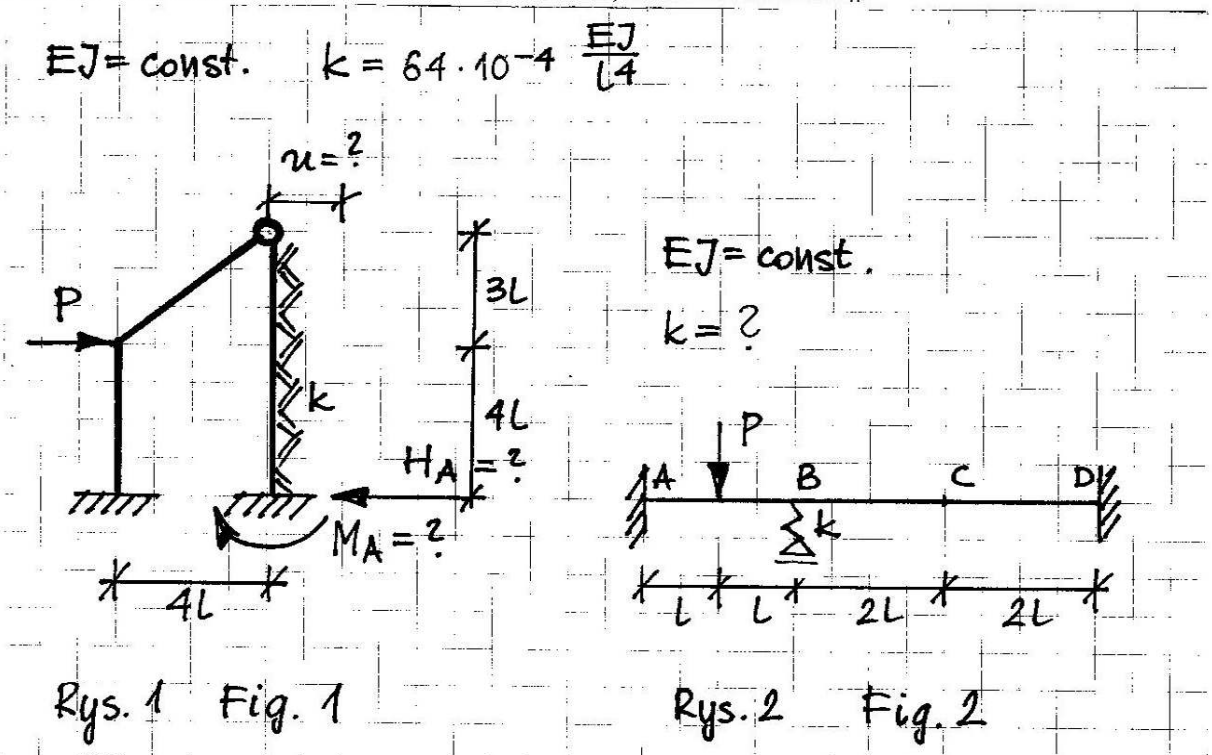
Egzamin z Mechaniki Konstrukcji, 17.06.2015
Exam on the Mechanics of Structures

NAZWISKO, Imię LAST NAME, First Name				
ocena zadania 1	ocena zadania 2	ocena zadania 3	ocena egzaminu	ocena łączna

Zadanie 1 (Rys. 1) **Problem #1 (Fig. 1)**
Oblicz reakcje M_A , H_A oraz przemieszczenie u.
Calculate reactions M_A , H_A and translation u.

Zadanie 2 (Rys. 2) **Problem #2 (Fig. 2)**
Oblicz wartość k, dla której kąt $\varphi_B = 0$. Następnie oblicz moment M_A.
Calculate the value of k for which the angle $\varphi_B = 0$. Next, calculate moment M_A.

