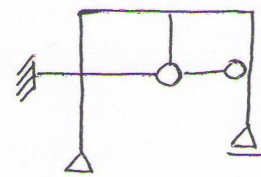
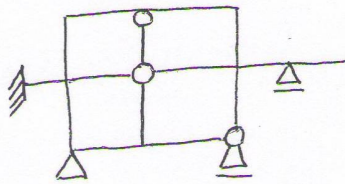
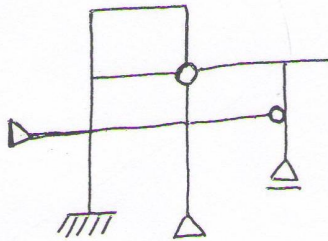
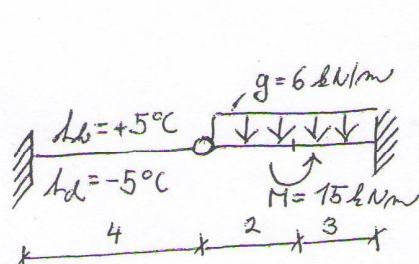


Určete: SSN, SPN, SPNzm.



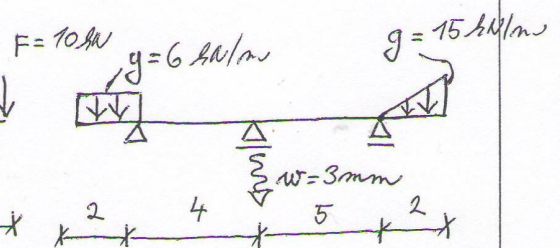
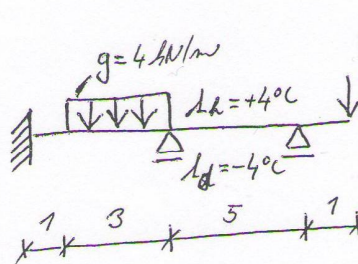
Vyřešte deformační stav konstrukce.



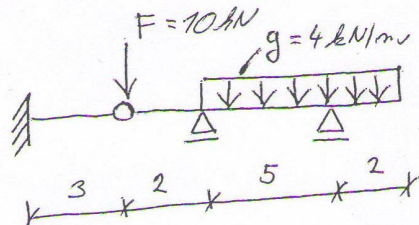
0,3
0,2

$$E = 2 \cdot 10^7 \text{ kPa}$$

$$\alpha = 1 \cdot 10^{-5} \text{ } ^\circ\text{C}^{-1}$$



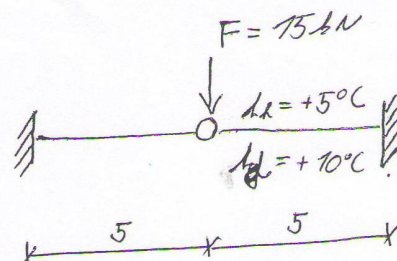
Určete numerický tvar vektoru pravé strany.



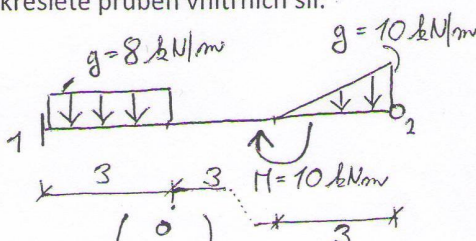
0,4
0,1

$$E = 2,3 \cdot 10^7 \text{ kPa}$$

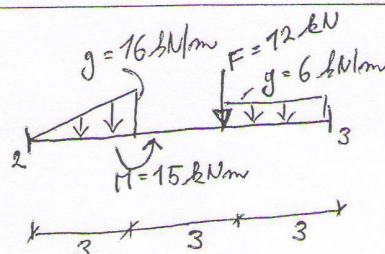
$$\alpha = 1,2 \cdot 10^{-5} \text{ } ^\circ\text{C}^{-1}$$



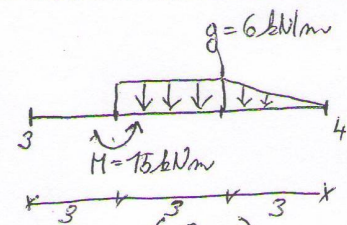
Vykreslete průběh vnitřních sil.



