

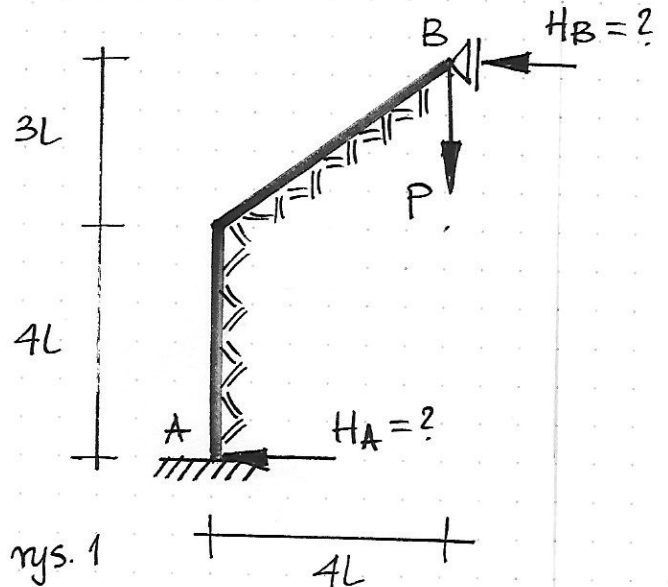
**Egzamin z Mechaniki Konstrukcji (MK IPB), 29.06.2017**  
**studia stacjonarne**

NAZWISKO, Imię				
rok akademicki zaliczenia ćwiczeń	nr albumu	grupa (IPB / BZ)	tryb studiów (ST / NST)	
ocena zadania 1	ocena zadania 2	ocena zadania 3	ocena egzaminu	ocena łączna

**Zadanie 1.**

$$EJ = const., \quad k = 0,0064 \frac{EJ}{l^4}$$

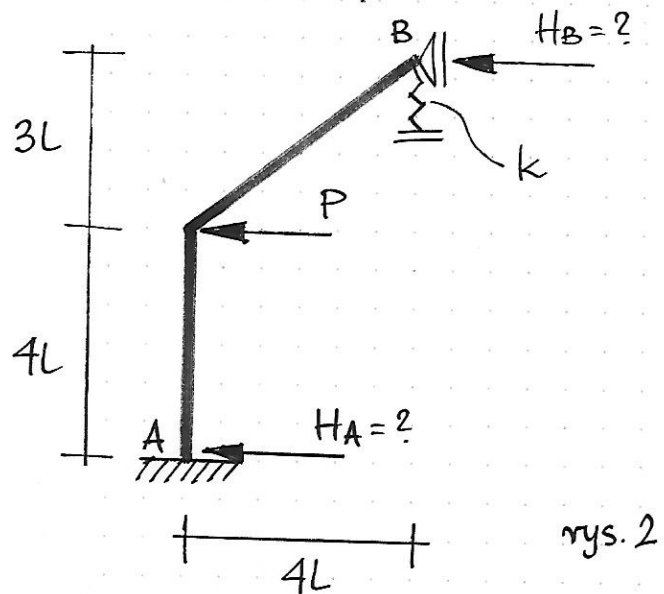
Oblicz reakcję  $H_A$  w podporze  $A$  oraz reakcję  $H_B$  w podporze  $B$  w ramie z rys. 1.



**Zadanie 2.**

$$EJ = const., \quad k = 4 \frac{EJ}{l^3}$$

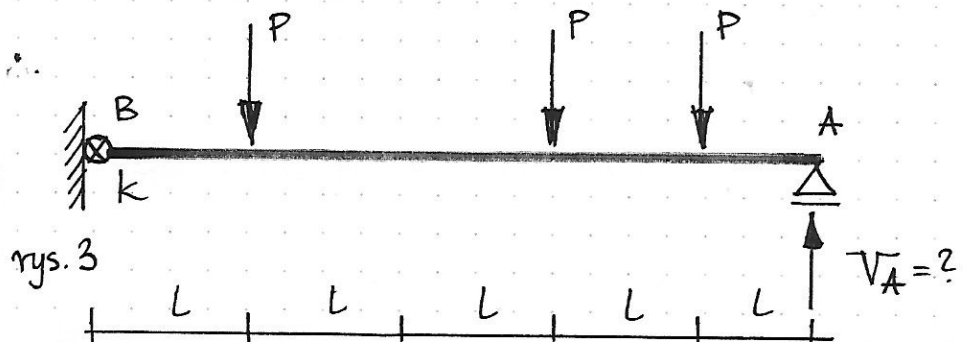
Oblicz reakcję  $H_A$  w podporze  $A$  oraz reakcję  $H_B$  w podporze  $B$  w ramie z rys. 2



