

ORIGIN := 1

A

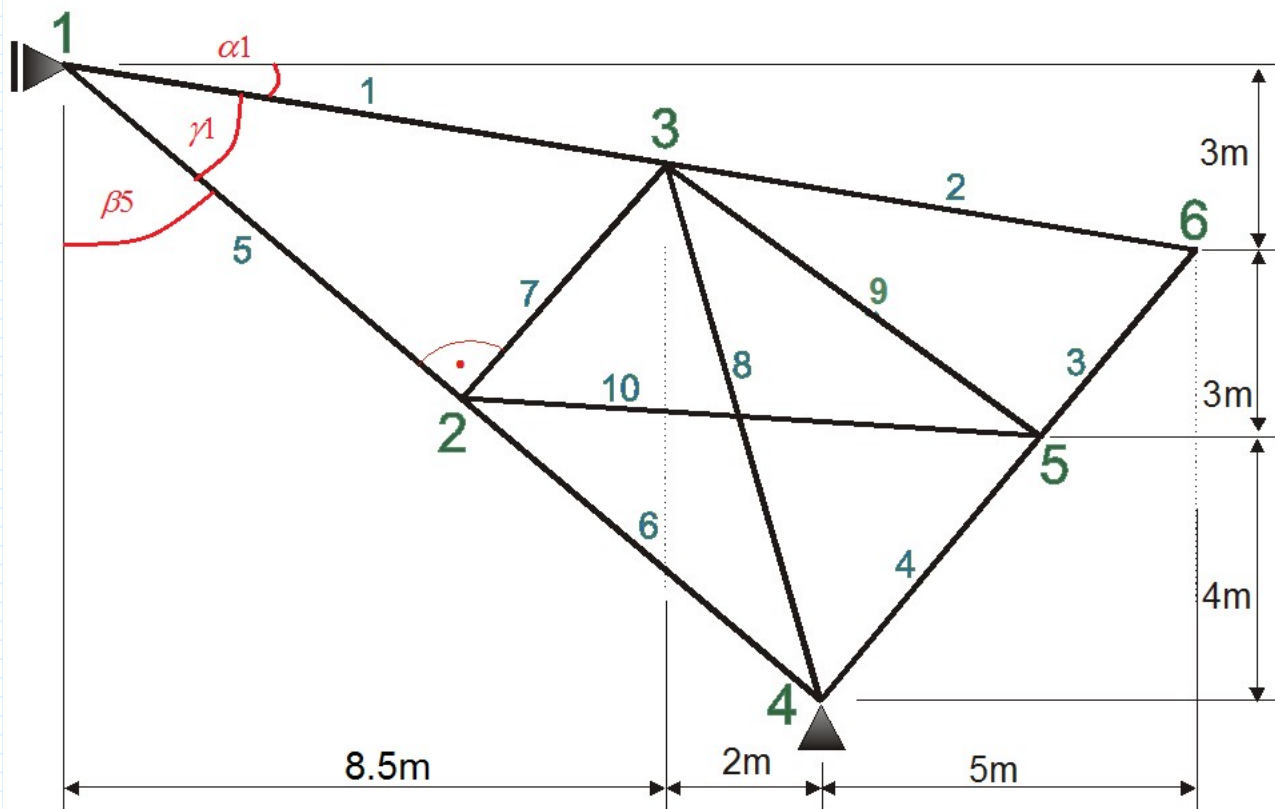
EA := 29 MN

Elementy: 2, 4, 7, 9

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

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

Wyznaczyć bloki **J** macierzy sztywności elementów kratownicy płaskiej.
Sładowe macierze podać z dokładnością do +/- 0.05 kN/m



$$Y3 := -3 \text{ m} \cdot \frac{8.5}{15.5} = -1.64516 \text{ m}$$

$$\alpha1 := \text{atan}\left(\frac{3}{15.5}\right) = 10.95406 \text{ deg}$$

$$\beta5 := \text{atan}\left(\frac{10.5}{10}\right) = 46.39718 \text{ deg}$$

$$\gamma1 := \frac{\pi}{2} - \alpha1 - \beta5 = 32.64876 \text{ deg}$$

$$l1 := \sqrt{(8.5 \text{ m})^2 + (Y3)^2} = 8.657745 \text{ m}$$

$$l5 := l1 \cdot \cos(\gamma1) = 7.289766 \text{ m}$$

$$X2 := l5 \cdot \sin(\beta5) = 5.2788 \text{ m}$$

$$Y2 := -l5 \cdot \cos(\beta5) = -5.02743 \text{ m}$$

Element "2"