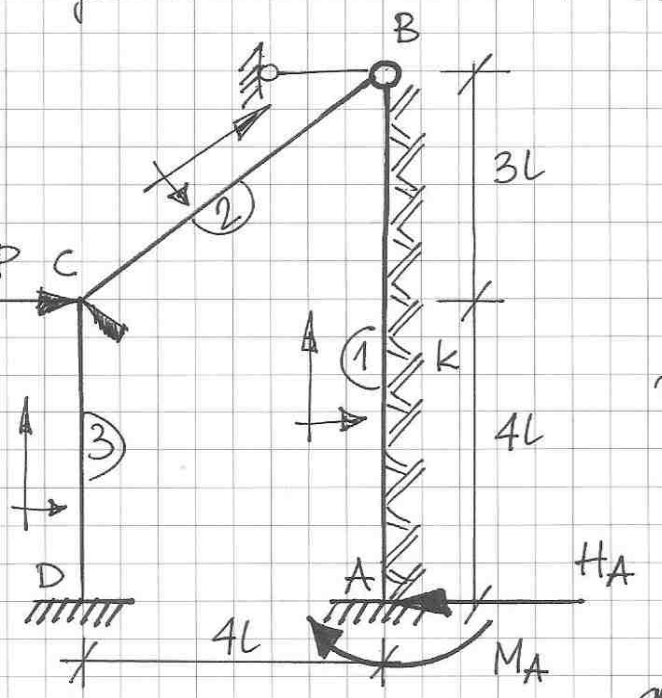
Zadanie 3 (Rys. 2) **Problem #3 (Fig. 2)**
Oblicz wartość k taką, że moment $M_D = 0$. Następnie oblicz moment M_A.
Calculate the value of k such that the moment $M_D = 0$. Next, calculate moment M_A.

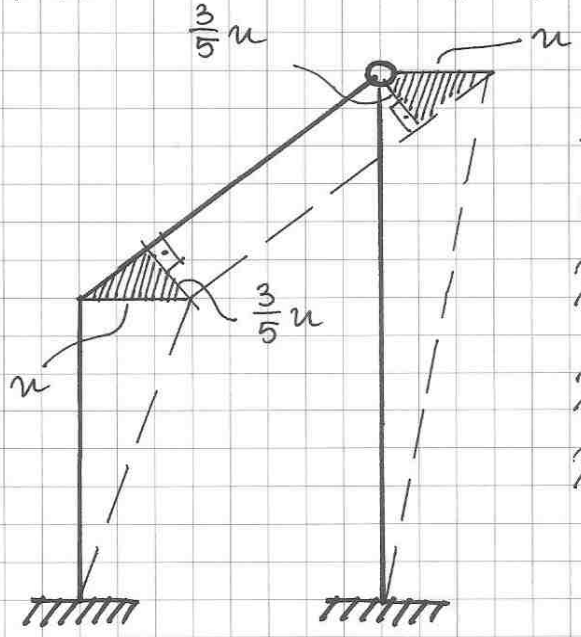


Rys. 1 Fig. 1 Rys. 2 Fig. 2

λ	C(λ)	S(λ)	T(λ)	R(λ)	M(λ)	N(λ)	C'(λ)	T'(λ)	R'(λ)
0,0	**4,000**	**2,000**	**6,000**	**6,000**	**12,000**	**12,000**	**3,000**	**3,000**	**3,000**
0,1	4,000	2,000	6,000	6,000	12,000	12,000	3,000	3,000	3,000
0,2	4,000	2,000	6,000	6,000	12,002	11,999	3,000	3,001	3,000
0,3	4,000	2,000	6,002	5,999	12,012	11,996	3,001	3,003	2,999
0,4	4,001	1,999	6,005	5,997	12,038	11,987	3,002	3,009	2,996
0,5	**4,002**	**1,998**	**6,013**	**5,992**	**12,093**	**11,968**	**3,005**	**3,021**	**2,990**
0,6	4,005	1,996	6,027	5,984	12,192	11,933	3,010	3,044	2,980
0,7	4,009	1,993	6,050	5,970	12,356	11,877	3,018	3,082	2,962
0,8	4,016	1,988	6,086	5,949	12,608	11,790	3,031	3,140	2,936
0,9	4,025	1,981	6,137	5,919	12,972	11,665	3,050	3,223	2,898
1,0	**4,038**	**1,972**	**6,208**	**5,877**	**13,480**	**11,491**	**3,075**	**3,338**	**2,846**
1,1	4,055	1,959	6,304	5,821	14,163	11,258	3,109	3,492	2,776
1,2	4,078	1,942	6,429	5,748	15,056	10,956	3,153	3,692	2,687
1,3	4,107	1,920	6,589	5,656	16,197	10,573	3,209	3,944	2,575
1,4	4,143	1,894	6,787	5,541	17,624	10,100	3,277	4,254	2,438
1,5	**4,186**	**1,862**	**7,030**	**5,402**	**19,377**	**9,526**	**3,359**	**4,629**	**2,275**
1,6	4,239	1,823	7,323	5,236	21,498	8,844	3,455	5,071	2,086
1,7	4,301	1,778	7,670	5,041	24,026	8,049	3,566	5,586	1,871
1,8	4,373	1,726	8,075	4,818	27,000	7,136	3,693	6,174	1,632
1,9	4,456	1,666	8,541	4,564	30,459	6,106	3,833	6,835	1,370
2,0	**4,550**	**1,600**	**9,073**	**4,280**	**34,438**	**4,962**	**3,988**	**7,568**	**1,091**

