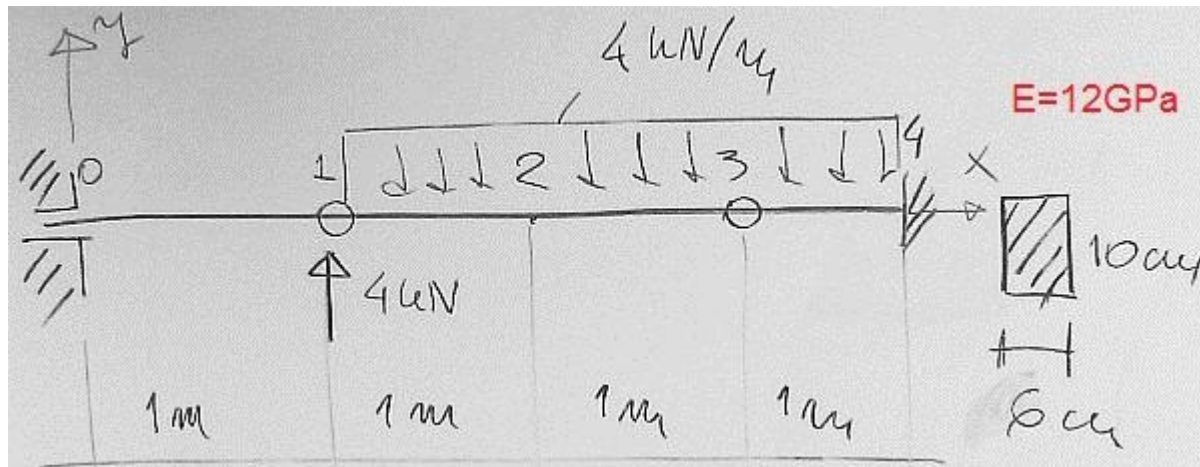


Metoda różnic skończonych - ugięcie belki



$$P := 4 \text{ kN} \quad q := 4 \frac{\text{kN}}{\text{m}} \quad E := 12 \text{ GPa}$$

$$L := 4 \text{ m} \quad b := 6 \text{ cm} \quad h := 10 \text{ cm} \quad J := b \cdot \frac{h^3}{12} = 500 \cdot \text{cm}^4$$

$$T1 := \frac{q \cdot 2\text{m}}{2} = 4 \cdot \text{kN} \quad T3 := T1 \quad R0 := T1 - P = 0 \cdot \text{kN} \quad R4 := T3 + q \cdot 1\text{m} = 8 \cdot \text{kN}$$

$$M0 := T1 \cdot 1\text{m} - P \cdot 1\text{m} = 0 \cdot \text{kN} \cdot \text{m} \quad M4 := T3 \cdot 1\text{m} + q \cdot 1\text{m} \cdot 0.5\text{m} = 6 \cdot \text{kN} \cdot \text{m}$$

$$n := 4 \quad \Delta := \frac{L}{n} = 1 \text{ m} \quad \alpha := \frac{\Delta^2}{E \cdot J} \quad \alpha = 16.667 \cdot \frac{1}{\text{MN}}$$

$$M1(x) := R0 \cdot x - M0$$

$$M2(x) := R4 \cdot (L - x) - q \cdot \frac{(L - x)^2}{2} - M4$$

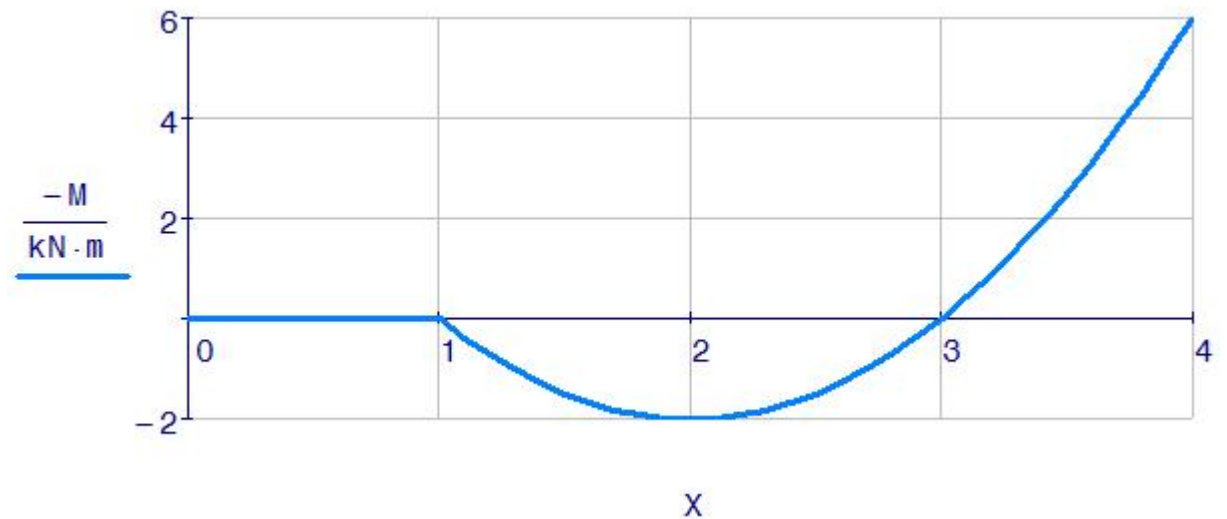
$$i := 0 .. n$$

$$X_i := i \cdot \Delta$$

$$i := 0 .. 1 \quad M_i := M1(X_i)$$

$$i := 1 .. n \quad M_i := M2(X_i)$$

$$M = \begin{bmatrix} & 0 \\ 0 & 0 \\ 1 & 0 \\ 2 & 2 \\ 3 & 0 \\ 4 & -6 \end{bmatrix} \cdot \text{kN} \cdot \text{m} \quad X = \begin{bmatrix} & 0 \\ 0 & 0 \\ 1 & 1 \\ 2 & 2 \\ 3 & 3 \\ 4 & 4 \end{bmatrix} \text{m}$$



Równania MRS

$$y_0 = 0 \quad \varphi_0 = 0$$

$$y_4 = 0 \quad \varphi_4 = 0$$

$$-2y_0 + 2y_1 = \alpha M_0$$

$$-2y_4 + 2y_3 = \alpha M_4$$

$$y_1 - 2y_2 + y_3 = \alpha M_2 \quad \text{-----} >$$

$$2y_1 = \alpha M_0$$

$$2y_3 = \alpha M_4$$

$$y_1 - 2y_2 + y_3 = \alpha M_2$$

M =

	0
0	0
1	0
2	2
3	0
4	-6

· kN · m

J = 500 cm⁴

$\alpha = 16.667 \cdot \frac{1}{\text{MN}}$

y =

	0
0	0.00
1	0.00
2	-41.67
3	-50.00
4	0.00

· mm