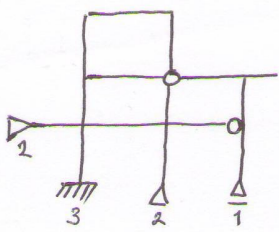
$$\{R_{1,2}^*\} = \begin{Bmatrix} 0 \\ -24 \\ 31 \\ 0 \\ -15 \\ 0 \end{Bmatrix}$$



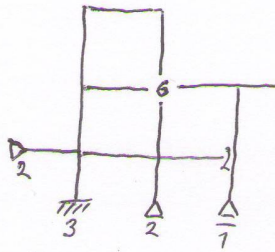
$$\{R_{2,3}^*\} = \begin{Bmatrix} 0 \\ -29 \\ 35 \\ 0 \\ -25 \\ -20 \end{Bmatrix}$$



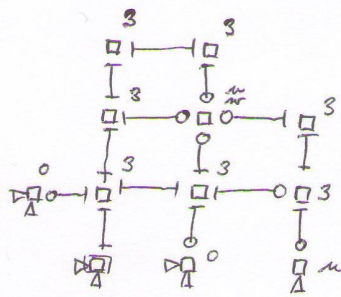
$$\{R_{3,4}^*\} = \begin{Bmatrix} 0 \\ -18 \\ 33 \\ 0 \\ -9 \\ 15 \end{Bmatrix}$$