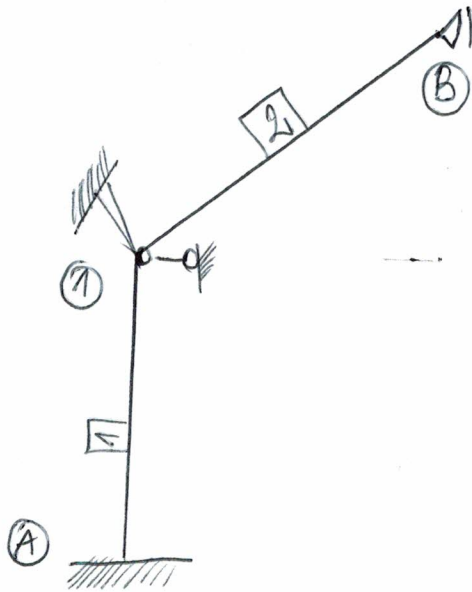
**Zadanie 3.**

$$EJ = const., \quad k = 10 \frac{EJ}{l}$$

Oblicz reakcję  $V_A$  w podporze  $A$  belki z rys. 3.



Układ zastępczy

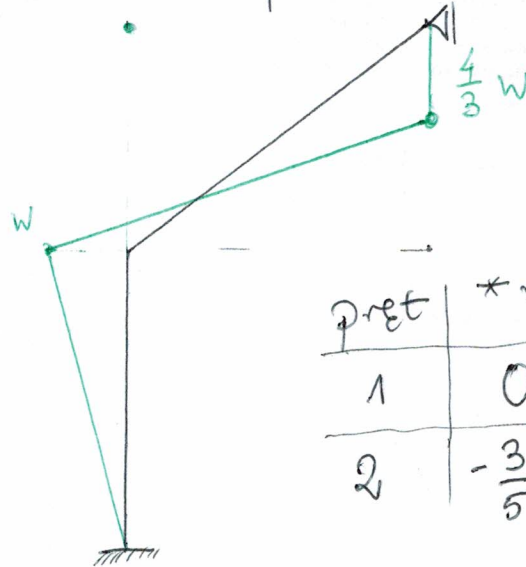


$$q = \begin{bmatrix} \varphi \\ \frac{w}{l} \end{bmatrix}$$

$$\alpha^{(1)} = 0,8$$

$$\alpha^{(2)} = 1,0$$

Plan przesunięć



Element	*w	w*
1	0	-w
2	$-\frac{3}{5}w$	$\frac{16}{15}w$

n.n. MP

$$\Phi_1^{(1)} + \Phi_1^{(2)} = 0 \quad (1)$$

$$-(W_1^{(1)}(-w) + W_1^{(2)}(-\frac{3}{5}w) + W_B^{(2)}(-\frac{16}{15}w)) + P \cdot \frac{4}{3}w = 0 \quad (2)$$

Wzory transformacyjne

$$1. \quad \Phi_1^{(1)} = \frac{EY}{4l} [\alpha(0,8) - \theta(0,8) \frac{-w}{4l}]$$

$$W_1^{(1)} = -\frac{EY}{(4l)^2} [\theta(0,8) \varphi - \gamma(0,8) \frac{-w}{4l}]$$

$$2. \quad \Phi_1^{(2)} = \frac{EY}{5l} [\alpha'(1,0) \varphi + \theta'(1,0) \frac{-\frac{3}{5}w}{5l} - \delta'(1,0) \frac{\frac{16}{15}w}{5l}]$$

$$W_1^{(2)} = \frac{EY}{(5l)^2} [\theta'(1,0) \varphi + \gamma'(1,0) \frac{-\frac{3}{5}w}{5l} - \epsilon'(1,0) \frac{\frac{16}{15}w}{5l}]$$

$$W_B^{(2)} = -\frac{EY}{(5l)^2} [\delta'(1,0) \varphi + \epsilon'(1,0) \frac{-\frac{3}{5}w}{5l} - \kappa'(1,0) \frac{\frac{16}{15}w}{5l}]$$

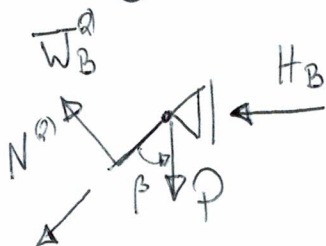
$$\frac{EY}{l} \begin{bmatrix} 1,619 & -0,179 \\ 0,179 & 0,272 \end{bmatrix} \begin{bmatrix} \varphi \\ \frac{w}{l} \end{bmatrix} = \begin{bmatrix} 0 \\ 1,333 \end{bmatrix} Pl$$

$$\varphi = -0,584 \frac{Pl^3}{Ey}$$

$$w = 5,287 \frac{Pl^3}{Ey}$$

$$H_A = -W_A^{(1)} = -\frac{Ey}{16l^2} \left[ \delta(0,8) \varphi - \varepsilon(0,8) \frac{w}{4l} \right] = -0,1757 P$$

