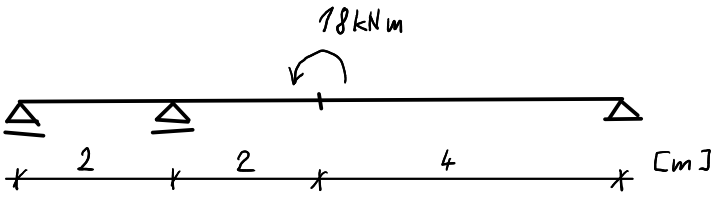
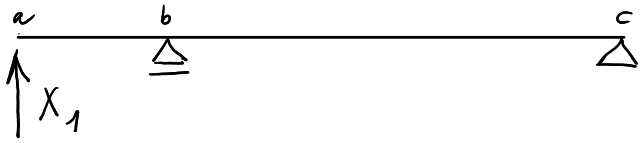


Řešte silovou metodou:
$E = 26$ GPa
$I = 5 \cdot 10^{-4}\ m^4$

1. VARIANTA:

ZSUS:



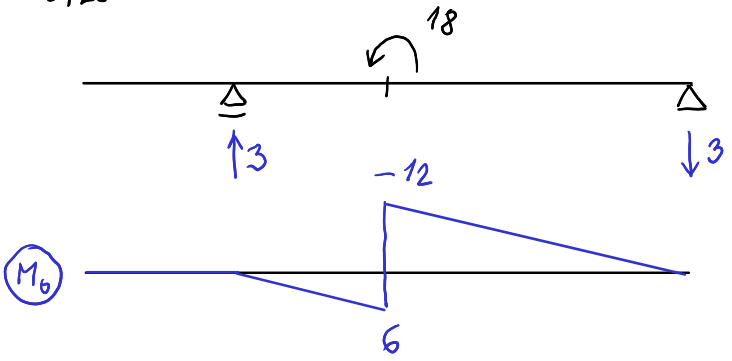
- kanonické (deformační) rovnice:

$$\delta_{1,1} \cdot X_1 + \delta_{1,0} = 0 \qquad (w_a = 0)$$

$$\delta_{1,1} = \int \frac{M_1 M_1}{EI}\, ds =$$

$$= \frac{1}{EI}\left\{\left(\frac{1}{2}\cdot 2\cdot 2\right)\cdot\left[\frac{2}{3}\cdot 2\right] + \left(\frac{1}{2}\cdot 2\cdot 6\right)\cdot\left[\frac{2}{3}\cdot 2\right]\right\} = \frac{32}{3EI}$$

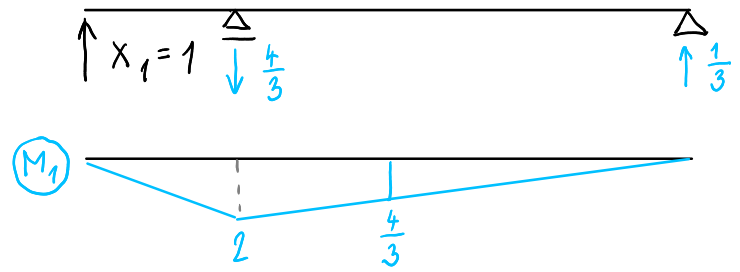
0,ZS:



$$\delta_{1,0} = \int \frac{M_1 M_0}{EI}\, ds =$$

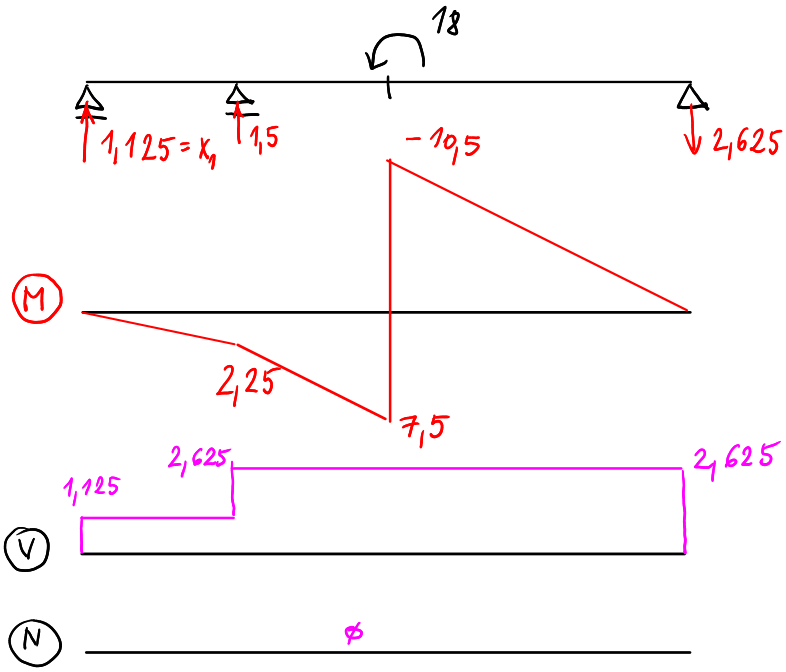
$$= \frac{1}{EI}\left\{\left(\frac{1}{2}\cdot 6\cdot 2\right)\cdot\left[\frac{2}{3}\cdot\frac{4}{3} + \frac{1}{3}\cdot 2\right] + \left(\frac{1}{2}(-12)\cdot 4\right)\cdot\left[\frac{2}{3}\cdot\frac{4}{3}\right]\right\} = \frac{-12}{EI}$$

1. ZS:



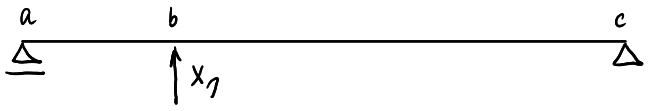
$$\frac{32}{3EI} X_1 - \frac{12}{EI} = 0 \qquad |\cdot EI$$

$$X_1 = \frac{12 \cdot 3}{32} = 1{,}125\ \text{kN}$$

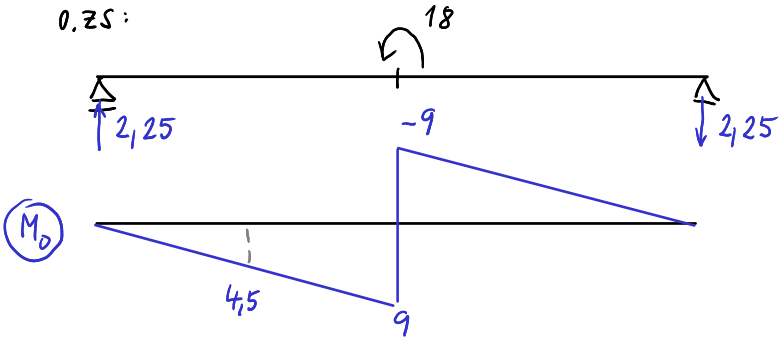


2. VARIANTA:

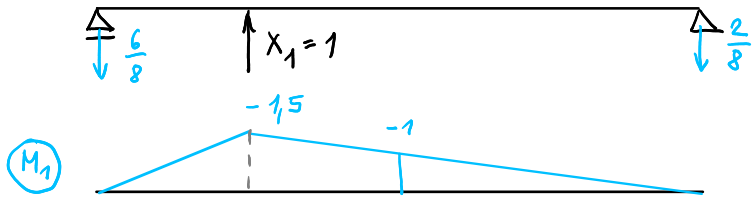
ZSUS:



0. ZS:



1. ZS:



- kanonické (deformační) rovnice:

$$\delta_{1,1} \cdot X_1 + \delta_{1,0} = 0 \qquad (w_b = 0)$$

$$\delta_{1,1} = \int \frac{M_1 M_1}{EI} ds =$$

$$= \frac{1}{EI}\left\{\left(\frac{1}{2}\cdot(-1{,}5)\cdot 2\right)\cdot\left[\frac{2}{3}\cdot(-1{,}5)\right] + \right.$$