$$8 + 3 \cdot 3 - 4 - 3 = 10 \times SN$$

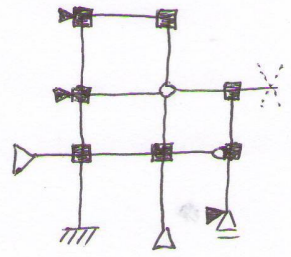


$$8 + 8 - 2 \cdot 3 = 10 \times SN$$

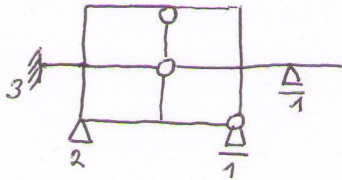


$$21 + 3 = 24$$

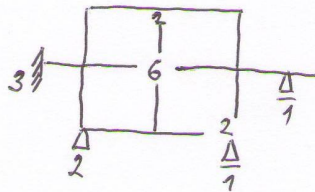
$$n_f = 24$$



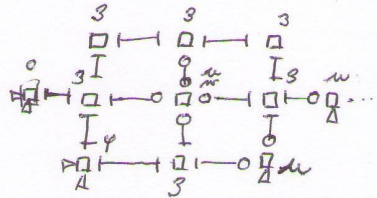
$$n_{f2} = 10$$



$$7 + 4 \cdot 3 - 5 - 3 = 11 \times SN$$

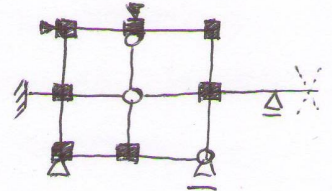


$$7 + 10 - 2 \cdot 3 = 11 \times SN$$

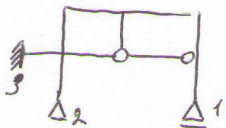


$$18 + 5 = 23$$

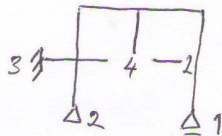
$$n_f = 23$$



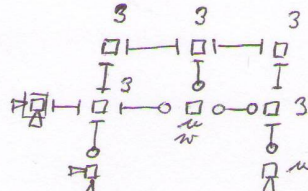
$$n_{f2} = 9$$



$$6 + 2 \cdot 3 - 3 - 3 = 6 \times SN$$

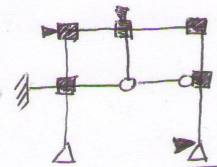


$$6 + 6 - 2 \cdot 3 = 6 \times SN$$



$$15 + 3 = 18$$

$$n_f = 18$$

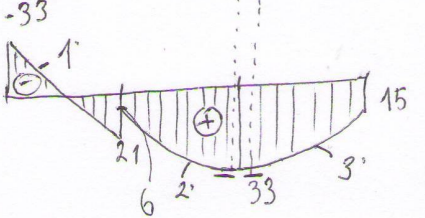
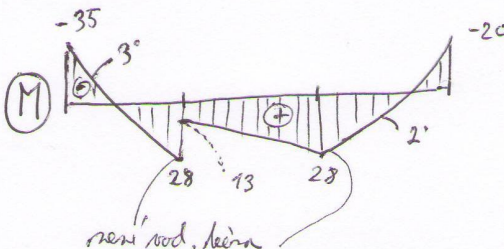
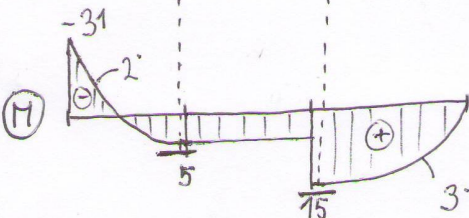
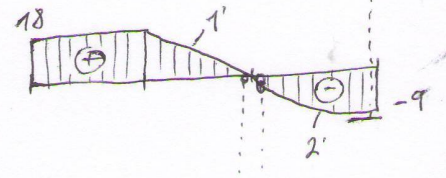
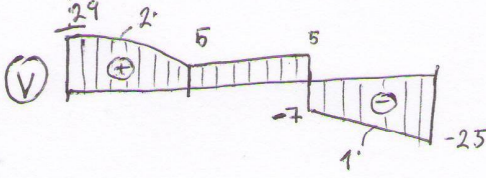
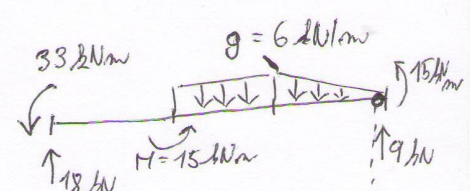
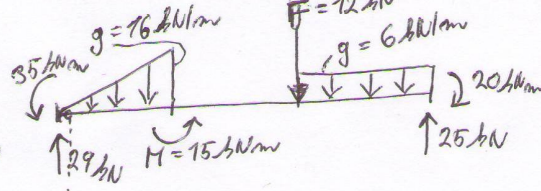
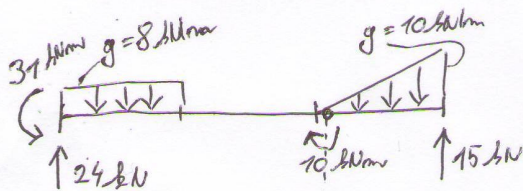
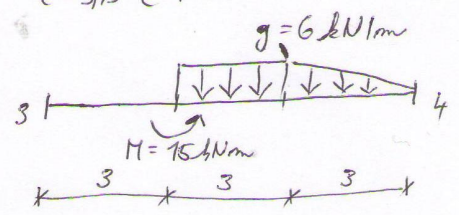
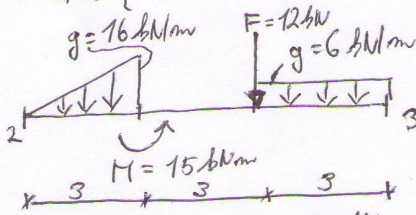
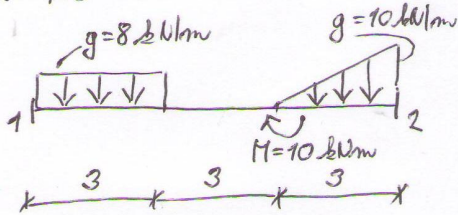


$$n_{f2} = 8$$

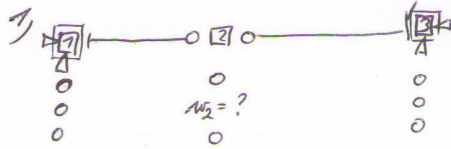
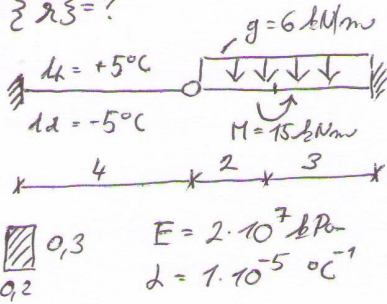
$$\{R_{1,2}^*\} = \{0; -24; 31 \mid 0; -15; 0\}^T$$

$$\{R_{2,3}^*\} = \{0; -29; 35 \mid 0; -25; -20\}^T$$

$$\{R_{3,4}^*\} = \{0; -18; 33 \mid 0; -9; 15\}^T$$



$$\{ \lambda \} = ?$$



$$n_1 = 1; \{ \lambda \} = \{ w_2 \}; \{ S \} = \{ 0 \} Z_2$$

2) PROT 1,2

$$l = \\ A = \\ I = \\ E =$$

$$[K_{1,2}] = \begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

$$\{ \bar{R}_{1,2} \} = \begin{Bmatrix} X_1 \\ Z_1 \\ M_1 \\ X_2 \\ Z_2 \\ M_2 \end{Bmatrix}$$

