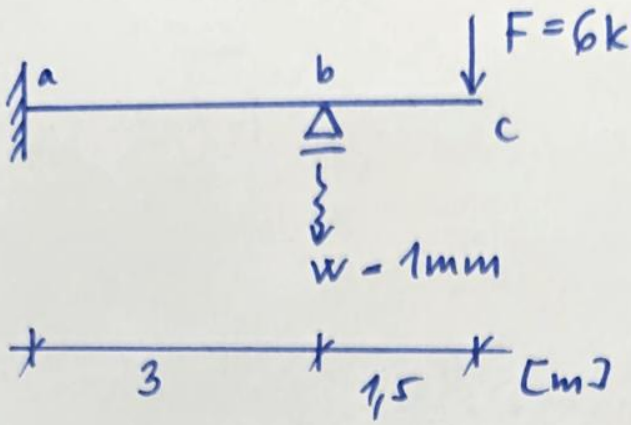


SILOVÁ METODA:

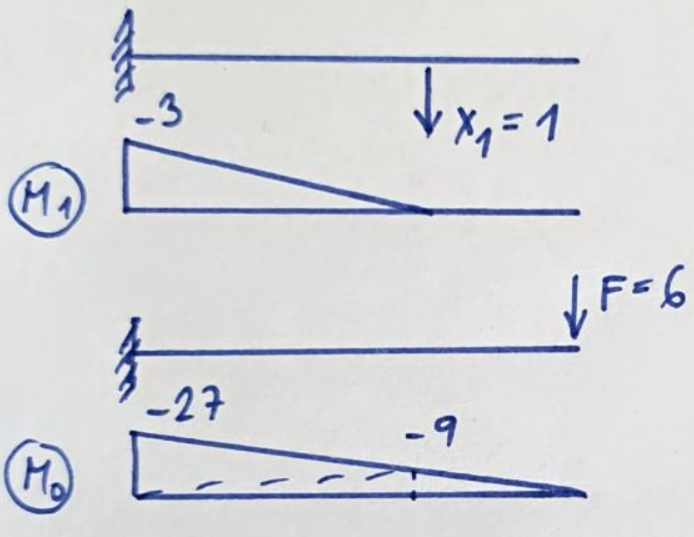
$E = 40\ GPa$

□ a $a = 0{,}3\,m$

$EI = 40 \cdot 10^6 \cdot \frac{1}{12} \cdot 0{,}3^4$

$= 27\,000\ kPa \cdot m^4$

ZPUSOB 1:



$\delta_{1,1} \cdot X_1 + \delta_{1,0} = {}^{+}1 \cdot 10^{-3}$

($w_6 = 1\,mm$)

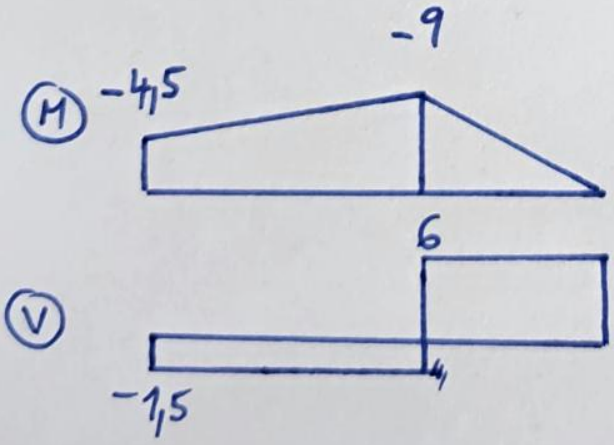
$\downarrow X_1 \quad \xi\, w$

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

$= \frac{9}{EI}$

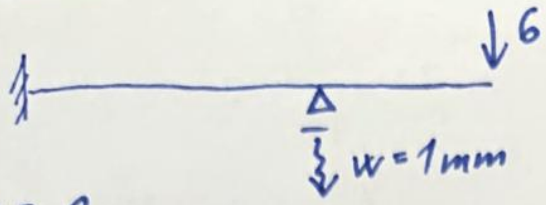
$\delta_{1,0} = \frac{1}{EI}\left\{\left(\frac{1}{2} \cdot 3 \cdot (-3)\right) \cdot \left[\frac{2}{3} \cdot (-27) + \frac{1}{3} \cdot (-9)\right]\right\}$

$= \frac{94{,}5}{EI}$



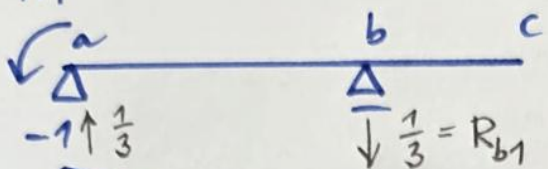
$\frac{9}{EI} \cdot X_1 + \frac{94{,}5}{EI} = 1 \cdot 10^{-3}$

