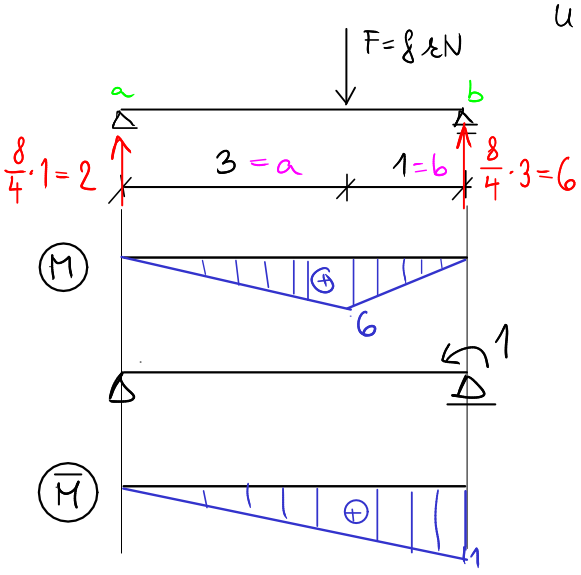
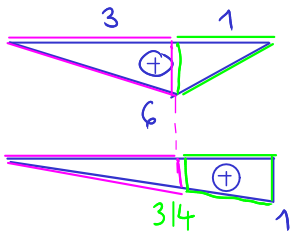
určete pootočení v bodě b, $EI = konst.$

$\varphi_b = ?$

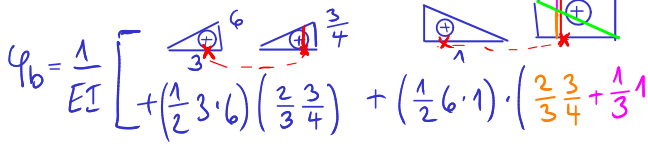


podle tabulek

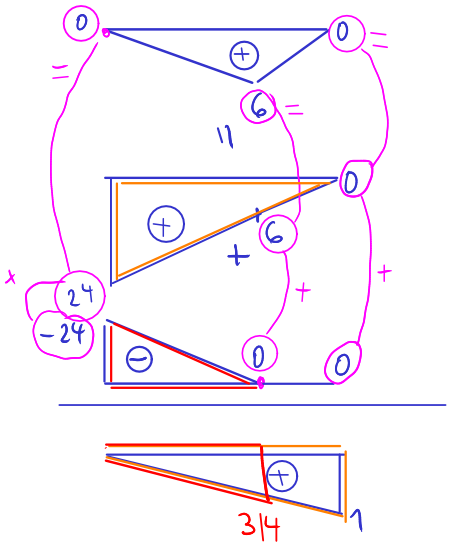
$$\varphi_b = \frac{Fab}{6EI\ell}(\ell + a) = \frac{8 \cdot 3 \cdot 1}{6EI \cdot 4}(4+3) = \frac{7}{EI}$$



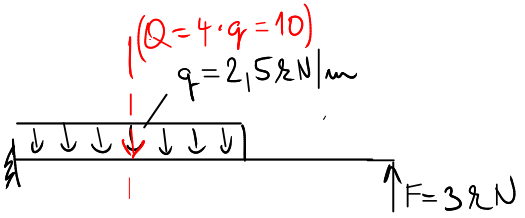
$$\varphi_b = \frac{1}{EI}\int M\bar{M}\,dx$$



$$\varphi_b = \frac{1}{EI}\left[+\left(\frac{1}{2}3\cdot 6\right)\left(\frac{2}{3}\frac{3}{4}\right) + \left(\frac{1}{2}6\cdot 1\right)\cdot\left(\frac{2}{3}\frac{3}{4} + \frac{1}{3}1\right)\right] = \underline{\underline{\frac{7}{EI}}}$$



$$\varphi_b = \frac{1}{EI}\left[+\left(\frac{1}{2}24\cdot 4\right)\left(\frac{1}{3}1\right) - \left(\frac{1}{2}24\cdot 3\right)\left(\frac{1}{3}\frac{3}{4}\right)\right] = \underline{\underline{\frac{7}{EI}}}$$



