

ORIGIN := 1

Elementy: 2, 7, 8, 10

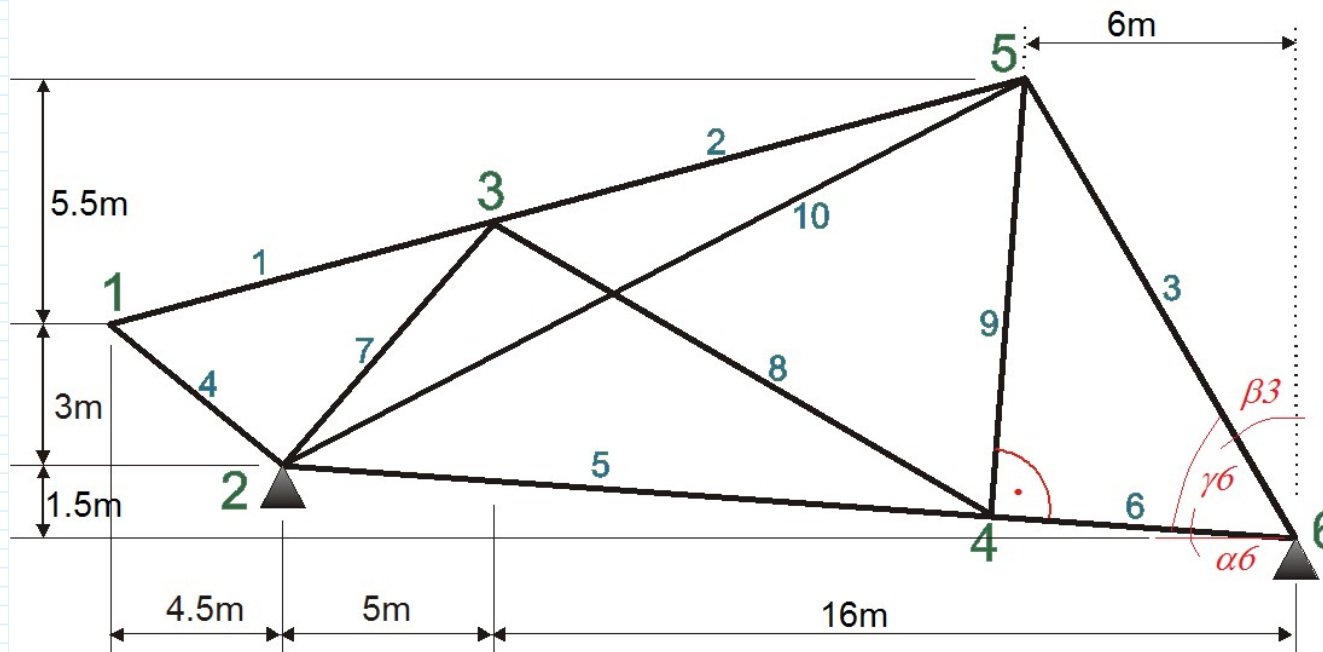
B

$EA := 29 \text{ MN}$

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

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

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



$$\alpha 6 := \operatorname{atan}\left(\frac{1.5}{21}\right) = 4.08562 \text{ deg}$$

$$\beta 3 := \operatorname{atan}\left(\frac{6}{10}\right) = 30.96376 \text{ deg}$$

$$\gamma 6 := \frac{\pi}{2} - \alpha 6 - \beta 3 = 54.95063 \text{ deg}$$

$$l 3 := \sqrt{6^2 + 10^2} \text{ m} = 11.661904 \text{ m}$$

$$l 6 := l 3 \cdot \cos(\gamma 6) = 6.697223 \text{ m}$$

$$Y 3 := 3 \text{ m} + 5.5 \text{ m} \cdot \frac{9.5}{19.5} = 5.679487 \text{ m}$$

