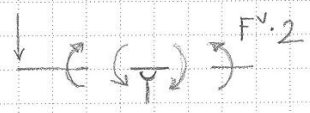
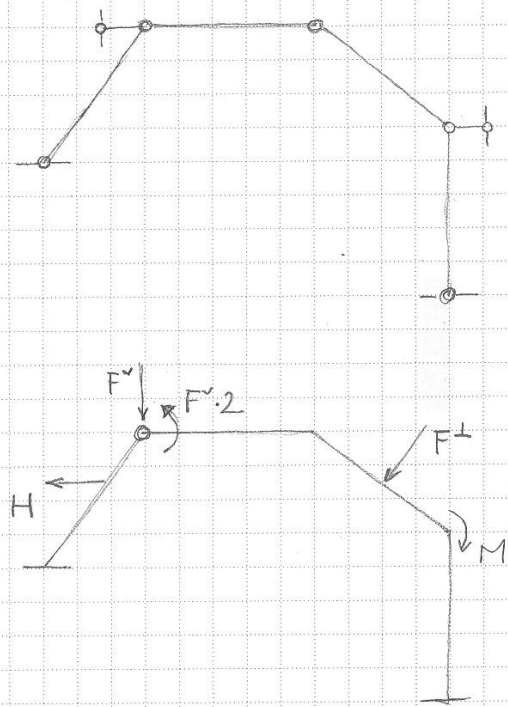
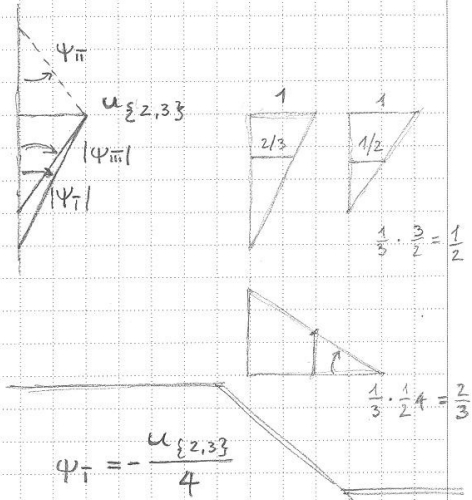
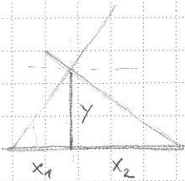
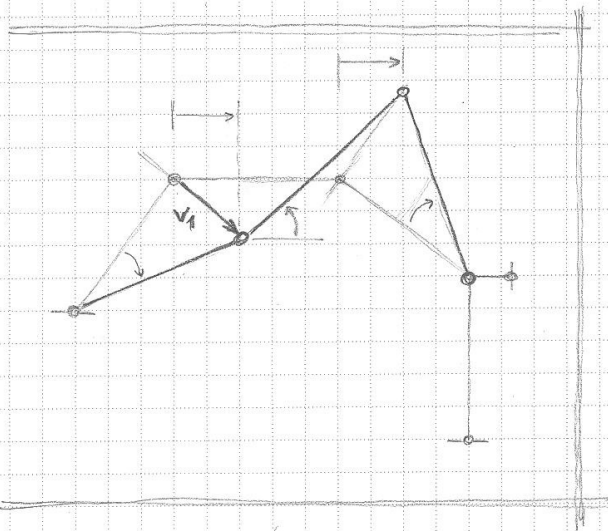
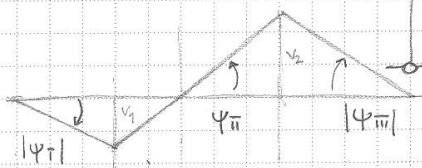
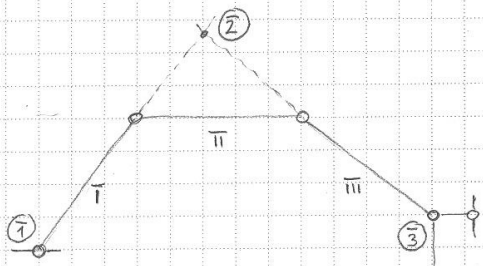


$H = 75 \text{ kN}$
 $F^v = 75 \text{ kN}$
 $F^\perp = 100 \text{ kN}$
 $M = 125 \text{ kNm}$
 $E = \text{const.}$