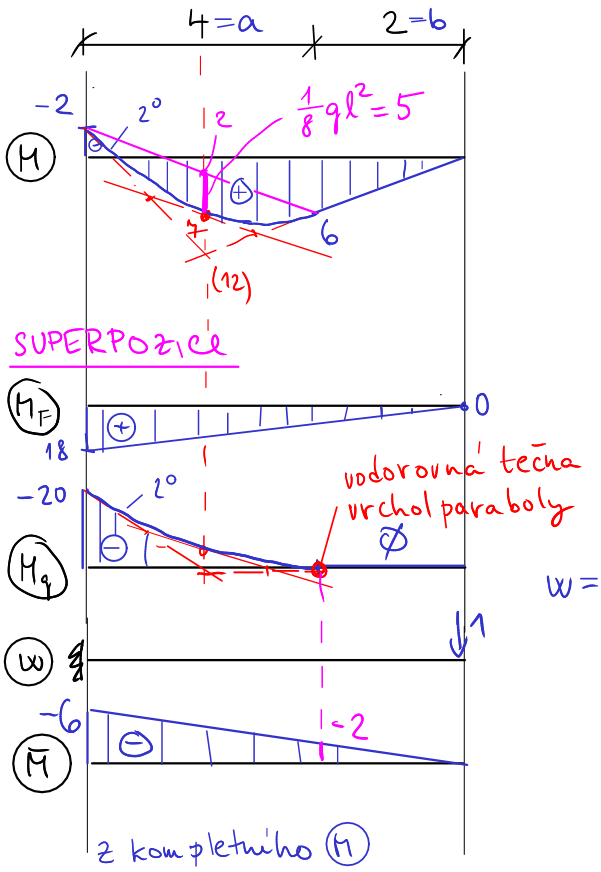
určete průhyb volného konce, EI = konst.

podle tabulek:

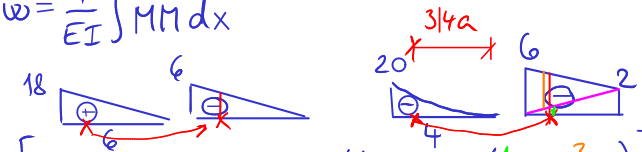
$$w_q = \frac{qa^3}{24EI}(4l-a) = \frac{133\overline{3}}{EI}$$

$$w_F = -\frac{Fl^3}{3EI} = \frac{-216}{EI}$$

$$w = w_q + w_F = -\frac{82\overline{6}}{EI}$$



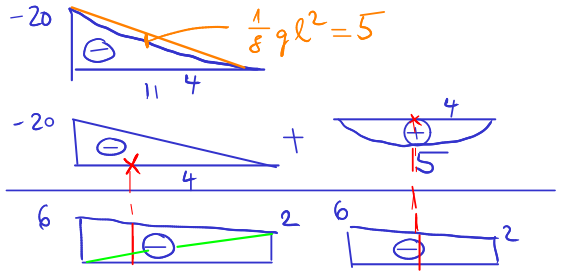
$$w = \frac{1}{EI}\int M\bar{M}\,dx$$



$$w = \frac{1}{EI}\left[-\left(\tfrac{1}{2}6\cdot 18\right)\left(\tfrac{2}{3}6\right) + \left(\tfrac{1}{3}20\cdot 4\right)\cdot\left(\tfrac{1}{4}2+\tfrac{3}{4}6\right)\right] = -\frac{82\overline{6}}{EI}$$

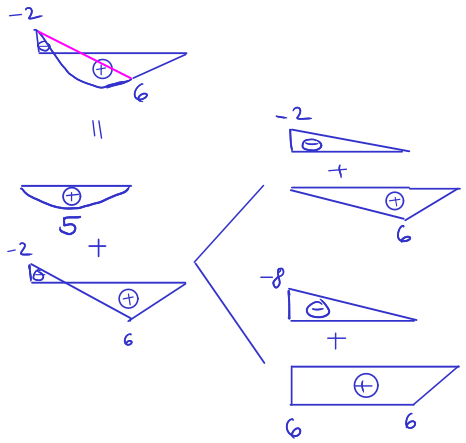
$133\overline{3}$

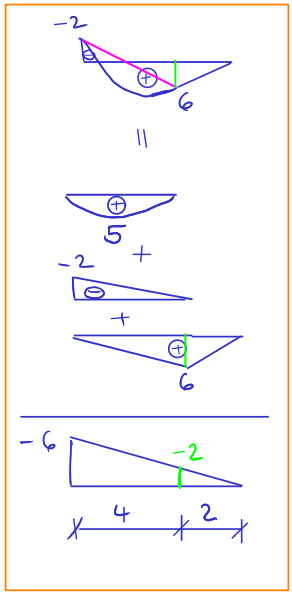
Nevím že tam je vrchol nebo neznám 3/4a ⇒ rozložím

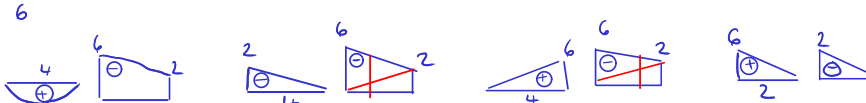


$$+\left(\tfrac{1}{2}20\cdot 4\right)\left(\tfrac{1}{3}2+\tfrac{2}{3}6\right) - \left(\tfrac{2}{3}5\cdot 4\right)\cdot\left(\frac{6+2}{2}\right)$$

