

ORIGIN := 1

A1

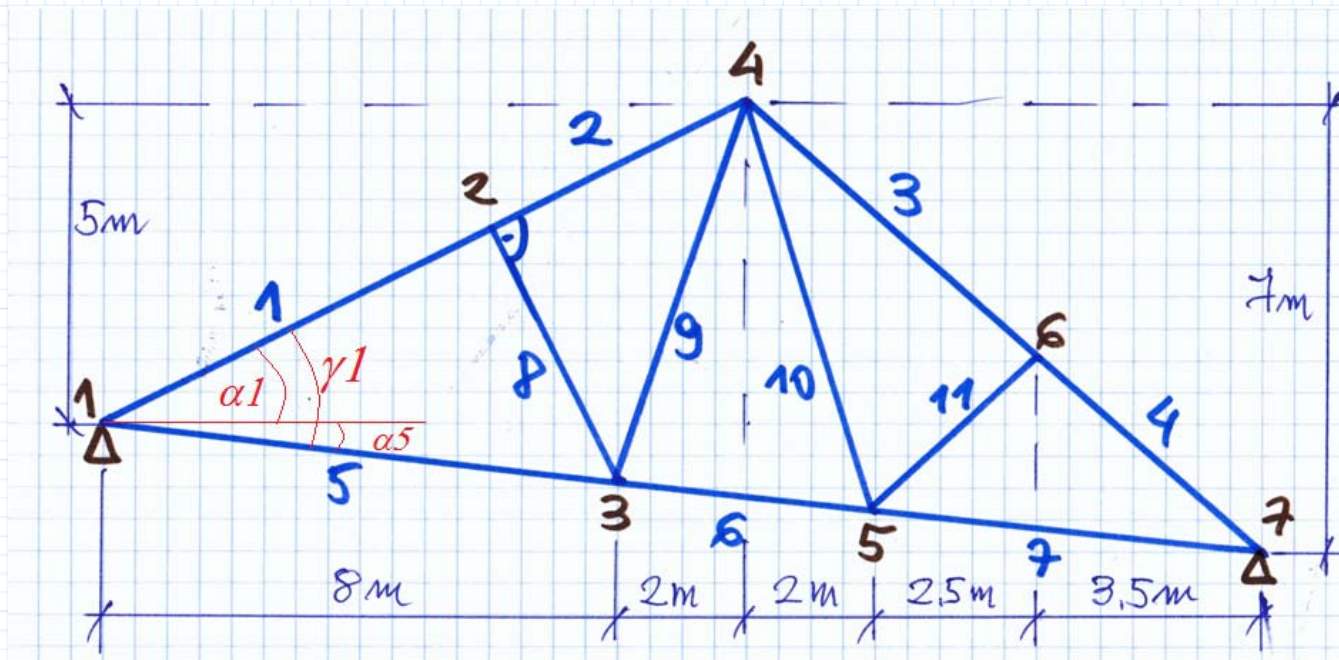
$EA := 32 \text{ MN}$

Elementy: 2, 7, 8, 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 (2,7,9,10) kratownicy płaskiej.  
Sładowe macierze podać z dokładnością do +/- 0.05 kN/m



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

$$\alpha 5 := \operatorname{atan}\left(\frac{2}{18}\right) = 6.34019 \text{ deg}$$

$$\gamma 1 := \alpha 1 + \alpha 5 = 32.90524 \text{ deg}$$

$$l 5 := \sqrt{8^2 + \left(\frac{8}{9}\right)^2} \text{ m} = 8.049231 \text{ m}$$

$$l 1 := l 5 \cdot \cos(\gamma 1) = 6.75789 \text{ m}$$

$$X 2 := l 1 \cdot \cos(\alpha 1) = 6.04444 \text{ m}$$

$$Y 2 := l 1 \cdot \sin(\alpha 1) = 3.02222 \text{ m}$$

### Element "2"

$$Lx := 10 \text{ m} - X2 = 3.95556 \text{ m}$$

$$Ly := 5 \text{ m} - Y2 = 1.97778 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.422446 \text{ m}$$

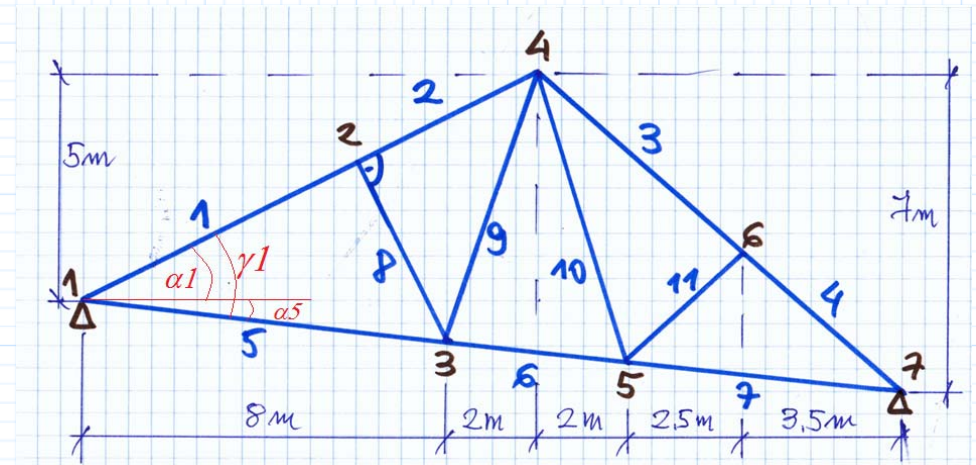
$$J^2 = \begin{bmatrix} 5788.7 & 2894.3 \\ 2894.3 & 1447.2 \end{bmatrix} \frac{kN}{m}$$

### Element "7"

$$Lx := 6 \text{ m} \quad Ly := -2 \text{ m} \cdot \frac{6}{18} = -0.666667 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.036923 \text{ m}$$

$$J^7 = \begin{bmatrix} 5236.1 & -581.8 \\ -581.8 & 64.6 \end{bmatrix} \frac{kN}{m}$$



### Element "8"

$$Lx := 8 \text{ m} - X2 = 1.95556 \text{ m}$$

$$Ly := -2 \text{ m} \cdot \frac{8}{18} - Y2 = -3.911111 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.372755 \text{ m}$$

$$J^8 = \begin{bmatrix} 1463.6 & -2927.2 \\ -2927.2 & 5854.4 \end{bmatrix} \frac{kN}{m}$$

Element "10"

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

$$Ly := -2 \text{ m} \cdot \frac{12}{18} - 5 \text{ m} = -6.333333 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.641620 \text{ m}$$

$$J^{10} = \begin{bmatrix} 436.9 & -1383.5 \\ -1383.5 & 4381.2 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