NEP.: $\psi_3, \psi_4, u_{2,3}, u_{4,3}$

$S = 3 \cdot 2 - 4 = 2$





$$\psi_I = -\frac{u_{\{2,3\}}}{4}$$

$$\psi_{II} = -\frac{u_{\{2,3\}}}{3}$$

$$v_1 = \psi_I \cdot 3 = \frac{3}{4} u_{\{2,3\}}$$

$$v_2 = \psi_{II} \cdot 4 = \frac{4}{3} u_{\{2,3\}}$$

$$\psi_{II} = \frac{v_1 + v_2}{5} = \frac{5}{12} u_{\{2,3\}}$$

$$\frac{3}{4} + \frac{4}{3} = \frac{9+16}{12} = \frac{25}{12}$$

$$\frac{4}{3} x_1 = \frac{3}{4} x_2 \quad x_1 = \frac{9}{16} x_2$$

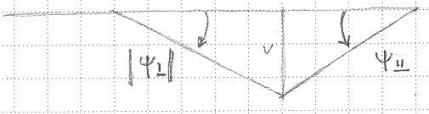
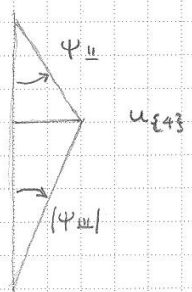
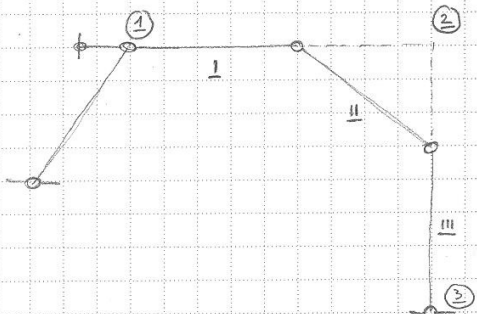
$$x_1 + x_2 = 5$$

$$\frac{9}{16} x_2 + \frac{16}{16} x_2 = 5 \quad \frac{25}{16} x_2 = 5$$

$$x_2 = \frac{16}{5}$$

$$y = \frac{3}{4} x_2 = \frac{12}{5} \quad \psi_{II} = \frac{u_{\{2,3\}}}{y}$$

$$\psi_{II} = \frac{5}{12} u_{\{2,3\}}$$

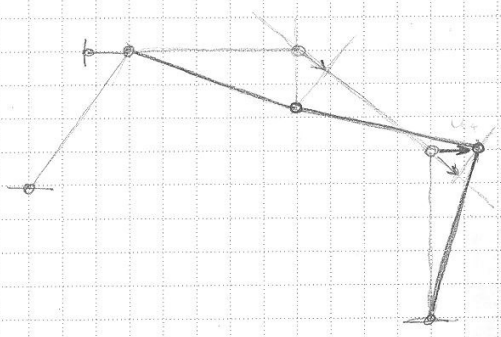


$$\psi_{III} = -\frac{u_{\xi 43}}{5}$$

$$\psi_{II} = \frac{u_{\xi 43}}{3}$$

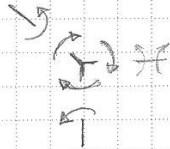
$$v = \psi_{II} \cdot 4 = \frac{4}{3} u_{\xi 43}$$

$$\psi_{I} = -\frac{v}{5} = -\frac{4}{15} u_{\xi 43}$$



$$\textcircled{1} \quad \sum M_{/3} = 0 \quad M_{32} + M_{34} = 0$$

$$\textcircled{2} \quad \sum M_{/4} = 0 \quad M_{43} + M_{45} + \underline{\underline{M}} = 0$$



$$\textcircled{3} \quad \sum W_{/u_{\{2,3\}}^{(1)}} = 0$$

$$M_{12} \cdot \psi_I^{(1)} + M_{32} \psi_{II}^{(1)} + (M_{34} + M_{43}) \psi_{III}^{(1)} \\ + H \cdot \bar{\delta}_H + F^V \cdot \bar{\delta}_{F^V} + (F^V \cdot 2) \cdot \psi_{II}^{(1)} + F^\perp \cdot \bar{\delta}_{F^\perp} = 0$$

$$\textcircled{4} \quad \sum W_{/u_{\{4,3\}}^{(1)}} = 0$$

$$M_{32} \cdot \psi_I^{(1)} + (M_{34} + M_{43}) \cdot \psi_{II}^{(1)} + M_{45} \psi_{III}^{(1)} \\ + (F^V \cdot 2) \cdot \psi_I^{(1)} + F^\perp \cdot \bar{\delta}_{F^\perp} = 0$$

$$M_{12} = -3k_{12} \psi_{12} + \bar{M}_{12}^c$$

$$M_{32} = 3k_{23} \psi_3 - 3k_{23} \psi_{23} + \bar{M}_{32}^c$$

$$M_{34} = 4k_{34} \psi_3 + 2k_{34} \psi_4 - 6k_{34} \psi_{34} + \bar{M}_{34}$$

$$M_{43} = 2k_{34} \psi_3 + 4k_{34} \psi_4 - 6k_{34} \psi_{34} + \bar{M}_{43}$$

$$M_{45} = 3k_{45} \psi_4 - 3k_{45} \psi_{45}$$

$$\psi_{12} = \psi_I = -\frac{u_{\{2,3\}}}{4}$$

$$\psi_{23} = \psi_{II} + \psi_I = \frac{5}{12} u_{\{2,3\}} - \frac{4}{15} u_{\{4,3\}}$$

$$\psi_{34} = \psi_{III} + \psi_{II} = -\frac{u_{\{2,3\}}}{3} + \frac{u_{\{4,3\}}}{3}$$

