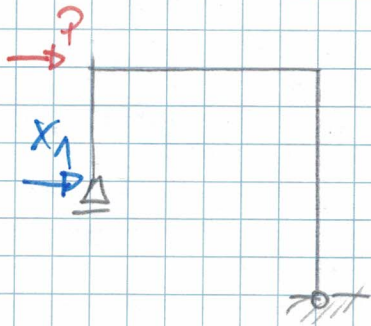


ZADANIE 1

USW

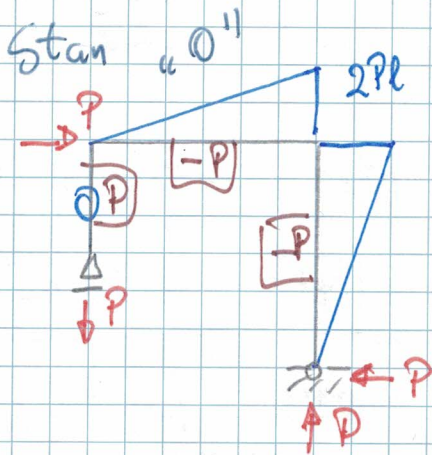
n-wic 2godnaci

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



M_1

N_1

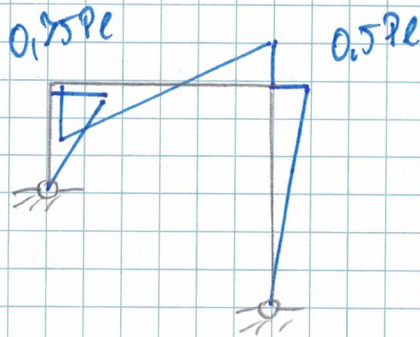


$$\delta_{11} = \frac{173}{80} \frac{l^3}{EI}$$

$$\delta_{10} = \frac{389}{90} \frac{Pl^3}{EI}$$

$$X_1 = -\frac{\delta_{10}}{\delta_{11}} = -0.75P$$

M



ZADANIE 2

Wektor niewiadomych

$$q = [q_1 \ q_2 \ q_3 \ q_4 \ \psi_1 \ \psi_2]^T$$

Wydłużenia prętów

$$\Delta_1 = q_2$$

$$\Delta_2 = q_3 - q_1$$

$$\Delta_3 = q_4$$

Kąty obrotu cięcin

$$\psi_1 = \frac{q_1}{l}$$

$$\psi_2 = \frac{-q_4 + q_3}{2l}$$

$$\psi_3 = \frac{q_3}{2l}$$

lewe i prawe kąty obrotu

$$\chi_1 = -\psi_1$$

$$\chi_1^* = \psi_1 - \psi_1$$

$$\chi_2 = \psi_1 - \psi_2$$

$$\chi_2^* = \psi_2 - \psi_2$$

$$\chi_3 = -\psi_3$$

$$\chi_3^* = \psi_2 - \psi_3$$

Macierze geometryczne

$$B = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

$$B^* = \begin{bmatrix} -\frac{1}{2l} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{2l} & 0 & \frac{1}{2l} & 1 & 0 \\ 0 & 0 & -\frac{1}{2l} & 0 & 0 & 0 \end{bmatrix}$$

$$B^* = \begin{bmatrix} \frac{1}{2l} & 0 & 0 & 0 & 1 & 0 \\ 0 & -\frac{1}{2l} & 0 & \frac{1}{2l} & 0 & 1 \\ 0 & 0 & -\frac{1}{2l} & 0 & 0 & 1 \end{bmatrix}$$

Macierze konstytutywne

$$E = \begin{bmatrix} \frac{EA_1}{l} & 0 & 0 \\ 0 & \frac{EA_2}{2l} & 0 \\ 0 & 0 & \frac{EA_3}{2l} \end{bmatrix}$$

$$D = \begin{bmatrix} \frac{2EA_1}{l} & 0 & 0 \\ 0 & \frac{2EA_2}{2l} & 0 \\ 0 & 0 & \frac{2EA_3}{2l} \end{bmatrix}$$

Wektor obs. wartości $Q = [P \ 0 \ 0 \ 0 \ 0 \ 0]^T$

Mac. symetryczna

$$K = B^T E B + 2 \beta^T D \beta + \beta^T D \beta^* + (\beta^*)^T D \beta + 2 (\beta^*)^T D \beta^*$$

Wzrost $n-n'$ $K \alpha = Q$