Egzamin z MK3 (IPB) 17.06.2015 Zadanie 1





$EJ = const.$

$k = 64 \cdot 10^{-4} \frac{EJ}{L^4}$

$\lambda^4 = \frac{kL^4}{4EJ}$

$\lambda = 0{,}2$

$\lambda^{(1)} = 1{,}4$

$$q = \left[\varphi_C \quad \frac{u}{L} \right]^T$$

$$\begin{cases} \Phi_C^{(2)} + \Phi_C^{(3)} = 0 \\ W_B^{(1)} \cdot \bar{u} + W_B^{(2)} \cdot \frac{3}{5}\bar{u} + W_C^{(2)} \cdot \frac{3}{5}\bar{u} + W_C^{(3)} \cdot \bar{u} = P\bar{u} \end{cases}$$

$$\Phi_C^{(2)} = \frac{3EJ}{5L} \left[\varphi_C \right]$$

$$\Phi_C^{(3)} = \frac{2EJ}{4L} \left[2\varphi_C - \frac{3u}{4L} \right]$$

$$W_B^{(1)} = -\frac{EJ}{49L^2} \left[-L^1(1{,}4) \frac{u}{7L} \right]$$

$$W_B^{(2)} = -\frac{3EJ}{25L^2} \left[\varphi_C \right]$$

$$W_C^{(2)} = \frac{3EJ}{25L^2} \left[\varphi_C \right]$$

$$W_C^{(3)} = -\frac{6EJ}{16L^2} \left[\varphi_C - 2\frac{u}{4L} \right]$$

$$\frac{EJ}{L} \left\{ \left[\frac{3}{5} + 1 \right] \varphi_C + \left[-\frac{3}{8} \right] \frac{u}{L} \right\} = 0$$

$$\frac{EJ}{L} \left\{ \left[-\frac{3}{8} \right] \varphi_C + \left[\frac{1}{49} \cdot \frac{1}{7} \cdot 6{,}503 + \frac{3}{4} \cdot \frac{1}{4} \right] \frac{u}{L} \right\} = PL$$

$$\varphi_C = 1{,}977 \frac{PL^2}{EJ} \qquad \frac{u}{L} = 8{,}434 \frac{PL^2}{EJ} \rightarrow u = 8{,}434 \frac{PL^3}{EJ}$$

$$M_A = \Phi_A^{(1)} = \frac{EJ}{7L} \left[-R^1(1{,}4) \cdot \frac{u}{7L} \right] = -0{,}42\,PL$$

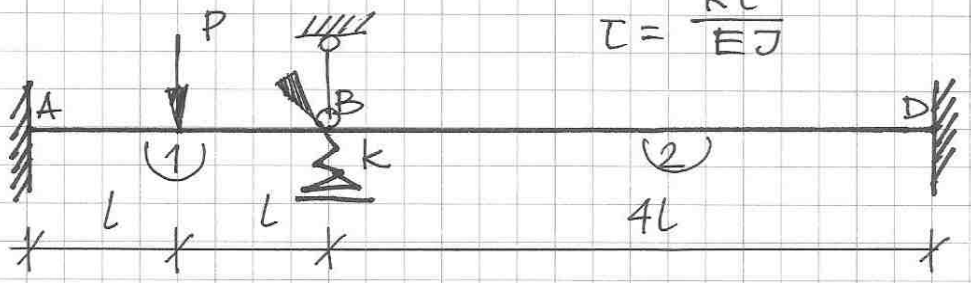
$$H_A = -W_A^{(1)} = -\frac{EJ}{49L^2} \left[-N^1(1{,}4) \frac{u}{7L} \right] = 0{,}025\,P$$

