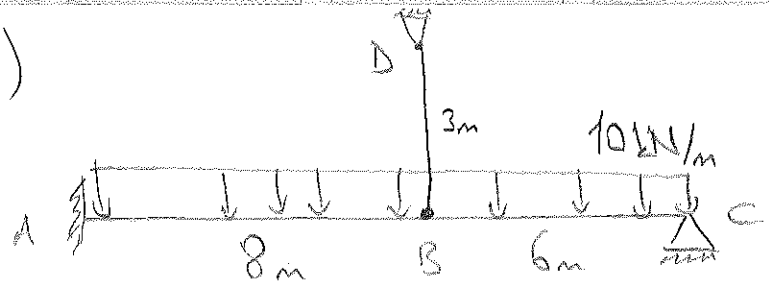
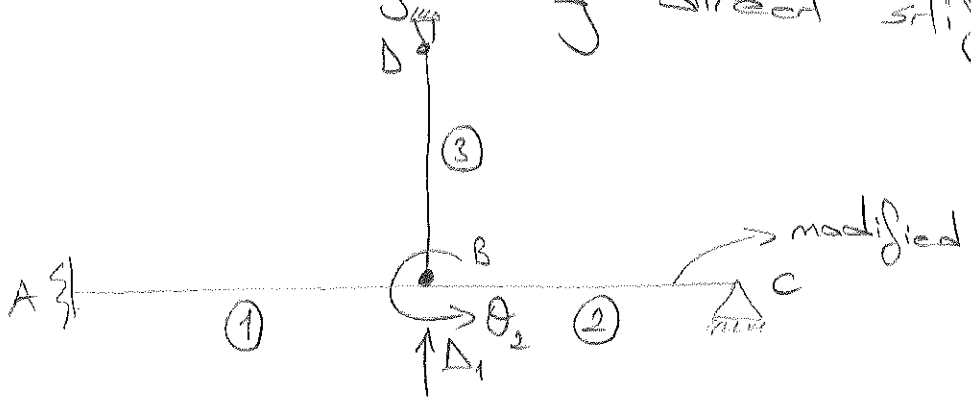
1)



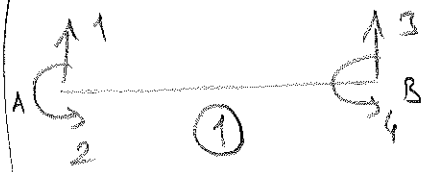
$EI_{beam} = 100.000\ kN.m^2$

$EA_{truss} = 10.000\ N$

Find support reactions at support A by using direct stiffness method.

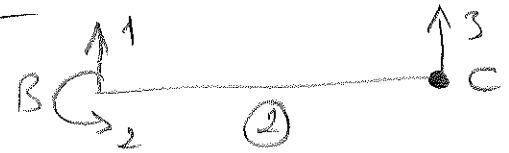


$$k_1 = \begin{bmatrix} \frac{12EI}{L^3} & \frac{6EI}{L^2} & -\frac{12EI}{L^3} & \frac{6EI}{L^2} \\ & \frac{4EI}{L} & -\frac{6EI}{L^2} & \frac{2EI}{L} \\ & & \frac{12EI}{L^3} & -\frac{6EI}{L^2} \\ \text{Symmetrical} & & & \frac{4EI}{L} \end{bmatrix}$$

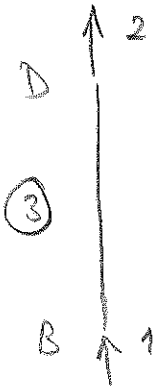


$$k_1 = \begin{bmatrix} 2,344 & 9,375 & -2,344 & 9,375 \\ & 50 & -9,375 & 25 \\ & & 2,344 & -9,375 \\ & & -9,375 & 50 \end{bmatrix} .10^3 \quad \begin{matrix} 1 \\ 2 \\ 1 \\ 2 \end{matrix}$$

$$k_2 = \begin{bmatrix} \frac{3EI}{L^3} & \frac{3EI}{L^2} & -\frac{3EI}{L^3} \\ & \frac{3EI}{L} & -\frac{3EI}{L^2} \\ & & \frac{3EI}{L^3} \end{bmatrix} = \begin{bmatrix} 1,383 & 8,333 & -1,383 \\ 8,333 & 50 & -8,333 \\ & & 1,383 \end{bmatrix} .10^3 \quad \begin{matrix} 1 \\ 2 \\ \cdot \end{matrix}$$



$$k_3 = \frac{EA}{L} \cdot \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \begin{matrix} 1 \\ 2 \end{matrix} \begin{bmatrix} \boxed{3,333} & -3,333 \\ -3,333 & 3,333 \end{bmatrix} \cdot 10^3$$