(-1,5; 2) (-1,5; 2)

$$\left. + \left(\frac{1}{2}\cdot(-1{,}5)\cdot 6\right)\cdot\left[\frac{2}{3}\cdot(-1{,}5)\right]\right\} = \frac{6}{EI}$$

(-1,5; 6) (-1,5; 6)

$$\delta_{1,0} = \int \frac{M_1 M_0}{EI} ds =$$

$$= \frac{1}{EI}\left\{\left(\frac{1}{2}\cdot 4{,}5\cdot 2\right)\left[\frac{2}{3}\cdot(-1{,}5)\right] + \right.$$

(2; 4,5) (-1,5; 2)

$$+ \left(\frac{1}{2}\cdot 4{,}5\cdot 2\right)\cdot\left[\frac{2}{3}\cdot(-1{,}5) + \frac{1}{3}\cdot(-1)\right] +$$

(2; 4,5) (-1,5; -1)

$$+ \left(\frac{1}{2}\cdot 9\cdot 2\right)\cdot\left[\frac{1}{3}\cdot(-1{,}5) + \frac{2}{3}\cdot(-1)\right] +$$

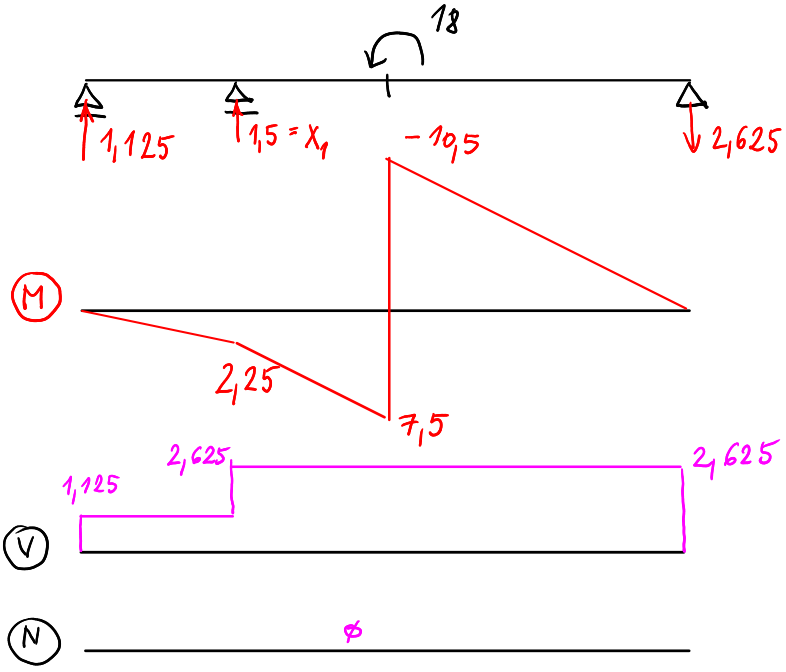
(2; 9) (-1,5; -1)

$$\left. + \left(\frac{1}{2}\cdot(-9)\cdot 4\right)\cdot\left[\frac{2}{3}\cdot(-1)\right]\right\} = -\frac{9}{EI}$$

(-9; 4) (-1; 4)

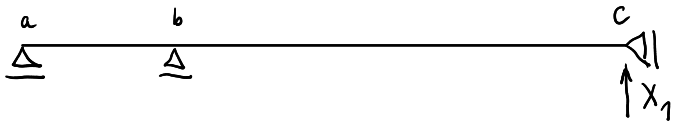
$$\frac{6}{EI}\cdot X_1 - \frac{9}{EI} = 0 \qquad 1\cdot EI$$

$$X_1 = \frac{9}{6} = 1{,}5\ kN$$



3. VARIANTA:

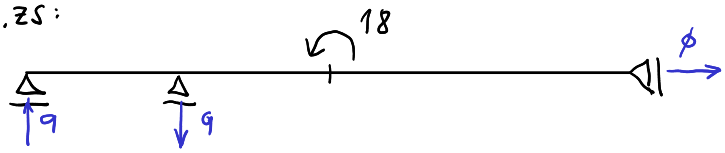
ZSUS:



