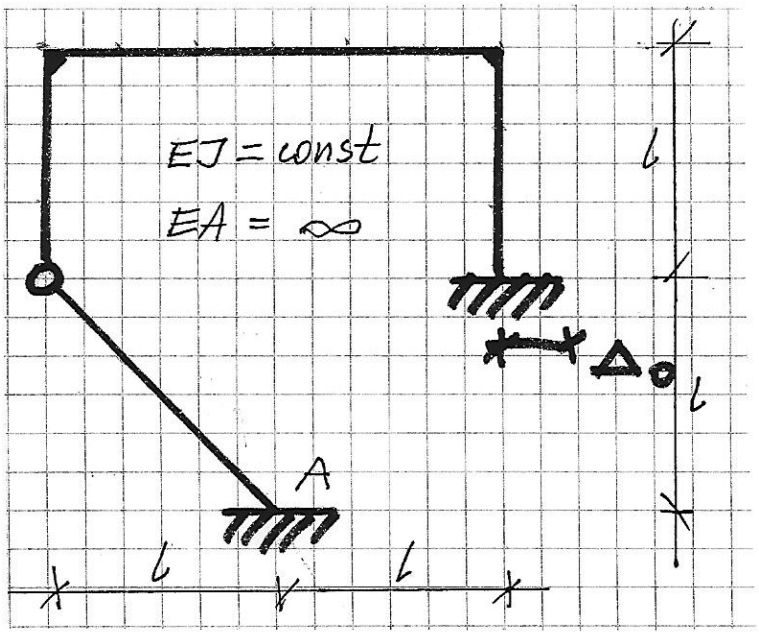
Egzamin pisemny z Mechaniki Konstrukcji I, 8 IX 2016 r.

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

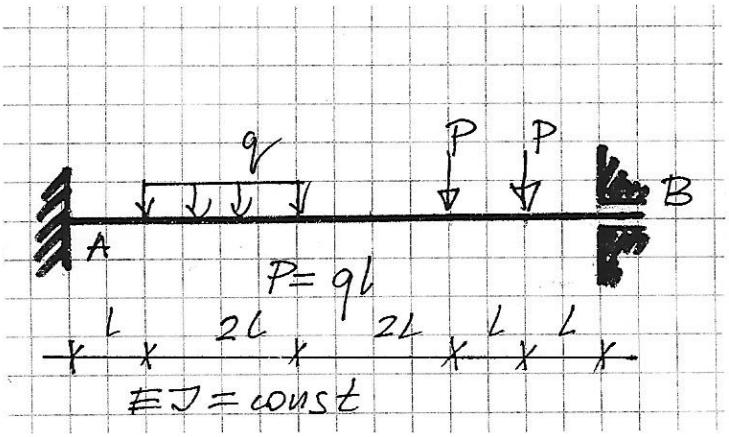
Zadanie 1

Dana jest rama płaska obciążona kinematycznie, por. rys. Znaleźć M_A metodą sił.
(*The plane frame, cf. the figure, is subject to the given kinematic load. Compute M_A by the force method)*



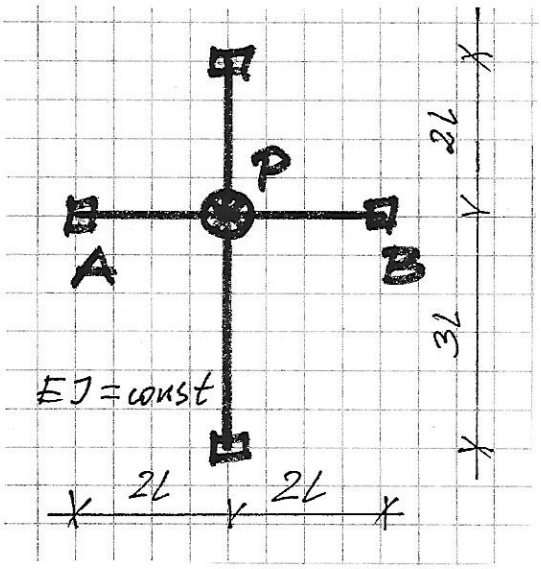
Zadanie 2

Dana jest belka obustronnie utwierdzona, obciążona jak na rysunku. Znaleźć M_A korzystając z twierdzenia Bettiego.
(*The beam is clamped at both the ends and loaded as in the figure. Compute M_A by using Betti's theorem)*