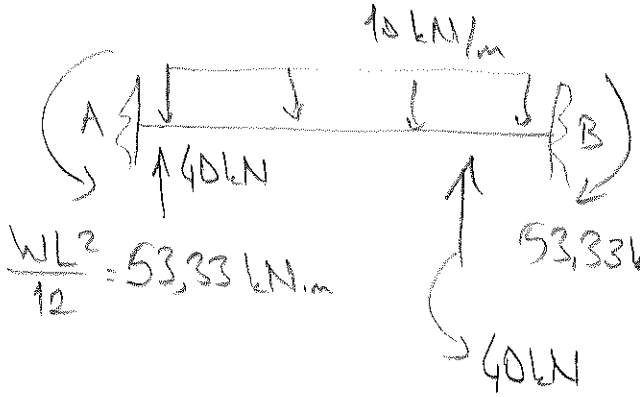


Form the structural stiffness matrix.

$$K_{str} = \begin{matrix} \\ 1 \\ 2 \end{matrix} \begin{bmatrix} \overset{1}{2,334 + 1,389 + 3,333} & \overset{2}{-3,375 + 8,333} \\ -3,375 + 8,333 & 50 + 50 \end{bmatrix} \cdot 10^3$$

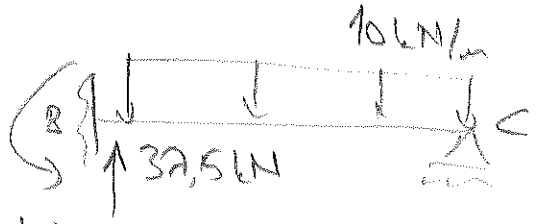
$$K_{str} = \begin{bmatrix} 7,056 & -1,042 \\ -1,042 & 100 \end{bmatrix} \cdot 10^3$$

Form structural force vector.



$\frac{WL^2}{12} = 53,33\ kN.m$

$53,33\ kN.m$



$\frac{WL^2}{8} = 45\ kN.m$

$$f_{str} = \begin{bmatrix} -1.(40+37,5) \\ -1.(45-53,33) \end{bmatrix} = \begin{bmatrix} -77,5\,kN \\ 8,33\,kN.m \end{bmatrix} \begin{matrix} 1 \\ 2 \end{matrix}$$

$$\Delta = K_{str}^{-1} \cdot f_{str} = \begin{bmatrix} -0,01099\,m \\ -3,12.10^{-5}\,rad \end{bmatrix}$$

$$f_A = FEM + k_{..u} = \begin{bmatrix} 40 \\ 53,33 \\ 40 \\ -53,33 \end{bmatrix} + \begin{bmatrix} 2,344 & 9,375 & -2,344 & 9,375 \\ & 50 & -9,375 & 25 \\ \text{Symmetrical} & & 2,344 & -9,375 \\ & & & 50 \end{bmatrix} .10^3 \cdot \begin{bmatrix} 0 \\ 0 \\ -0,01099 \\ -3,12.10^{-5} \end{bmatrix}$$

$$f_A = \begin{bmatrix} 65,47\,kN \\ 155,58\,kN.m \\ 14,53\,kN \\ 48,14\,kN.m \end{bmatrix}$$

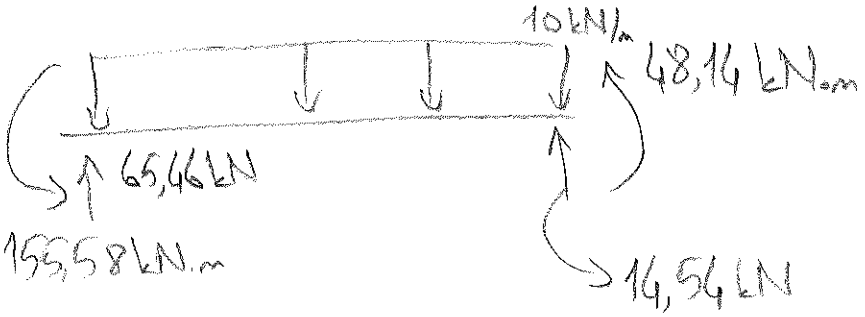
II. way: $M_{AB} = FEM_{AB} + \frac{2EI}{8} \cdot \left(2.\theta_A + \theta_2 + \frac{3\Delta_1}{8} \right)$

$$M_{AB} = 53,33 + 2.\frac{100.000}{8} \cdot \left(-3,12.10^{-5} + \frac{3.0,01099}{8} \right)$$

$$M_{AB} = 155,58\,kN.m$$

$$M_{BA} = FEM_{BA} + \frac{2EI}{8} \cdot \left(2.\theta_2 + \theta_A + \frac{3\Delta_1}{8} \right)$$

$$M_{BA} = -53,33 + \frac{2.100.000}{8} \cdot \left(2.-3,12.10^{-5} + \frac{3.0,01099}{8} \right) = 48,14\,kN.m$$ (3)


10kN/m
48,14 kN.m
65,46kN
155,58kN.m
14,54 kN