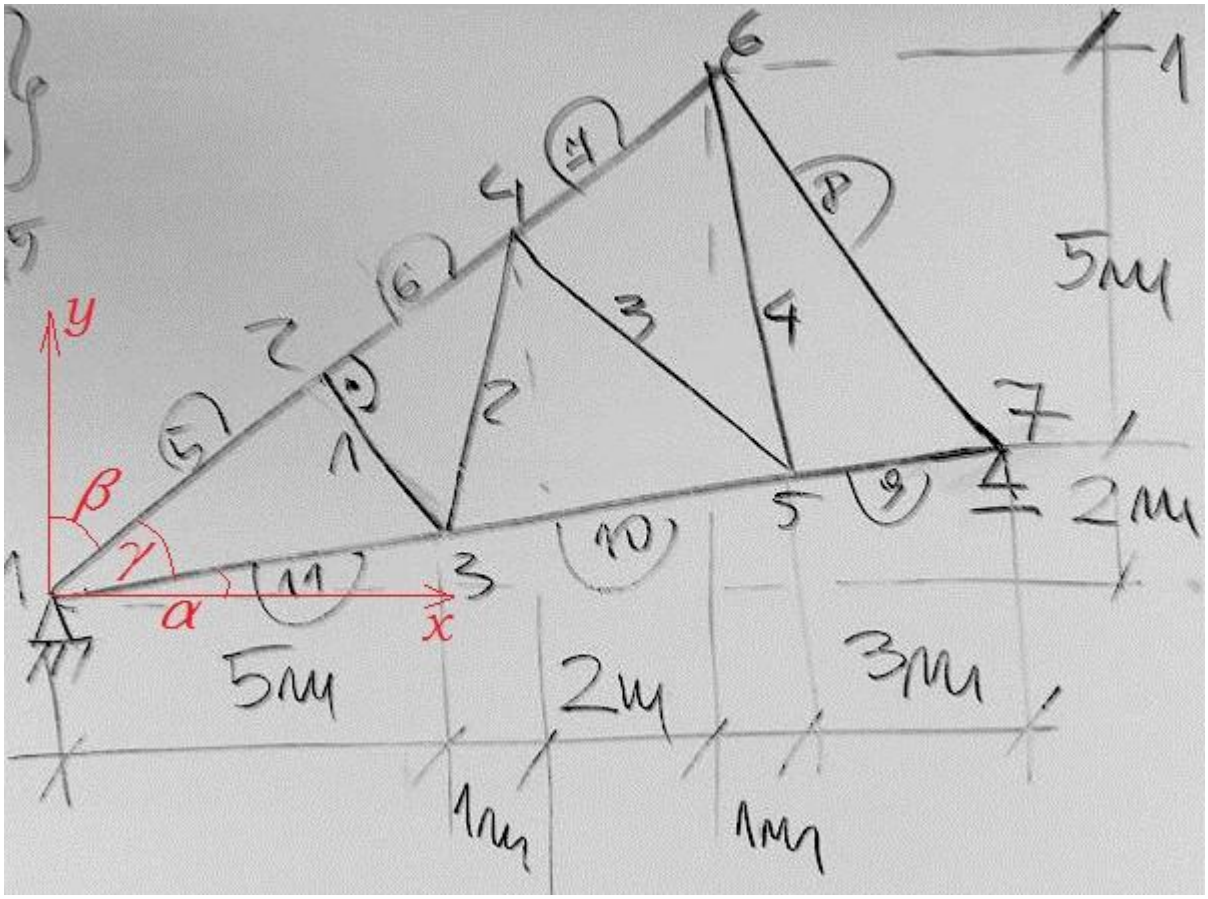
1B - Macierze sztywności elementów kratownicy



elementy := (1 , 2 , 3 , 4) EA := 23MN *dokładnść ±0.5kN/m*

$\alpha := \operatorname{atan}\left(\frac{2}{12}\right) = 9.462 \cdot \mathrm{deg}$

$\beta := \operatorname{atan}\left(\frac{8}{7}\right) = 48.814 \cdot \mathrm{deg}$

$\gamma := \frac{\pi}{2} - \alpha - \beta = 31.7236 \cdot \mathrm{deg}$

$Y3 := 2\mathrm{m} \cdot \frac{5}{12} = 0.833\,\mathrm{m}$ $Y4 := 7\mathrm{m} \cdot \frac{6}{8} = 5.25\,\mathrm{m}$ $Y5 := 2\mathrm{m} \cdot \frac{9}{12} = 1.5\,\mathrm{m}$

$L11 := \sqrt{(5\mathrm{m})^2 + (Y3)^2} = 5.06897\,\mathrm{m}$ $L5 := L11 \cdot \cos(\gamma) = 4.31164\,\mathrm{m}$

$X2 := L5 \cdot \sin(\beta) = 3.24484\,\mathrm{m}$ $Y2 := Y5 \cdot \cos(\beta) = 0.98776\,\mathrm{m}$

Element "1" - blok macierzy sztywności

$Lx := 5m - X2 = 1.75516\,m$ $\qquad$ $Ly := Y3 - Y2 = -0.154424\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 1.761942\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{bmatrix} 12954 & -1140 \\ (-1140) & 100 \end{bmatrix} \frac{kN}{m}$$

Element "2" - blok macierzy sztywności

$Lx := 1m = 1\,m$ $\qquad$ $Ly := Y4 - Y3 = 4.416667\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.528459\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{bmatrix} 248 & 1094 \\ (1094) & 4831 \end{bmatrix} \frac{kN}{m}$$

Element "3" - blok macierzy sztywności

$Lx := 3m$ $\qquad$ $Ly := Y5 - Y4 = -3.750000\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.802343\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{bmatrix} 1869 & -2336 \\ (-2336) & 2920 \end{bmatrix} \frac{kN}{m}$$

Element "4" - blok macierzy sztywności

$Lx := 1m = 1\,m$ $\qquad$ $Ly := Y5 - 7m = -5.500000\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.59017\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{bmatrix} 132 & -724 \\ (-724) & 3983 \end{bmatrix} \frac{kN}{m}$$