opracował:
G. Dzierżanowski

Egzamin z MK3 (IPB) 17.06.2015 Zadanie 2

Zadanie 3

$\tau = \frac{kl^3}{EJ}$

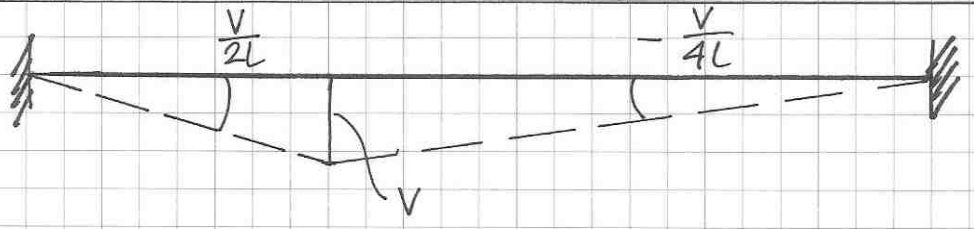


$EJ = \text{const.}$

$q = \left[\varphi_B \quad \frac{V}{L}\right]^T$

Momenty wyjściowe $\overset{\circ}{\Phi}{}^{(1)}_A$, $\overset{\circ}{\Phi}{}^{(1)}_B$ łatwo wyznaczyć stosując Metodę Sił.

$\overset{\circ}{\Phi}{}^{(1)}_A = -\frac{1}{4}PL \qquad \overset{\circ}{\Phi}{}^{(1)}_B = \frac{1}{4}PL$



$$\begin{cases} \Phi^{(1)}_B + \Phi^{(2)}_B = 0 \\ \left[\Phi^{(1)}_A + \Phi^{(1)}_B\right] \cdot \frac{V}{2L} + \left[\Phi^{(2)}_B + \Phi^{(2)}_D\right] \cdot \left(-\frac{V}{4L}\right) - kV\overline{V} + P \cdot \frac{1}{2}\overline{V} = 0 \end{cases}$$

$\Phi^{(1)}_A = \frac{2EJ}{2L}\left[\varphi_B - 3\frac{V}{2L}\right] - \frac{1}{4}PL \qquad \Phi^{(2)}_B = \frac{2EJ}{4L}\left[2\varphi_B + 3\frac{V}{4L}\right]$

$\Phi^{(1)}_B = \frac{2EJ}{2L}\left[2\varphi_B - 3\frac{V}{2L}\right] + \frac{1}{4}PL \qquad \Phi^{(2)}_D = \frac{2EJ}{4L}\left[\varphi_B + 3\frac{V}{4L}\right]$

$$\begin{cases} 3\varphi_B - 1{,}125\frac{V}{L} + 0{,}25\frac{PL^2}{EJ} = 0 \\ -1{,}125\varphi_B + (1{,}6875 + \tau)\frac{V}{L} - 0{,}5\frac{PL^2}{EJ} = 0 \end{cases}$$

$\varphi_B = \frac{0{,}5\,(0{,}5625 - \tau)}{7{,}59375 + 6\tau}\frac{PL^2}{EJ} \qquad \frac{V}{L} = \frac{2{,}4375}{7{,}59375 + 6\tau}\frac{PL^2}{EJ}$

Zad. 2

$\varphi_B = 0 \rightarrow \tau = 0{,}5625 \rightarrow$

$\rightarrow \frac{V}{L} = 0{,}222\,\frac{PL^2}{EJ}$

$M_A = \Phi^{(1)}_A = -0{,}583\,PL$

opracował: G. Dzierżanowski

Zad. 3

$M_D = 0 \rightarrow \Phi^{(2)}_D = 0 \rightarrow$

$\rightarrow \varphi_B + 3\frac{V}{4L} = 0 \rightarrow \tau = 4{,}21875$

$\varphi_B = -0{,}056\,\frac{PL^2}{EJ} \qquad \frac{V}{L} = 0{,}074\,\frac{PL^2}{EJ}$

$M_A = -0{,}417\,PL$