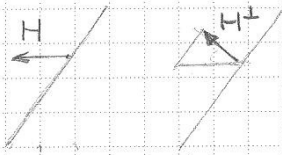
$$\psi_{45} = \psi_{III} = -\frac{u_{\{4,3\}}}{5}$$

$$\bar{M}_{34} = \frac{F^\perp \cdot 5}{8}$$

$$\bar{M}_{43} = -\frac{F^\perp \cdot 5}{8}$$

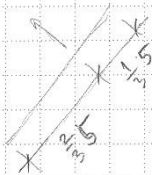
$$\bar{M}_{34} = 62,5 \text{ kNm}$$

$$\bar{M}_{43} = -62,5 \text{ kNm}$$



$$\frac{H^\perp}{H} = \frac{4}{5}$$

$$H^\perp = \frac{4}{5} H = 60 \text{ kN}$$



$$\bar{M}_{12}^c = \bar{M}_{12} - \frac{1}{2} \bar{M}_{21}$$

$$= \frac{-H^\perp \cdot (\frac{2}{3} \cdot 5) (\frac{1}{3} \cdot 5)^2}{5^2} + \frac{1}{2} \frac{-H^\perp (\frac{2}{3} \cdot 5)^2 (\frac{1}{3} \cdot 5)}{5^2}$$

$$= -44,44 \text{ kNm}$$

$$\bar{M}_{32}^c = \frac{1}{2} (F^\perp \cdot 2) = 75 \text{ kNm}$$



$$k_{12} = \frac{EJ}{5} = k \quad k_{23} = \frac{2EJ}{5} = 2k \quad k_{34} = \frac{2EJ}{5} = 2k \quad k_{45} = \frac{EJ}{5} = k$$

$$\textcircled{1} \left[3 \cdot 2k \varphi_3 - 3 \cdot 2k \psi_{23} + \bar{M}_{32}^c \right] + \left[4 \cdot 2k \varphi_4 + 2 \cdot 2k \varphi_4 - 6 \cdot 2k \psi_{34} + \bar{M}_{34} \right] = 0$$

$$14k \varphi_3 + 4k \varphi_4 - 6k \left(\frac{5}{12} u_{\{2,3\}} - \frac{4}{15} u_{\{4,3\}} \right)$$

$$- 12k \left(-\frac{u_{\{2,3\}}}{3} + \frac{u_{\{4,3\}}}{3} \right) = -62,5 - 75$$

$$14k \varphi_3 + 4k \varphi_4 + \frac{3}{2}k u_{\{2,3\}} - \frac{12}{5}k u_{\{4,3\}} = -137,5 \quad ||$$

$$\textcircled{2} \left[2 \cdot 2k \varphi_3 + 4 \cdot 2k \varphi_4 - 6 \cdot 2k \psi_{34} + \bar{M}_{43} \right]$$

$$+ \left[3 \cdot k \cdot \varphi_4 - 3k \psi_{45} \right] + M = 0$$

$$4k \varphi_3 + 11k \varphi_4 - 12k \left(-\frac{u_{\{2,3\}}}{3} + \frac{u_{\{4\}}}{3} \right) - 3k \left(-\frac{u_{\{4\}}}{5} \right) = -125 - (-62,5)$$

$$4k \varphi_3 + 11k \varphi_4 + 4k u_{\{2,3\}} - \frac{17}{5}k u_{\{4\}} = -62,5$$

$$\begin{aligned} \textcircled{3} & \left[-3k \varphi_{12} + \overline{M}_{12}^c \right] \cdot \varphi_I^{(1)} \\ & + \left[3 \cdot 2k \varphi_3 - 3 \cdot 2k \varphi_{23} + \overline{M}_{32}^c \right] \cdot \varphi_{II}^{(1)} \\ & + \left[6 \cdot 2k \cdot \varphi_3 + 6 \cdot 2k \varphi_4 - 12 \cdot 2k \varphi_{34} + \overline{M}_{34} + \overline{M}_{43} \right] \varphi_{III}^{(1)} \\ & + H \cdot \left(\frac{1}{2} \right) + F^v \cdot \frac{3}{4} + (F^v \cdot 2) \cdot \frac{5}{12} + F^+ \cdot \left(-\frac{2}{3} \right) + F_n^+ \cdot \left(-\frac{1}{2} \right) = 0 \end{aligned}$$