PROT 2,3

$$l = \\ A = \\ I = \\ E =$$

$$[K_{2,3}] = \begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

$$\{ \bar{R}_{2,3} \} = \begin{Bmatrix} X_2 \\ Z_2 \\ M_2 \\ X_3 \\ Z_3 \\ M_3 \end{Bmatrix}$$

$$3) [K] = [\dots]_{w_2}; \{ \bar{R} \} = \{ \dots \}_{Z_2}; \{ F \} = \{ \dots \}_{Z_2}$$

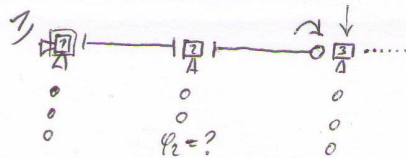
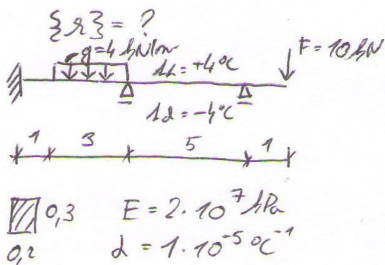
$$[K] \cdot \{ \lambda \} = \{ F \}$$

$$[\dots] \cdot \{ w_2 \} = \{ \dots \}$$

$$\dots \cdot w_2 = \dots$$

$$w_2 = 2,5326 \cdot 10^{-2}$$

$$\{ \lambda \} = ?$$



$$n_1 = 1; \{ \lambda \} = \{ \varphi_2 \}; \{ S \} = \{ 0 \} M_2$$

2) PROT 1,2

$$l = \\ A = \\ I = \\ E =$$

$$[K_{1,2}] = \begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

$$\{ \bar{R}_{1,2} \} = \begin{Bmatrix} X_1 \\ Z_1 \\ M_1 \\ X_2 \\ Z_2 \\ M_2 \end{Bmatrix}$$

PROT 2,3

$$l = \\ A = \\ I = \\ E =$$

$$[K_{2,3}] = \begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

$$\{ \bar{R}_{2,3} \} = \begin{Bmatrix} X_2 \\ Z_2 \\ M_2 \\ X_3 \\ Z_3 \\ M_3 \end{Bmatrix}$$

$$3) [K] = [\dots]_{\varphi_2}; \{ \bar{R} \} = \{ \dots \}_{M_2}; \{ F \} = \{ \dots \}_{M_2}$$

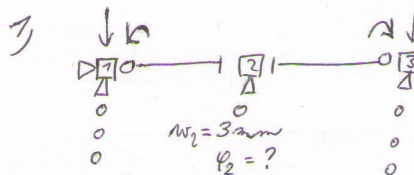
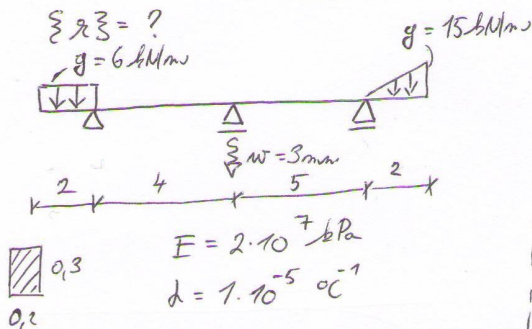
$$[K] \cdot \{ \lambda \} = \{ F \}$$

$$[\dots] \cdot \{ \varphi_2 \} = \{ \dots \}$$

$$\dots \cdot \varphi_2 = \dots$$

$$\varphi_2 = 9,488 \cdot 10^{-4} \text{ rad}$$

$$\{ \lambda \} = ?$$



$$n_1 = 1; \{ \lambda \} = \{ \varphi_2 \}; \{ S \} = \{ 0 \}$$

2) PROT 1,2

$$l = \\ A = \\ I = \\ E =$$

$$[K_{1,2}] = \begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

$$\{ \bar{R}_{1,2} \} = \begin{Bmatrix} X_1 \\ Z_1 \\ M_1 \\ X_2 \\ Z_2 \\ M_2 \end{Bmatrix}$$

$$\{ \tilde{R}_{1,2} \} = [K_{1,2}] \cdot \{ \tilde{\lambda}_{1,2} \} = \begin{Bmatrix} X_1 \\ Z_1 \\ M_1 \\ X_2 \\ Z_2 \\ M_2 \end{Bmatrix}$$