$$Y 4 := l 6 \cdot \sin(\alpha 6) - 1.5 \text{ m} = -1.022843 \text{ m}$$

$$X 3 := 5 \text{ m}$$

$$X 4 := 21 \text{ m} - l 6 \cdot \cos(\alpha 6) = 14.319797 \text{ m}$$

Element "2"

$$Lx := 10 \text{ m} = 10 \text{ m}$$

$$Ly := 8.5 \text{ m} - Y3 = 2.82051 \text{ m}$$

$$\bar{L} := \sqrt{(Lx)^2 + (Ly)^2} = 10.390154 \text{ m}$$

$$J^2 = \begin{bmatrix} 2585.4 & 729.2 \\ 729.2 & 205.7 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

Element "7"

$$\bar{L}x := 5 \text{ m} = 5 \text{ m}$$

$$\bar{L}y := Y3 = 5.679487 \text{ m}$$

$$\bar{L} := \sqrt{(\bar{L}x)^2 + (\bar{L}y)^2} = 7.566807 \text{ m}$$

$$J^7 = \begin{bmatrix} 1673.4 & 1900.8 \\ 1900.8 & 2159.1 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

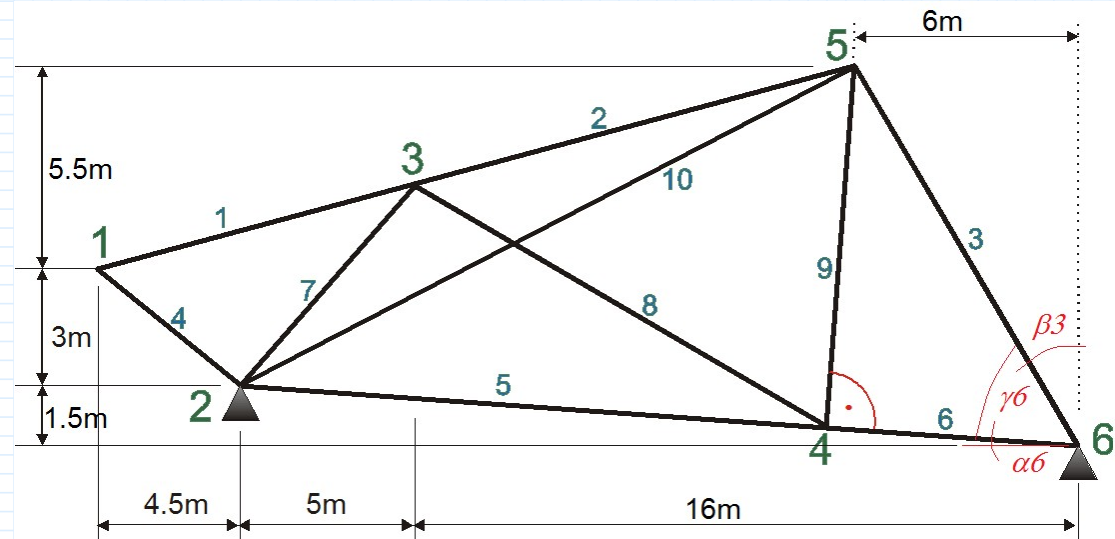
Element "8"

$$\bar{L}x := X4 - 5 \text{ m} = 9.319797 \text{ m}$$

$$\bar{L}y := Y4 - Y3 = -6.70233 \text{ m}$$

$$\bar{L} := \sqrt{(\bar{L}x)^2 + (\bar{L}y)^2} = 11.479540 \text{ m}$$

$$J^8 = \begin{bmatrix} 1665.1 & -1197.4 \\ -1197.4 & 861.1 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$



Element "10"

$$Lx := 15 \text{ m} = 15 \text{ m}$$

$$Ly := 8.5 \text{ m} = 8.5 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 17.240940 \text{ m}$$

$$J^{10} = \begin{bmatrix} 1273.2 & 721.5 \\ 721.5 & 408.8 \end{bmatrix} \frac{kN}{m}$$