Węzeł (B)



$$W_B^{(2)} - P \sin \beta + H_B \cos \beta = 0$$

$$H_B = \frac{5}{3} \left( \frac{4}{5} P - W_B^{(2)} \right) = 0,1785 P$$

## ZADANIE 2

Układ zastępczy, plan przesunąć i wzory transformacyjne  
 → ZADANIE 1

r.r. MP

$$\Phi_1^{(1)} + \Phi_1^{(2)} = 0 \quad (1)$$

$$- (W_1^{(1)} (-w) + W_1^{(2)} (-\frac{3}{5} w) + W_B^{(2)} (-\frac{16}{25} w)) + Pw + k \frac{4}{3} w (-\frac{4}{3} w) = 0 \quad (2)$$

$$\frac{Ey}{l} \begin{bmatrix} 1,600 & 0,175 \\ 0,175 & 7,365 \end{bmatrix} \begin{bmatrix} \varphi \\ \frac{w}{l} \end{bmatrix} = \begin{bmatrix} 0 \\ Pl \end{bmatrix}$$

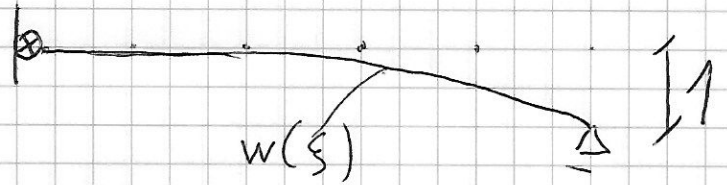
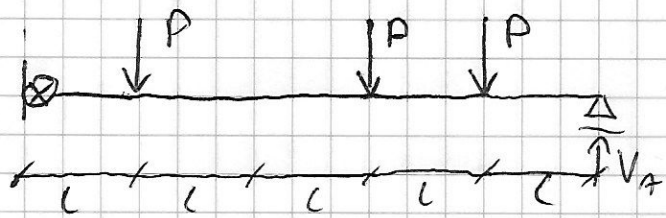
$$\varphi = -0,0149 \frac{Pl^3}{Ey}$$

$$w = 0,136 \frac{Pl^3}{Ey}$$

$$H_A = -W_A^{(1)} = -0,02 P$$

$$H_B = \frac{5}{3} \left( k \frac{4}{3} w (-0,8) - W_B^{(2)} \right) = -0,98 P$$

Examin 2 MK 3 (IPB 132) 29.06.2017r. Zad. 3



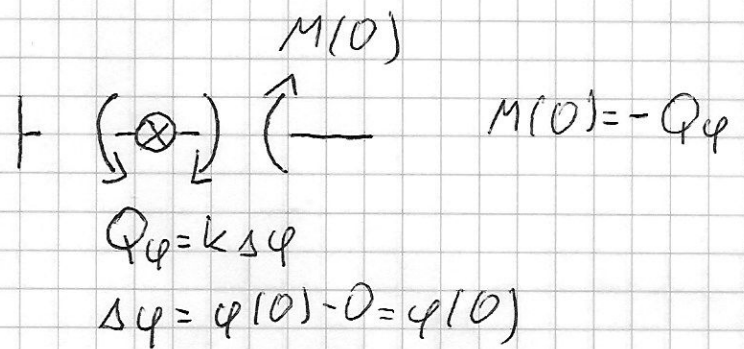
Korzystając z TW. Bettiego:

$$V_A(-1) + Pw\left(\frac{1}{5}\right) + Pw\left(\frac{3}{5}\right) + Pw\left(\frac{4}{5}\right) \Rightarrow V_A = P\left(w\left(\frac{1}{5}\right) + w\left(\frac{3}{5}\right) + w\left(\frac{4}{5}\right)\right)$$

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

$$\varphi(\xi) = \frac{1}{5L} w'(\xi)$$

$$M(\xi) = -\frac{EJ}{(5L)^2} w''(\xi)$$



Warunki Brzegowe

$$w(0) = 0 \quad w(1) = 1$$

$$M(0) = -k\varphi(0) \quad M(1) = 0$$

$$C_0 = 0 \quad C_1 = \frac{3}{53} \quad C_2 = \frac{75}{53} \quad C_3 = -\frac{25}{53}$$

$$w(\xi) = \frac{3}{53}\xi + \frac{75}{53}\xi^2 - \frac{25}{53}\xi^3$$

$$V_A = P\left(w\left(\frac{1}{5}\right) + w\left(\frac{3}{5}\right) + w\left(\frac{4}{5}\right)\right) = \frac{322}{265} P$$