$$\begin{aligned} & \left[-3k \left(-\frac{u_{\{2,3\}}}{4} \right) - 44,44 \right] \cdot \left(-\frac{1}{4} \right) \\ & + \left[6k \varphi_3 - 6k \left(\frac{5}{12} u_{\{2,3\}} - \frac{4}{15} u_{\{4\}} \right) + 75 \right] \left(\frac{5}{12} \right) \\ & + \left[12k \varphi_3 + 12k \varphi_4 - 24k \left(-\frac{u_{\{2,3\}}}{3} + \frac{u_{\{4\}}}{3} \right) \right] \left(-\frac{1}{3} \right) \\ & - \frac{2}{3} 75 + \frac{3}{4} 75 + \frac{5}{6} 75 - \frac{2}{3} 80 - \frac{1}{2} 60 = 0 \end{aligned}$$

$$-\frac{3}{2}k \varphi_3 - 4k \varphi_4 - \frac{187}{48}k u_{\{2,3\}} + \frac{10}{3}k u_{\{4\}} = -3,47 - 31,25$$

$$= -27,78$$

$$\begin{aligned} \textcircled{4} & \left[3 \cdot 2k \cdot \varphi_3 - 3 \cdot 2k \varphi_{23} + \overline{M}_{32}^c \right] \cdot \varphi_I^{(1)} \\ & + \left[6 \cdot 2k \cdot \varphi_3 + 6 \cdot 2k \varphi_4 - 12 \cdot 2k \cdot \varphi_{34} \right] \varphi_{II}^{(1)} \\ & + \left[3k \varphi_4 - 3k \varphi_{45} \right] \cdot \varphi_{III}^{(1)} \\ & + (F^v \cdot 2) \varphi_I^{(1)} + F_n^+ \cdot \left(\frac{1}{2} \cdot \frac{4}{3} \right) + F_n^+ \cdot \left(-\frac{1}{2} \cdot 1 \right) = 0 \end{aligned}$$

$$\begin{aligned}
& \left[6k \varphi_3 - 6k \left(\frac{5}{12} u_{\{2,3\}} - \frac{4}{15} u_{\{4\}} \right) + 75 \right] \cdot \left(-\frac{4}{15} \right) \\
& + \left[12k \varphi_3 + 12k \varphi_4 - 24k \left(-\frac{u_{\{2,3\}}}{3} + \frac{u_{\{4\}}}{3} \right) \right] \cdot \left(\frac{1}{3} \right) \\
& + \left[3k \varphi_4 - 3k \left(-\frac{u_{\{4\}}}{5} \right) \right] \cdot \left(-\frac{1}{5} \right) \\
& + 150 \cdot \left(-\frac{4}{15} \right) + 80 \cdot \frac{2}{3} + 60 \cdot \left(-\frac{1}{2} \right) = 0 \qquad 16,67 + 20
\end{aligned}$$

$$\frac{12}{5} k \varphi_3 + \frac{17}{5} k \varphi_4 + \frac{10}{3} k u_{\{2,3\}} - \frac{241}{75} k u_{\{4\}} = 36,67$$

$$k \begin{bmatrix} 14 & 4 & 3/2 & -12/5 \\ 4 & 11 & 4 & -17/5 \\ -3/2 & -4 & -187/48 & 10/3 \\ 12/5 & 17/5 & 10/3 & -241/75 \end{bmatrix} \begin{bmatrix} \varphi_3 \\ \varphi_4 \\ u_{\{2,3\}} \\ u_{\{4\}} \end{bmatrix} = \begin{bmatrix} -137,5 \\ -62,5 \\ -27,78 \\ 36,67 \end{bmatrix}$$

$$k \begin{bmatrix} 14 & 4 & 3/2 & -12/5 \\ 4 & 11 & 4 & -17/5 \\ 3/2 & 4 & 187/48 & -10/3 \\ -12/5 & -17/5 & -10/3 & 241/75 \end{bmatrix} \begin{bmatrix} \varphi_3 \\ \varphi_4 \\ u_{\{2,3\}} \\ u_{\{4\}} \end{bmatrix} = \begin{bmatrix} -137,5 \\ -62,5 \\ 27,78 \\ -36,67 \end{bmatrix}$$

$$\varphi_3 = -17,135/k$$

$$\varphi_4 = -6,803/k$$

$$u_{\{2,3\}} = -54,789/k$$

$$u_{\{4\}} = -88,243/k$$

$$M_{12} = -85,53 \text{ kNm}$$

$$M_{32} = -32,02 \text{ kNm}$$

$$M_{34} = 32,02 \text{ kNm}$$

$$M_{43} = -51,65 \text{ kNm}$$

$$M_{45} = -73,35 \text{ kNm}$$