Zadanie 3

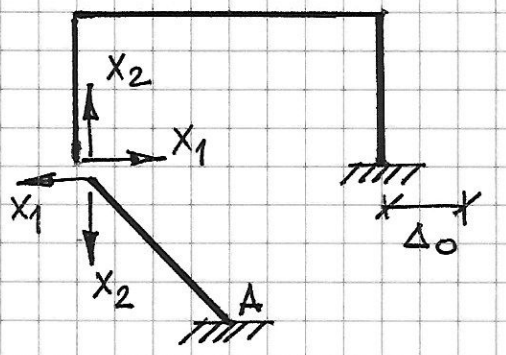
Dany jest ruszt przegubowy. Znaleźć funkcję opisującą ugięcie belki AB.
(Consider the given system of beams. Find the function describing the deflection of the beam AB)



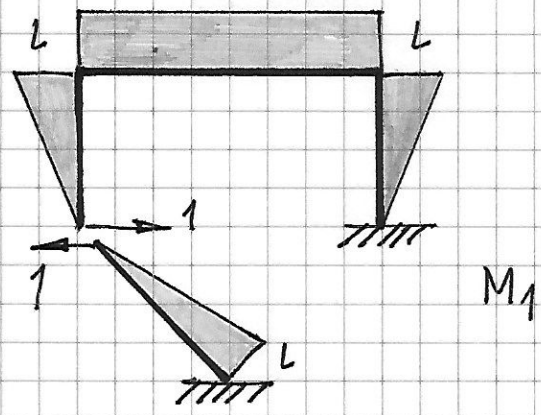
Egzamin z MK 1, 8.09.2016, zadanie 1

Exam on MoS 1, problem 1

Schemat zastępczy / The primary system

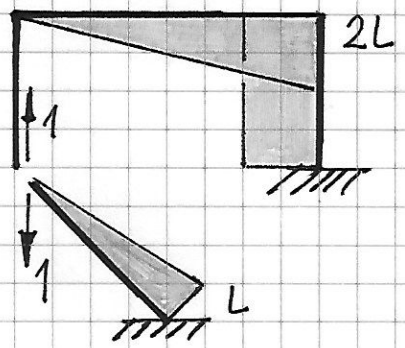


$X_1 = 1$



M_1

$X_2 = 1$



M_2

Równania zgodności / Compatibility equations

$$\delta_{11} X_1 + \delta_{12} X_2 + \delta_{10} = 0$$

$$\delta_{21} X_1 + \delta_{22} X_2 + \delta_{20} = 0$$

$$\delta_{11} = \frac{8+\sqrt{2}}{3} \frac{L^3}{EJ}$$

$$\delta_{12} = \delta_{21} = \frac{-9+\sqrt{2}}{3} \frac{L^3}{EJ}$$

$$\delta_{22} = \frac{20+\sqrt{2}}{3} \frac{L^3}{EJ}$$

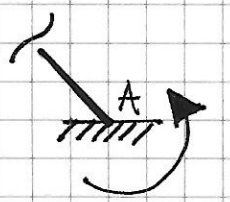
$$\delta_{10} = \Delta_o$$

$$\delta_{20} = 0$$

$$X_1 = -0{,}146 \frac{\Delta_o EJ}{L^3}$$