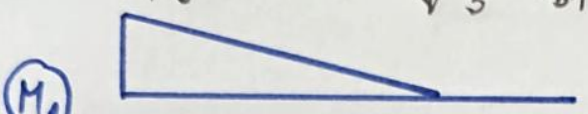
$X_1 = -7{,}5\ kN$

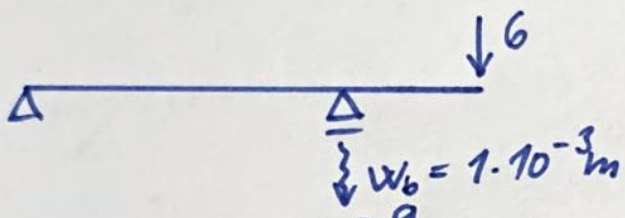


ZUS 2:

$X_1 = 1$







$$\delta_{1,1} \cdot X_1 + \delta_{1,0} = 0$$

$$(\varphi_a = 0)$$

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

$$= \frac{1}{EI}$$

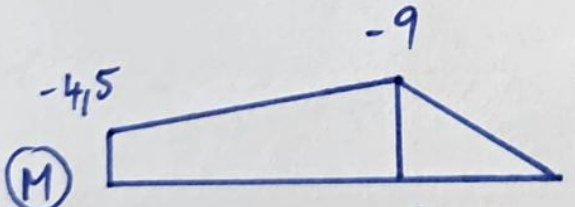
$$\delta_{1,0} = \frac{1}{EI}\left\{\left(\frac{1}{2} \cdot 3 \cdot (-9)\right) \cdot \left[\frac{1}{3} \cdot (-1)\right]\right\}$$

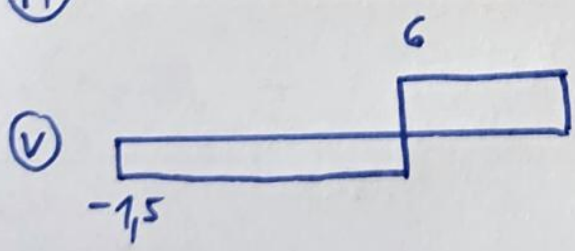
$$- (+R_{b1} \cdot w_b) =$$

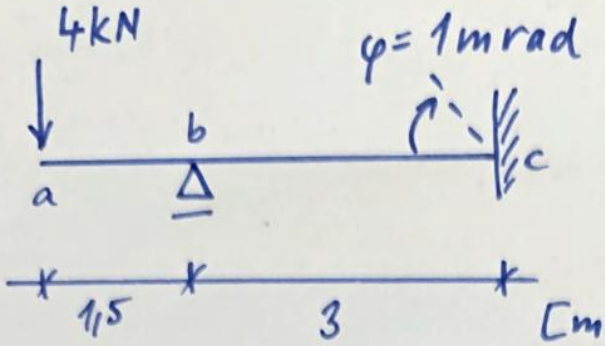
$$= \frac{4{,}5}{EI} - \frac{1}{3} \cdot 1 \cdot 10^{-3}$$

$$\frac{1}{EI} \cdot X_1 + \frac{4{,}5}{EI} - \frac{1}{3} \cdot 10^{-3} = 0$$

$$X_1 = 4{,}5 \text{ kNm}$$







SÍLOVÁ METODA:

$E = 30\,GPa$

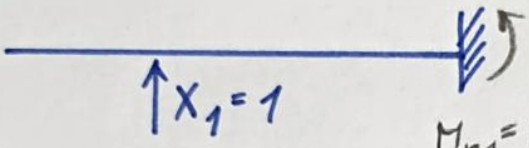
$\square_a$ $a = 0{,}4\,m$

$EI = 30 \cdot 10^6 \cdot \frac{1}{12} \cdot 0{,}4^4$

$EI = 64\,000\ kPa \cdot m^4$

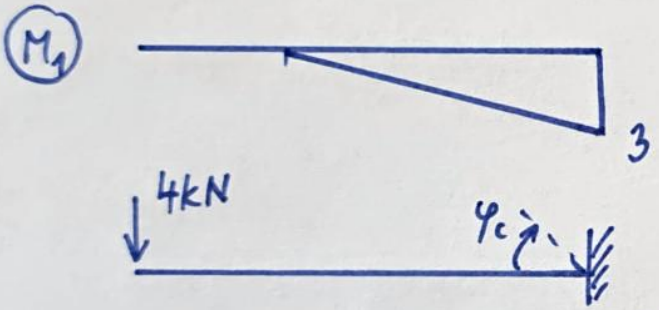
ZSUS 1:

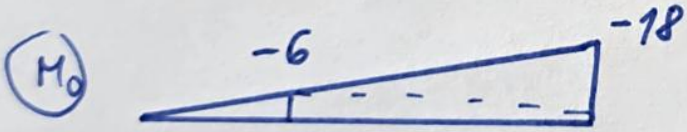
$\delta_{1,1} \cdot X_1 + \delta_{1,0} = 0 \quad (w_b = 0)$



$\delta_{1,1} = \frac{1}{EI}\left\{\left(\frac{1}{2} \cdot 3 \cdot 3\right) \cdot \left[\frac{2}{3} \cdot 3\right]\right\}$

$= \frac{9}{EI}$



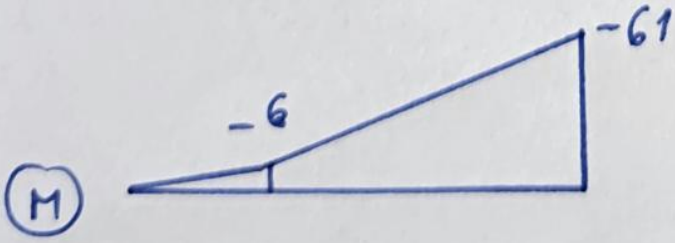


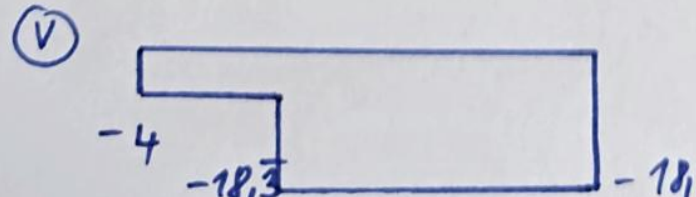
$\delta_{1,0} = \frac{1}{EI}\left\{\left(\frac{1}{2} \cdot 3 \cdot 3\right) \cdot \left[\frac{2}{3} \cdot (-18) + \frac{1}{3} \cdot (-6)\right]\right\} - (-M_{r1} \cdot \varphi_c) =$

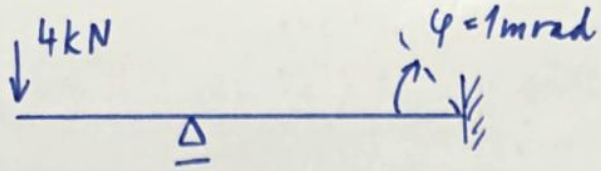
$= \frac{-63}{EI} + 3 \cdot 1 \cdot 10^{-3}$

$\frac{9}{EI} \cdot X_1 = \frac{63}{EI} - 3 \cdot 10^{-3}$

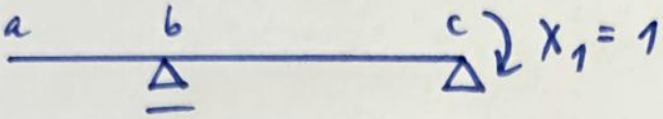
$X_1 = -14{,}\overline{3}\ kN$







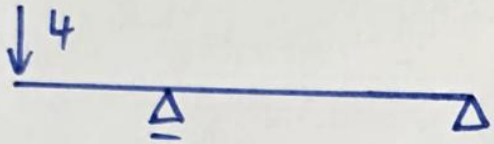
ZSUS 2:

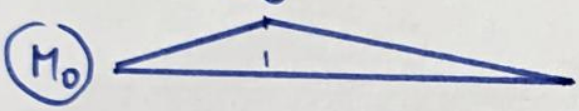


$\delta_{1,1} \cdot X_1 + \delta_{1,0} = 1 \cdot 10^{-3}$

$(\varphi_c = {}^{+}1\,\text{mrad})$

$(\curvearrowright \varphi \; \curvearrowleft X_1)$





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

$$= \frac{1}{EI}$$

$$\delta_{1,0} = \frac{1}{EI} \left\{ \left(\frac{1}{2} \cdot (-6) \cdot 3 \right) \cdot \left[\frac{1}{3} \cdot (-1) \right] \right\}$$

$$= \frac{3}{EI}$$

$$\frac{1}{EI} \cdot X_1 + \frac{3}{EI} = 1 \cdot 10^{-3}$$

$$\underline{\underline{X_1 = 61\,\text{kNm}}}$$