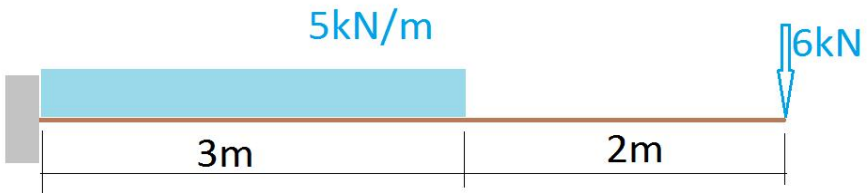
Beam deflection by Finite Difference Method



$ORIGIN := 0$

$E := 10GPa$ - *Young modulus for wood*

$b := 10cm$ - *Cross section breadth*

$h := 20cm$ - *Cross section height*

$J := b \cdot \frac{h^3}{12}$ $J = 6666.667 \cdot cm^4$ - *Moment of the inertia for the beam cross section*

$F := 6kN$

$q := 5\frac{kN}{m}$

$L := 5m$ $L1 := 3m$

$n := 10$

$\Delta := \frac{L}{n}$ $\alpha := \frac{\Delta^2}{E \cdot J}$

$i := 0 .. \quad n$

$X_i := i \cdot \Delta$

$M1(x) := -F \cdot (L - x)$ *- Bending moments functions*

$$M2(x) := M1(x) - q \cdot \frac{(L1 - x)^2}{2}$$

$i := 0 .. \quad 6$

$M_i := M2(X_i)$ *- Bending moments matrix*

$i := 7 .. \quad n$

$M_i := M1(X_i)$

Bending moment graph

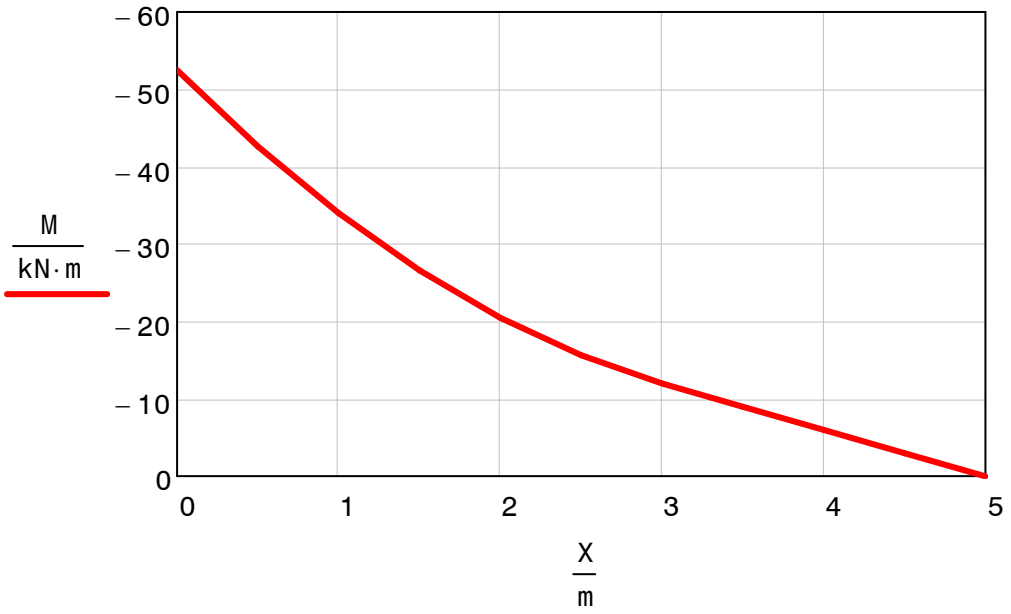
$M =$

	0
0	-52.500
1	-42.625
2	-34.000
3	-26.625
4	-20.500
5	-15.625
6	-12.000
7	-9.000
8	-6.000
9	-3.000
10	0.000

$\cdot kN \cdot m$ $\quad X =$

	0
0	0.000
1	0.500
2	1.000
3	1.500
4	2.000
5	2.500
6	3.000
7	3.500
8	4.000
9	4.500
10	5.000

m



$y_{10} := 0$ *- initiation of the beam deflection matrix*

Boudary conditions for cantilevar beam

$y_0 := 0$ *- zero deflection on support*

$y_1 := \frac{\alpha \cdot M_0}{2}$ *- zero rotation angle for support by central difference equation*

Solution by explicit method

$i := 1 .. \; n - 1$

$y_{i+1} := 2 \cdot y_i - y_{i-1} + \alpha \cdot M_i$

$y =$

	0
0	0.000
1	-0.984
2	-3.567
3	-7.425
4	-12.281
5	-17.906
6	-24.117
7	-30.778
8	-37.777
9	-45.000
10	-52.336

$\cdot cm$