

ORIGIN := 1

B2

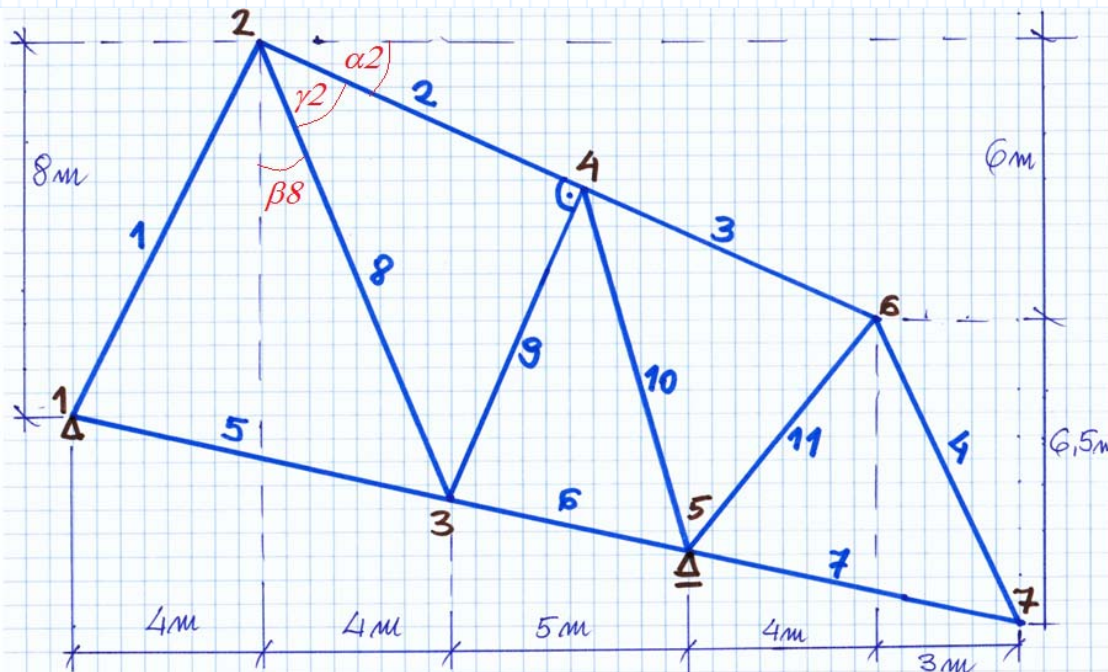
EA := 31 MN

Elementy: 1, 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



$$Y3 := -4.5 \text{ m} \cdot \frac{8}{20} = -1.80000 \text{ m}$$

$$\alpha2 := \text{atan}\left(\frac{6}{13}\right) = 24.77514 \text{ deg}$$

$$\beta8 := \text{atan}\left(\frac{4}{8 - \frac{Y3}{m}}\right) = 22.20348 \text{ deg}$$

$$\gamma2 := \frac{\pi}{2} - (\alpha2 + \beta8) = 43.02138 \text{ deg}$$

$$l8 := \sqrt{4^2 + \left(8 - \frac{Y3}{m}\right)^2} \text{ m} = 10.584895 \text{ m}$$

$$l2 := l8 \cdot \cos(\gamma2) = 7.73861 \text{ m}$$

$$Y4 := 8 \text{ m} - l2 \cdot \sin(\alpha2) = 4.75707 \text{ m}$$

$$X4 := 4 \text{ m} + l2 \cdot \cos(\alpha2) = 11.02634 \text{ m}$$

Element "1"

$$Lx := 4 \text{ m} = 4.00000 \text{ m}$$

$$Ly := 8 \text{ m} = 8.00000 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 8.944272 \text{ m}$$

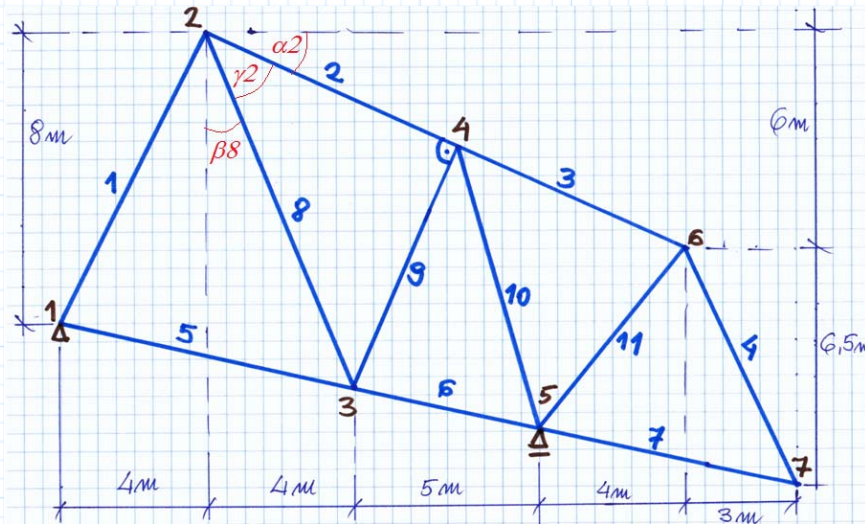
$$J^1 = \begin{bmatrix} 693.2 & 1386.4 \\ 1386.4 & 2772.7 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

Element "8"

$$Lx := 4 \text{ m} \quad Ly := Y3 - 8 \text{ m} = -9.800000 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 10.584895 \text{ m}$$

$$J^8 = \begin{bmatrix} 418.2 & -1024.7 \\ -1024.7 & 2510.5 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$



Element "9"

$$Lx := X4 - 8 \text{ m} = 3.026341 \text{ m}$$

$$Ly := Y4 - Y3 = 6.557073 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 7.221769 \text{ m}$$

$$J^9 = \begin{bmatrix} 753.8 & 1633.3 \\ 1633.3 & 3538.8 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

$$Y6 := 2 \text{ m} \quad Y5 := -4.5 \text{ m} \cdot \frac{13}{20} = -2.92500 \text{ m}$$

Element "11"

$$Lx := 4 \text{ m} = 4 \text{ m}$$

$$Ly := Y6 - Y5 = 4.925000 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.344732 \text{ m}$$

$$J^{11} = \begin{bmatrix} 1942 & 2391 \\ 2391 & 2944 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

