

ORIGIN := 1

B1

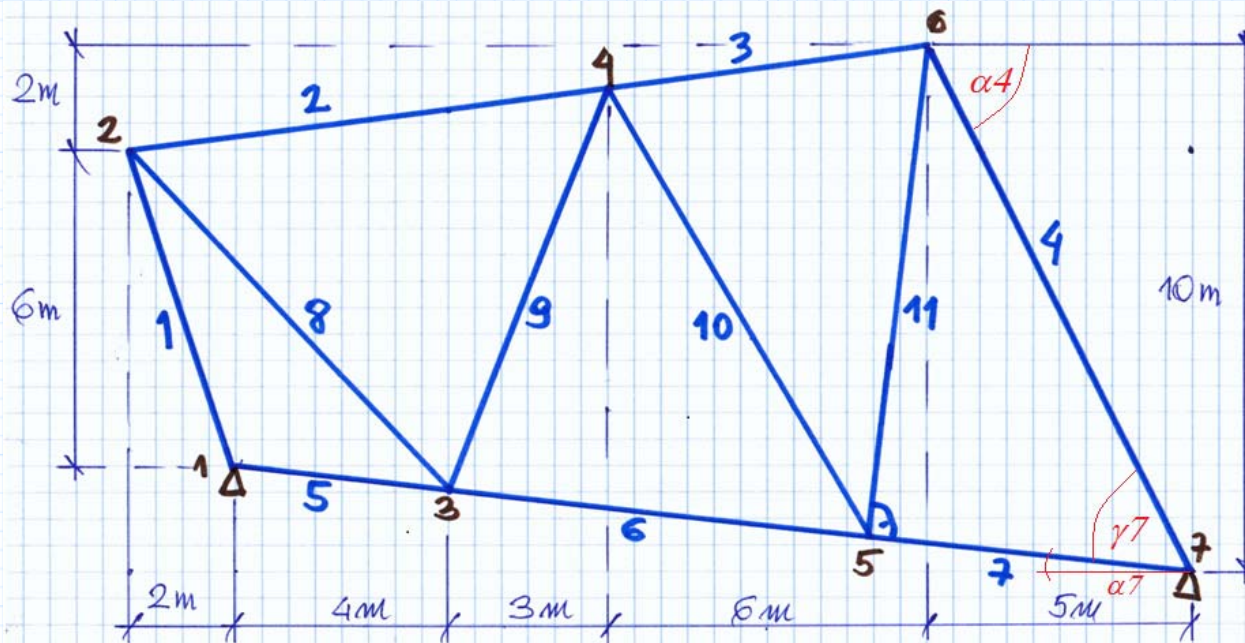
$EA := 31 \text{ MN}$

Elementy: 2, 8, 9, 11

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

$$J(Lx, Ly) := \frac{EA}{L(Lx, Ly)^3} \begin{bmatrix} Lx^2 & Lx \cdot Ly \\ Lx \cdot Ly & Ly^2 \end{bmatrix}$$

Wyznaczyć bloki J macierzy sztywności elementów (2,7,9,10) kratownicy płaskiej.
Sładowe macierze podać z dokładnością do +/- 0.05 kN/m



$$\alpha 7 := \text{atan}\left(\frac{2}{18}\right) = 6.34019 \text{ deg}$$

$$\alpha 4 := \text{atan}\left(\frac{10}{5}\right) = 63.43495 \text{ deg}$$

$$\gamma 7 := \alpha 4 - \alpha 7 = 57.09476 \text{ deg}$$

$$l 4 := \sqrt{5^2 + 10^2} \text{ m} = 11.18034 \text{ m}$$

$$l 7 := l 4 \cdot \cos(\gamma 7) = 6.07373 \text{ m}$$

$$Y 5 := -2 \text{ m} + l 7 \cdot \sin(\alpha 7) = -1.32927 \text{ m} \quad X 5 := 18 \text{ m} - l 7 \cdot \cos(\alpha 7) = 11.96341 \text{ m}$$

Element "2"

$$Lx := 9 \text{ m} = 9 \text{ m}$$

$$Ly := 2 \text{ m} \cdot \frac{9}{15} = 1.20000 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 9.079648 \text{ m}$$

$$J^2 = \begin{bmatrix} 3354.6 & 447.3 \\ 447.3 & 59.6 \end{bmatrix} \frac{kN}{m}$$

Element "8"

$$Y3 := -2 \text{ m} \cdot \frac{4}{18} = -0.44444 \text{ m}$$

$$Y3 := -3 \text{ m} \cdot \frac{6}{14} = -1.28571 \text{ m}$$

$$Lx := 6 \text{ m}$$

$$Ly := Y3 - 6 \text{ m} = -6.444444 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 8.805161 \text{ m}$$

$$J^8 = \begin{bmatrix} 1634.8 & -1755.8 \\ -1755.8 & 1885.9 \end{bmatrix} \frac{kN}{m}$$

$$Y4 := 6 \text{ m} + 2 \text{ m} \cdot \frac{9}{15} = 7.20000 \text{ m}$$

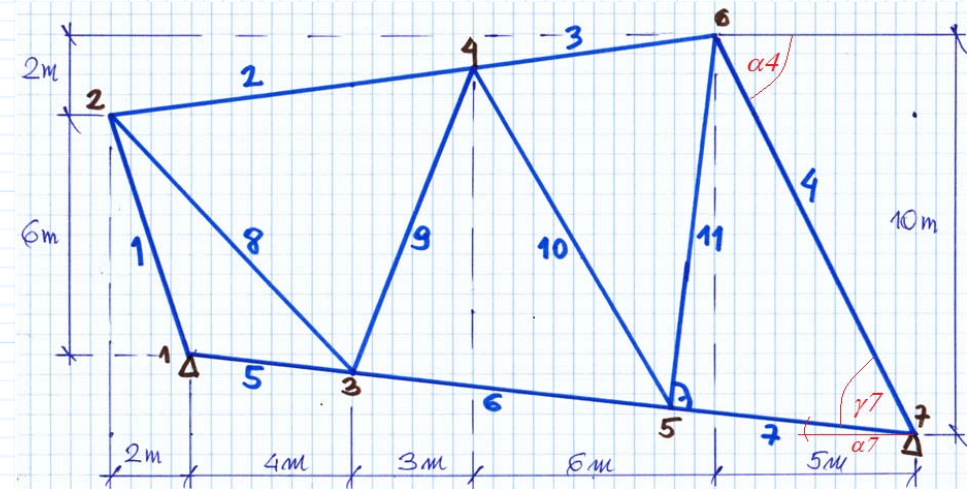
Element "9"

$$Lx := 3 \text{ m} = 3 \text{ m}$$

$$Ly := Y4 - Y3 = 7.644444 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 8.212036 \text{ m}$$

$$J^9 = \begin{bmatrix} 503.8 & 1283.7 \\ 1283.7 & 3271.2 \end{bmatrix} \frac{kN}{m}$$



Element "11"

$$Lx := 13 \text{ m} - X5 = 1.036585 \text{ m}$$

$$Ly := 8 \text{ m} - Y5 = 9.329268 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 9.386680 \text{ m}$$

$$J^{11} = \begin{bmatrix} 40.3 & 362.5 \\ 362.5 & 3262.3 \end{bmatrix} \frac{kN}{m}$$