$$X_2 = -0{,}158 \frac{\Delta_o EJ}{L^3}$$

$$M_A = X_1 \cdot L + X_2 \cdot L = -0{,}604 \frac{\Delta_o EJ}{L^2}$$

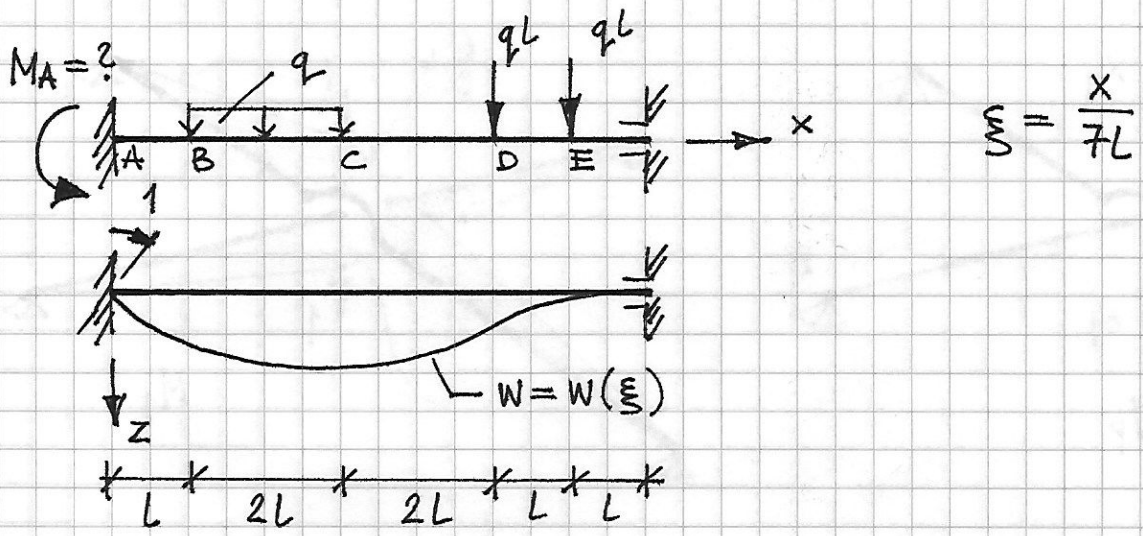


$0{,}604 \frac{\Delta_o EJ}{L^2}$

Egzamin z MK1, 8.09.2016, zadanie 2

Exam on MoS 1, problem 2

The idea:



$$\xi = \frac{x}{7L}$$

Na mocy tw. Bettiego / By Betti's Theorem

$$M_A \cdot (-1) + \int_{\xi_B}^{\xi_C} q \cdot w(\xi) \cdot 7L\, d\xi + qL \cdot w(\xi_D) + qL \cdot w(\xi_E) = 0$$

$$M_A = \int_{\xi_B}^{\xi_C} 7qL\, w(\xi) d\xi + qL\left[w(\xi_D) + w(\xi_E)\right]$$

Wyznaczenie $w = w(\xi)$ / Determining $w = w(\xi)$

$$w(\xi) = C_0 + C_1\xi + C_2\xi^2 + C_3\xi^3$$

Warunki brzegowe / Boundary conditions

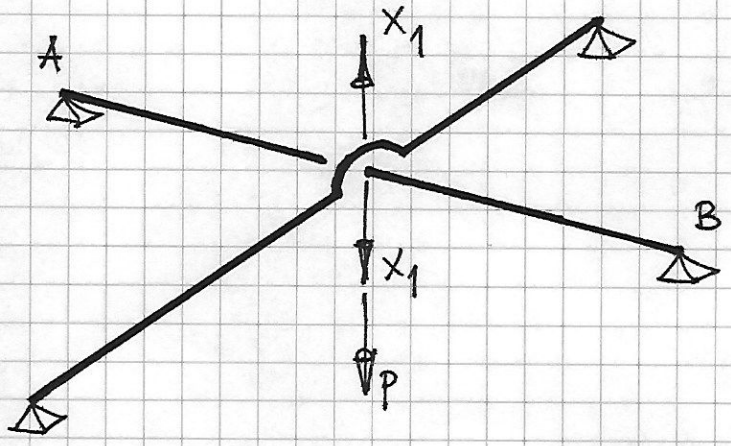
$$\begin{array}{l} w(0) = 0 \\ \frac{1}{7L} \cdot w'(0) = 1 \\ w(1) = 0 \\ \frac{1}{7L} \cdot w'(1) = 0 \end{array} \Bigg| \longrightarrow \quad w(\xi) = 7L\left(\xi^3 - 2\xi^2 + \xi\right)$$