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

$$Ly := -3 \text{ m} - Y3 = -1.35484 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 7.129908 \text{ m}$$

$$J^2 = \begin{bmatrix} 3920.5 & -758.8 \\ -758.8 & 146.9 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

Element "4"

$$Lx := 5 \text{ m} \cdot \frac{4}{7} = 2.85714 \text{ m}$$

$$Ly := 7 \text{ m} \cdot \frac{4}{7} = 4 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.915614 \text{ m}$$

$$J^4 = \begin{bmatrix} 1993.1 & 2790.3 \\ 2790.3 & 3906.5 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

$$X3 := l1 \cdot \cos(\alpha1) = 8.5 \text{ m}$$

$$Y3 := -l1 \cdot \sin(\alpha1) = -1.64516 \text{ m}$$

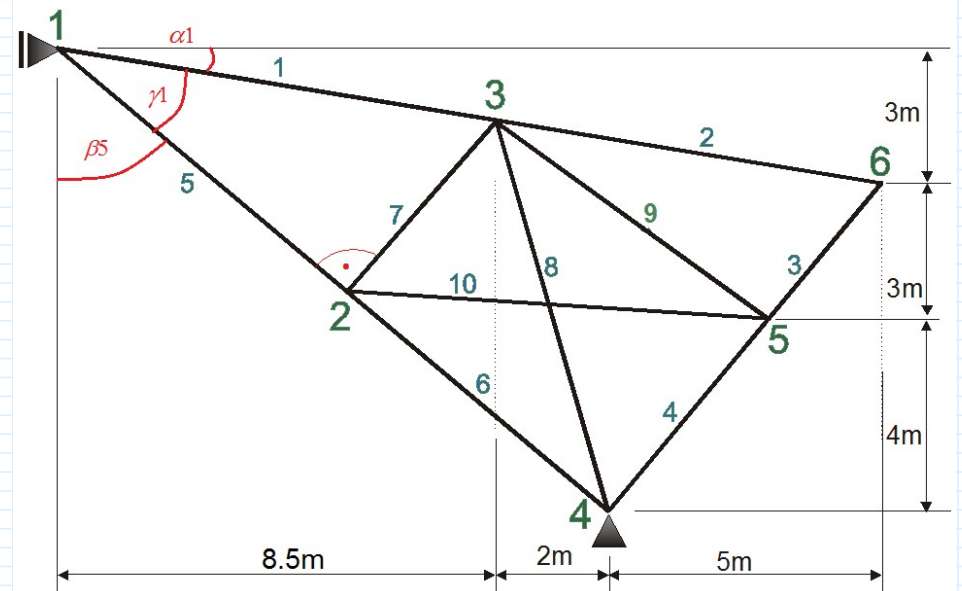
Element "7"

$$Lx := X3 - X2 = 3.221204 \text{ m}$$

$$Ly := Y3 - Y2 = 3.382264 \text{ m}$$

$$J^7 = \begin{bmatrix} 2953.1 & 3100.7 \\ 3100.7 & 3255.8 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.670745 \text{ m}$$



$$X5 := 10.5 \text{ m} + 5 \text{ m} \cdot \frac{4}{7} = 13.35714 \text{ m} \quad Y5 := -6 \text{ m}$$

Element "9"

$$Lx := X5 - 8.5 \text{ m} = 4.857143 \text{ m} \quad Ly := Y5 - Y3 = -4.354839 \text{ m} \quad L := \sqrt{(Lx)^2 + (Ly)^2} = 6.523531 \text{ m}$$

$$J^9 = \begin{bmatrix} 2464.4 & -2209.5 \\ -2209.5 & 1981.0 \end{bmatrix} \frac{kN}{m}$$