- kanonické (deformační) rovnice:

$$\delta_{1,1} \cdot X_1 + \delta_{1,0} = 0 \qquad (w_c = 0)$$

0. ZS:



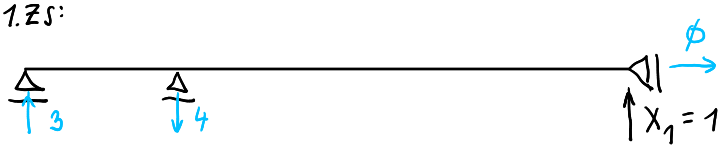
M_0

$$\delta_{1,1} = \int \frac{M_1 M_1}{EI}\, ds =$$

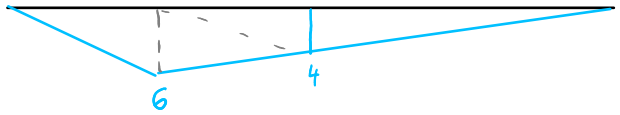
$$= \frac{1}{EI}\left\{\left(\tfrac{1}{2}\cdot 6\cdot 2\right)\cdot\left[\tfrac{2}{3}\cdot 6\right] + \left(\tfrac{1}{2}\cdot 6\cdot 6\right)\cdot\left[\tfrac{2}{3}\cdot 6\right]\right\}$$

$$= \frac{96}{EI}$$

1. ZS:



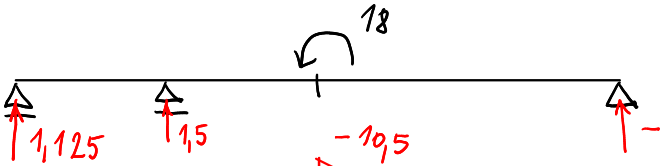
M_1



$$\delta_{1,0} = \int \frac{M_1 M_0}{EI}\, ds =$$

$$= \frac{1}{EI}\left\{\left(\tfrac{1}{2}\cdot(18)\cdot 2\right)\cdot\left[\tfrac{2}{3}\cdot 6\right] +\right.$$

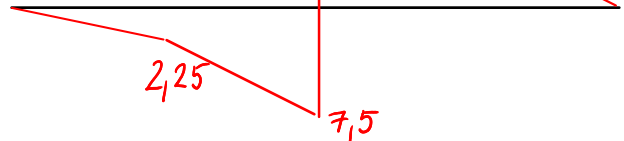
$$\left. + \left(\tfrac{1}{2}(6+4)\cdot 2\right)\cdot[18]\right\} = \frac{252}{EI}$$



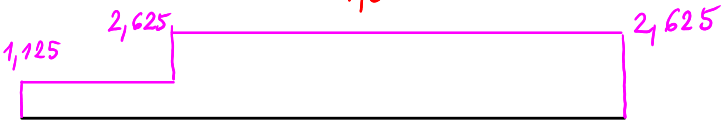
$$\frac{96}{EI}\cdot X_1 + \frac{252}{EI} = 0 \qquad |\cdot EI$$