$$M_A = 2{,}463\, qL^2$$

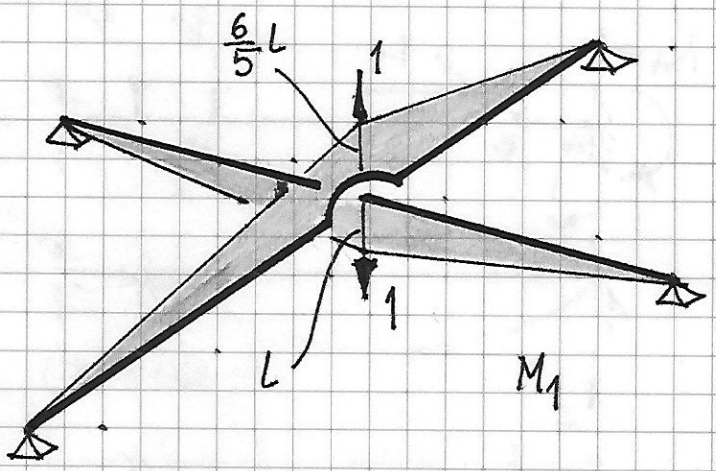
Egzamin z MK1 , 8.09.2016 , zadanie 3

Exam on MOS1 , problem 3

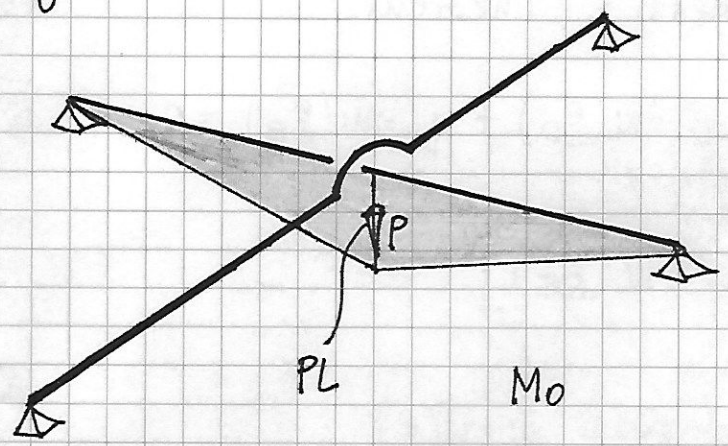
The primary structure



$X_1 = 1$



"0"

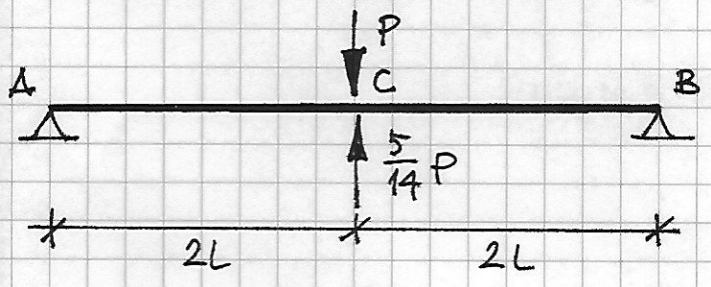


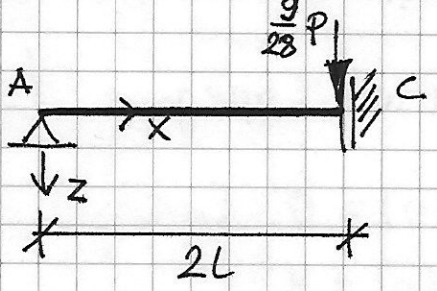
$$\delta_{11} = \frac{56}{15}\frac{L^3}{EJ}$$

$$\delta_{10} = \frac{4}{3}\frac{PL^3}{EJ}$$

$$X_1 = -\frac{5}{14}P$$

Korzystamy z symetrii zadania / We use the symmetry of the problem





Linia ugięcia na odcinku A-C / Deflection line between A and C

$$w(x) = Ax^3 + Bx^2 + Cx + D$$

$$w(0) = 0$$

$$w''(0) = 0$$

$$w'(2L) = 0$$

$$-EJ\,w'''(2L) = \frac{9}{28}P$$

$$\rightarrow \quad w(x) = \frac{3}{7}\left[3\xi - \xi^3\right]\frac{PL^3}{EJ}$$