

ORIGIN := 1

A1

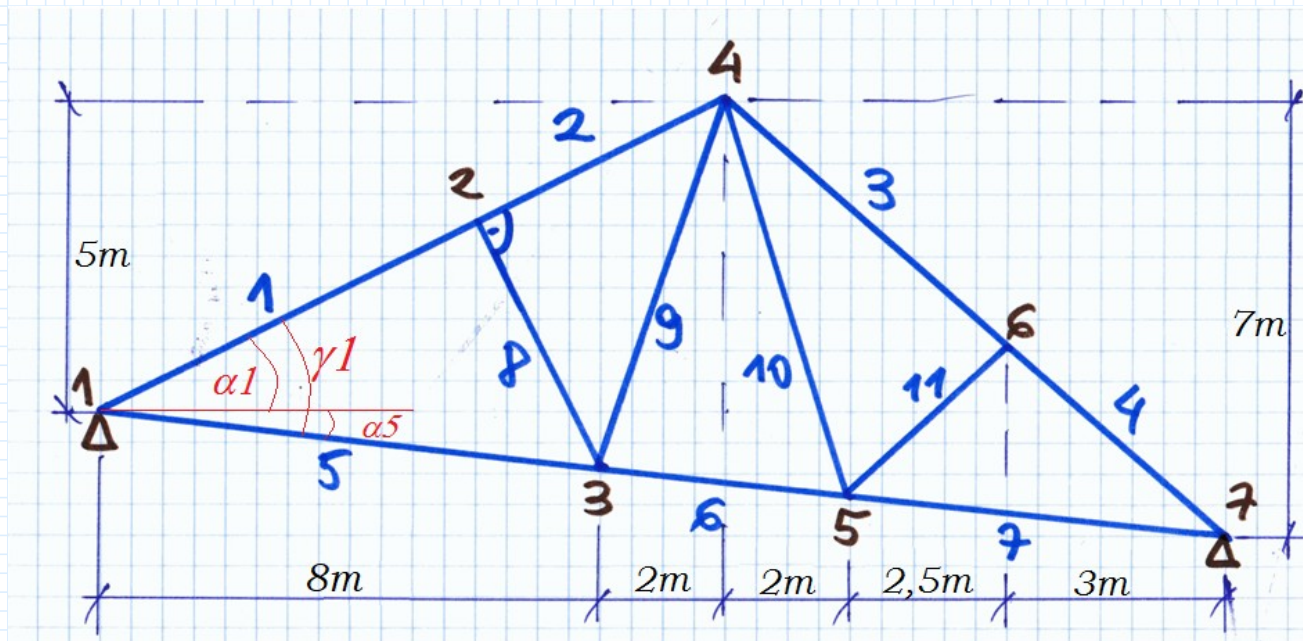
EA := 29 MN

Elementy: 2, 8, 9, 10

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

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

Wyznaczyć bloki **J** macierzy sztywności elementów (2,8,9,10) kratownicy płaskiej.
Sładowe macierze podać z dokładnością do +/- 0.05 kN/m



$$\alpha 1 := \operatorname{atan}\left(\frac{5}{10}\right) = 26.56505 \text{ deg}$$

$$\alpha 5 := \operatorname{atan}\left(\frac{2}{17.5}\right) = 6.51980 \text{ deg}$$

$$\gamma 1 := \alpha 1 + \alpha 5 = 33.08485 \text{ deg}$$

$$l 5 := \sqrt{8^2 + \left(\frac{2 \cdot 8}{17.5}\right)^2} \text{ m} = 8.052075 \text{ m}$$

$$l 1 := l 5 \cdot \cos(\gamma 1) = 6.74654 \text{ m}$$

$$X 2 := l 1 \cdot \cos(\alpha 1) = 6.03429 \text{ m}$$

$$Y 2 := l 1 \cdot \sin(\alpha 1) = 3.01714 \text{ m}$$

Element "2"

$$Lx := 10 \text{ m} - X2 = 3.96571 \text{ m}$$

$$Ly := 5 \text{ m} - Y2 = 1.98286 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.433803 \text{ m}$$

$$J^2 = \begin{bmatrix} 5232.5 & 2616.3 \\ 2616.3 & 1308.1 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

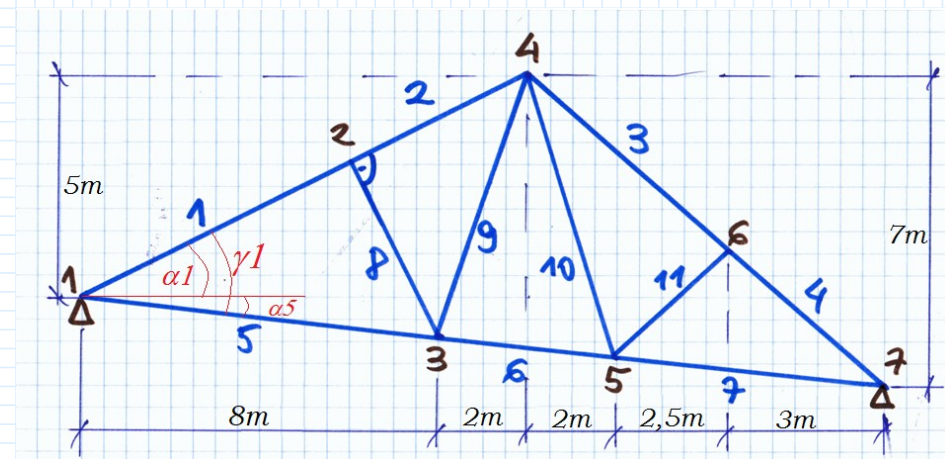
Element "8"

$$Lx := 8 \text{ m} - X2 = 1.965714 \text{ m}$$

$$Ly := -2 \text{ m} \cdot \frac{8}{17.5} - Y2 = -3.931429 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.395471 \text{ m}$$

$$J^8 = \begin{bmatrix} 1319.5 & -2639.1 \\ -2639.1 & 5278.2 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$



Element "9"

$$Lx := 2 \text{ m} = 2 \text{ m}$$

$$Ly := 2 \text{ m} \cdot \frac{8}{17.5} + 5 \text{ m} = 5.914286 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.243298 \text{ m}$$

$$J^9 = \begin{bmatrix} 476.7 & 1409.6 \\ 1409.6 & 4168.3 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

Element "10"

$$\bar{L}x := 2 \text{ m}$$

$$\bar{L}y := -2 \text{ m} \cdot \frac{12}{17.5} - 5 \text{ m} = -6.371429 \text{ m}$$

$$\bar{L} := \sqrt{(\bar{L}x)^2 + (\bar{L}y)^2} = 6.677956 \text{ m}$$

$$J^{10} = \begin{bmatrix} 389.5 & -1240.9 \\ -1240.9 & 3953.1 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