$$X_1 = \frac{-252}{96} = -2{,}625\ \text{kN}$$

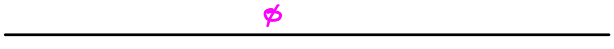
M



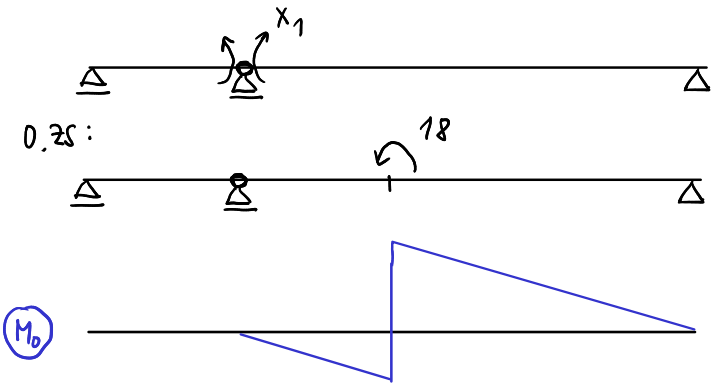
V



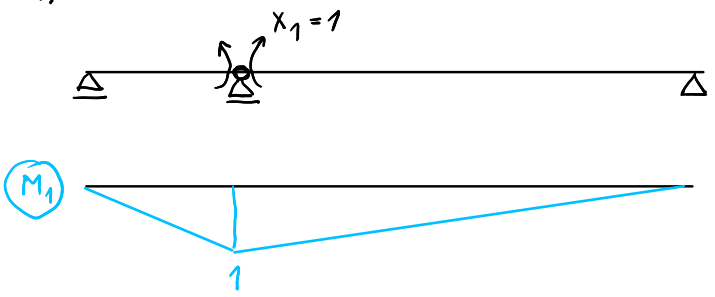
N



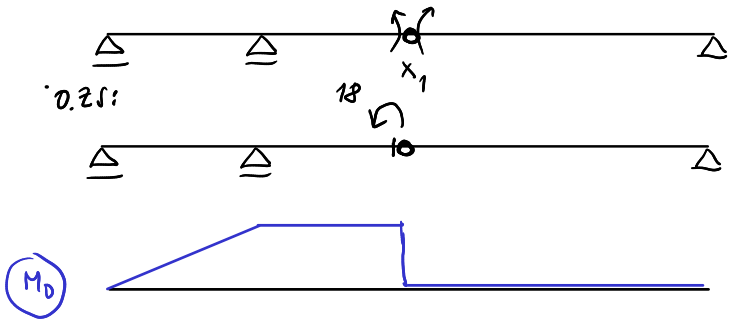
Další možné zsus:



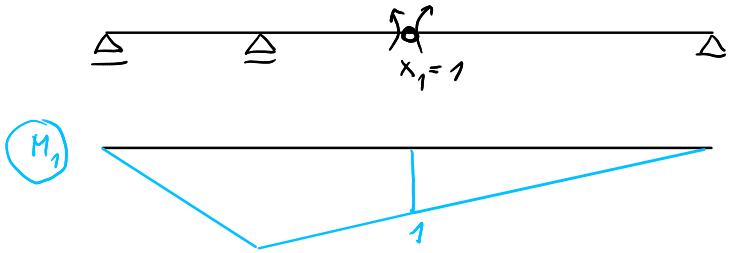
1. ZS:



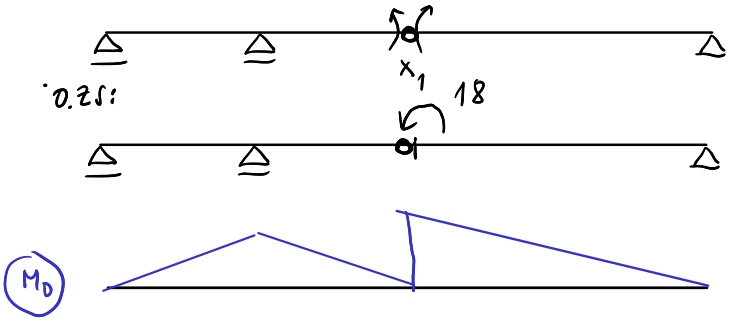
$\Rightarrow X_1 = 2{,}25$ kNm



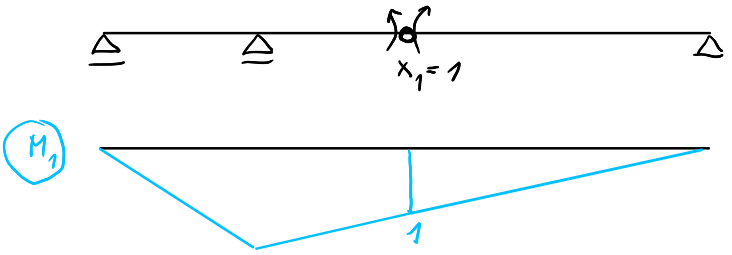
1. ZS:



$\Rightarrow X_1 = -10{,}5$ kNm



1. ZS:



$\Rightarrow X_1 = 7{,}5$ kNm

A TAK DÁLE