

ORIGIN := 1

A

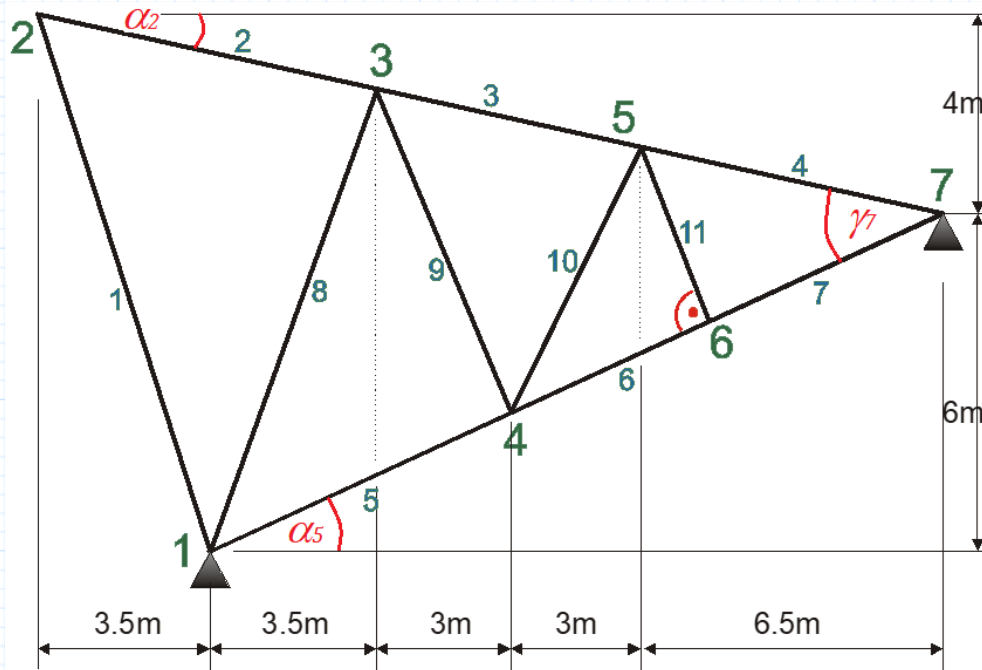
EA := 27 MN

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 kratownicy płaskiej.  
Sładowe macierze podać z dokładnością do +/- 0.05 kN/m



$$\alpha 2 := \text{atan}\left(\frac{4}{19.5}\right) = 11.5921754 \text{ deg}$$

$$\alpha 5 := \text{atan}\left(\frac{6}{16}\right) = 20.5560452 \text{ deg}$$

$$\gamma 7 := \alpha 2 + \alpha 5 = 0.5610923$$

$$l 4 := \frac{6.5 \text{ m}}{\cos(\alpha 2)} = 6.6353431 \text{ m}$$

$$l 11 := l 4 \cdot \sin(\gamma 7) = 3.5307413 \text{ m}$$

$$Y 2 := 10 \text{ m} \quad Y 3 := Y 2 - 4 \text{ m} \cdot \frac{7}{19.5} \quad Y 4 := 6 \text{ m} \cdot \frac{6.5}{16}$$

Element "2"

$$Lx := 7 \text{ m} = 7 \text{ m}$$

$$Ly := Y3 - Y2 = -1.43590 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 7.145754 \text{ m}$$

$$J^2 = \begin{bmatrix} 3625.9 & -743.8 \\ -743.8 & 152.6 \end{bmatrix} \frac{kN}{m}$$

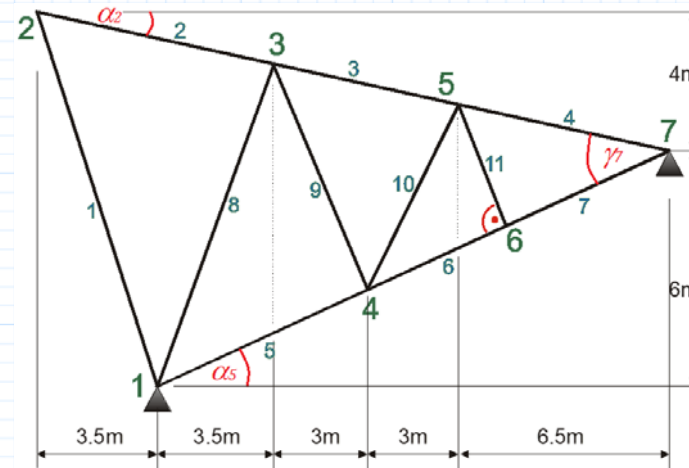
Element "8"

$$Lx := 3.5 \text{ m} = 3.5 \text{ m}$$

$$Ly := Y3 = 8.564103 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 9.251695 \text{ m}$$

$$J^8 = \begin{bmatrix} 417.7 & 1022.0 \\ 1022.0 & 2500.7 \end{bmatrix} \frac{kN}{m}$$



Element "9"

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

$$Ly := Y4 - Y3 = -6.126603 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.821676 \text{ m}$$

$$J^9 = \begin{bmatrix} 765.5 & -1563.3 \\ -1563.3 & 3192.5 \end{bmatrix} \frac{kN}{m}$$

### Element "11"

$$Lx := l_{11} \cdot \sin(\alpha_5) = 1.239726 \text{ m}$$

$$Ly := -l_{11} \cdot \cos(\alpha_5) = -3.305936 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.530741 \text{ m}$$

$$J^{11} = \begin{bmatrix} 942.8 & -2514.1 \\ -2514.1 & 6704.3 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

