

ORIGIN := 1

A

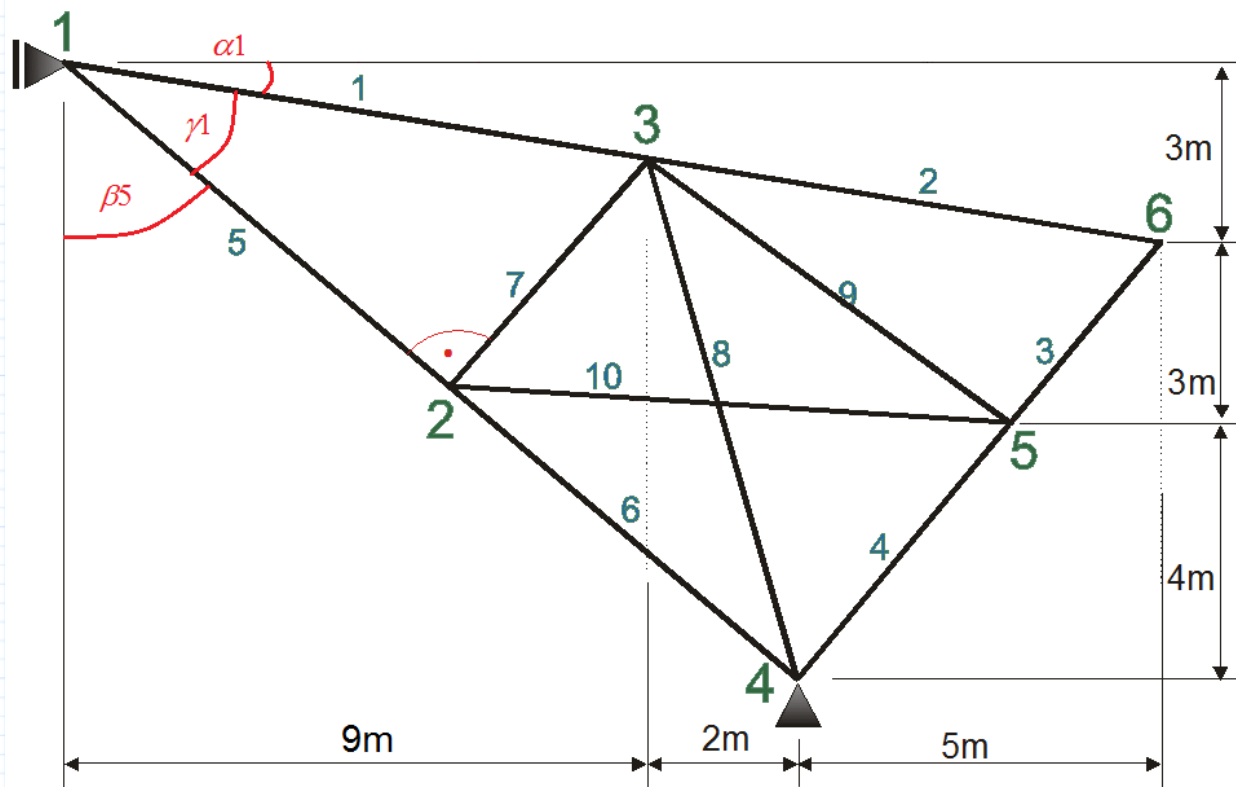
EA := 33 MN

Elementy: 1, 5, 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 kratownicy płaskiej.
Sładowe macierze podać z dokładnością do +/- 0.05 kN/m



$$Y3 := -3 \text{ m} \cdot \frac{9}{16} = -1.68750 \text{ m}$$

$$\alpha1 := \text{atan}\left(\frac{3}{16}\right) = 10.61966 \text{ deg}$$

$$\beta5 := \text{atan}\left(\frac{11}{10}\right) = 47.72631 \text{ deg}$$

$$\gamma1 := \frac{\pi}{2} - \alpha1 - \beta5 = 31.65403 \text{ deg}$$

$$l1 := \sqrt{9^2 + \left(\frac{27}{16}\right)^2} \text{ m} = 9.156837 \text{ m}$$

$$l5 := l1 \cdot \cos(\gamma1) = 7.794596 \text{ m}$$

$$X2 := l5 \cdot \sin(\beta5) = 5.76753 \text{ m}$$

$$Y2 := -l5 \cdot \cos(\beta5) = -5.24321 \text{ m}$$

Element "1"

$$Lx := 9 \text{ m} = 9 \text{ m}$$

$$Ly := Y3 = -1.68750 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 9.156837 \text{ m}$$

$$J^1 = \begin{bmatrix} 3481.5 & -652.8 \\ -652.8 & 122.4 \end{bmatrix} \frac{kN}{m}$$

Element "5"

$$Lx := X2 = 5.76753 \text{ m} \quad Ly := Y2 = -5.243213 \text{ m}$$

$$J^5 = \begin{bmatrix} 2318.0 & -2107.3 \\ -2107.3 & 1915.7 \end{bmatrix} \frac{kN}{m}$$

$$X5 := 16 \text{ m} - 5 \text{ m} \cdot \frac{3}{7} \quad Y5 := -6 \text{ m}$$

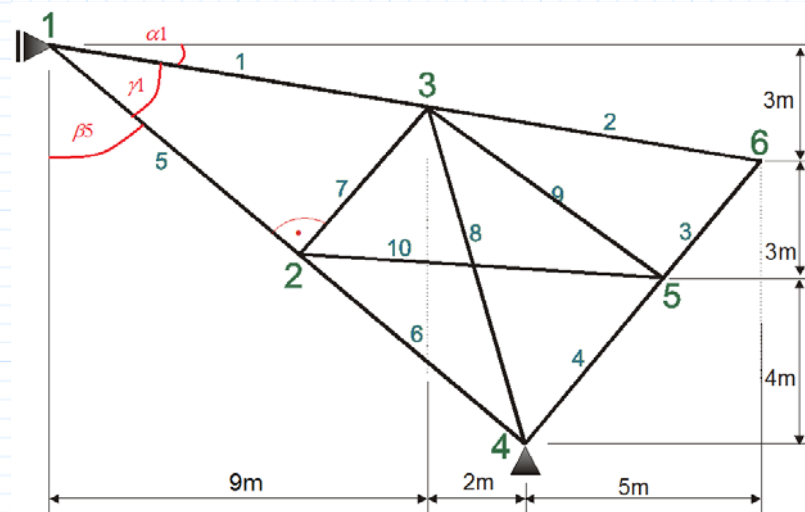
Element "9"

$$Lx := X5 - 9 \text{ m} = 4.857143 \text{ m}$$

$$Ly := Y5 - Y3 = -4.312500 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.495344 \text{ m}$$

$$J^9 = \begin{bmatrix} 2841.0 & -2522.4 \\ -2522.4 & 2239.6 \end{bmatrix} \frac{kN}{m}$$



Element "10"

$$Lx := X5 - X2 = 8.089609 \text{ m}$$

$$Ly := Y5 - Y2 = -0.756787 \text{ m}$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 8.124931 \text{ m}$$

$$J^{10} = \begin{bmatrix} 4026.3 & -376.7 \\ -376.7 & 35.2 \end{bmatrix} \frac{kN}{m}$$