PROT 2,3

$$l = \\ A = \\ I = \\ E =$$

$$[K_{2,3}] = \begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

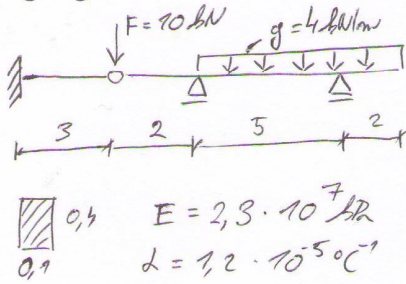
$$\{ \bar{R}_{2,3} \} = \begin{Bmatrix} X_2 \\ Z_2 \\ M_2 \\ X_3 \\ Z_3 \\ M_3 \end{Bmatrix}$$

$$\{ \tilde{R}_{2,3} \} = [K_{2,3}] \cdot \{ \tilde{\lambda}_{2,3} \} = \begin{Bmatrix} X_2 \\ Z_2 \\ M_2 \\ X_3 \\ Z_3 \\ M_3 \end{Bmatrix}$$

$$3) [K] = [\dots]_{\varphi_2}; \{ \bar{R} \} = \{ \dots \}_{M_2}; \{ F \} = \{ \dots \}_{M_2}$$

$$[K] \cdot \{ \lambda \} = \{ F \}; [\dots] \cdot \{ \varphi_2 \} = \{ \dots \}; \dots \cdot \varphi_2 = \dots; \varphi_2 = 1,772 \cdot 10^{-4} \text{ rad}$$

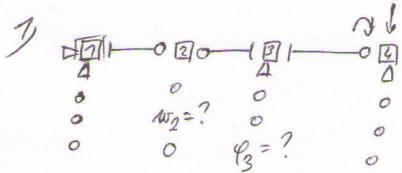
$$\{F\} = ?$$



$$2) \{R_{12}\} = \begin{Bmatrix} X_1 \\ Z_1 \\ M_1 \\ X_2 \\ Z_2 \\ M_2 \end{Bmatrix} \quad \{R_{23}\} = \begin{Bmatrix} X_2 \\ Z_2 \\ M_2 \\ X_3 \\ Z_3 \\ M_3 \end{Bmatrix}$$

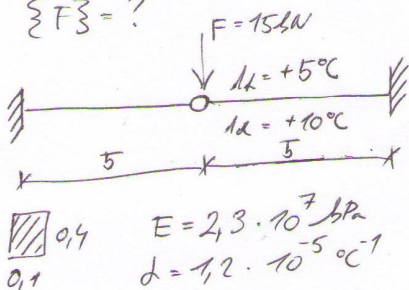
$$\{R_{34}\} = \begin{Bmatrix} X_3 \\ Z_3 \\ M_3 \\ X_4 \\ Z_4 \\ M_4 \end{Bmatrix}$$

$$3) \{R\} = \begin{Bmatrix} I_2 \\ M_3 \end{Bmatrix} ; \{F\} = \begin{Bmatrix} 10 \\ -8.5 \end{Bmatrix} \begin{Bmatrix} I_2 \\ M_3 \end{Bmatrix}$$

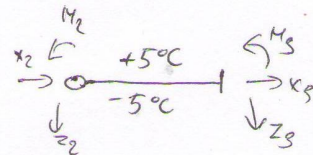


$$n_f = 2 ; \{r\} = \begin{Bmatrix} u_2 \\ \varphi_3 \end{Bmatrix} ; \{s\} = \begin{Bmatrix} 10 \\ 0 \end{Bmatrix} \begin{Bmatrix} I_2 \\ M_3 \end{Bmatrix}$$

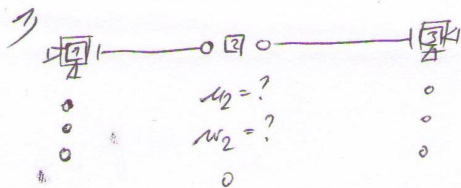
$$\{F\} = ?$$



$$2) \{R_{12}\} = \begin{Bmatrix} X_1 \\ Z_1 \\ M_1 \\ X_2 \\ Z_2 \\ M_2 \end{Bmatrix} \quad \{R_{23}\} = \begin{Bmatrix} X_2 \\ Z_2 \\ M_2 \\ X_3 \\ Z_3 \\ M_3 \end{Bmatrix}$$



$$3) \{R\} = \begin{Bmatrix} X_2 \\ Z_2 \end{Bmatrix} ; \{F\} = \begin{Bmatrix} -82.8 \\ 14.448 \end{Bmatrix} \begin{Bmatrix} X_2 \\ Z_2 \end{Bmatrix}$$



$$n_f = 2 ; \{r\} = \begin{Bmatrix} u_2 \\ w_2 \end{Bmatrix} ; \{s\} = \begin{Bmatrix} 0 \\ 15 \end{Bmatrix} \begin{Bmatrix} X_2 \\ Z_2 \end{Bmatrix}$$