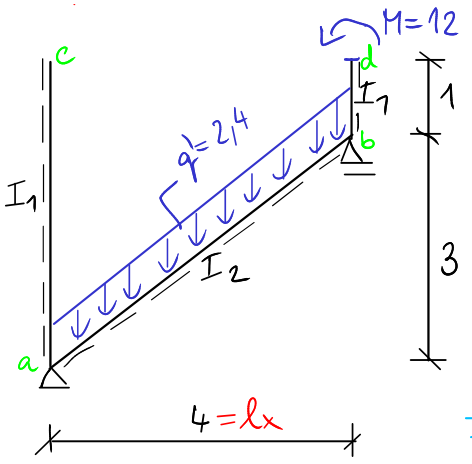
$133\overline{3}$ ✓







$$w = \frac{1}{EI}\left[-\frac{2}{3}4\cdot 5\left(\frac{6+2}{2}\right) + \frac{1}{2}2\cdot 4\cdot\left(\frac{2}{3}6+\frac{1}{3}2\right) - \frac{1}{2}6\cdot 4\cdot\left(\frac{2}{3}2+\frac{1}{3}6\right) - \frac{1}{2}6\cdot 2\cdot\left(\frac{2}{3}2\right)\right] = \frac{-82\overline{6}}{EI}\ \checkmark$$



O kolik se k sobě přiblíží volné konce lomeného nosníku.

$E = 25\ GPa$

$I_1 = 3 \cdot 10^{-4}\ m^4$

$I_2 = 8 \cdot 10^{-4}\ m^4$

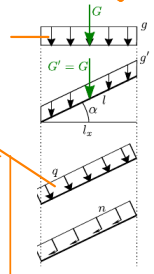
$g = \frac{g' l}{l_x} = \frac{2{,}4 \cdot 5}{4} = 3\ kN/m$

pozn. lze vykreslit bez znalosti reakcí

- vzepětí paraboly

$\frac{1}{8} g l_x^2$

$\frac{1}{8} q l^2$



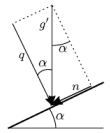
$G' = G$

$g' l = g l_x$

$\frac{l_x}{l} = \cos\alpha$

$g' l = g l \cos\alpha$

$\boxed{g' = g \cos\alpha}$

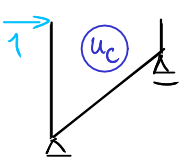


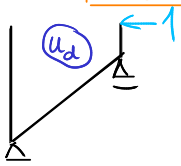
$\frac{n}{g'} = \sin\alpha \Rightarrow \boxed{n = g' \sin\alpha}$

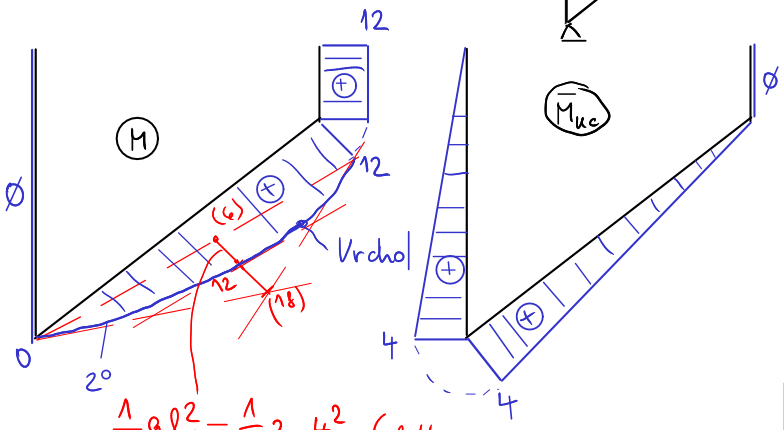
$\frac{q}{g'} = \cos\alpha \Rightarrow \boxed{q = g' \cos\alpha}$

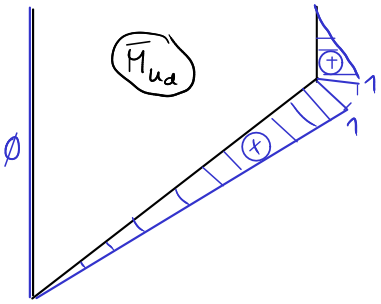
$\boxed{n = g \sin\alpha \cos\alpha}$

$\boxed{q = g \cos^2\alpha}$



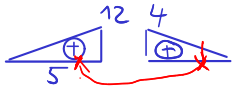


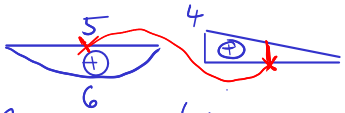




$\frac{1}{8} g l_x^2 = \frac{1}{8} 3 \cdot 4^2 = 6\ kNm$

$u_c = \frac{1}{EI} \int M \bar{M}\, dx = \frac{1}{EI_2} \left[+\left(\frac{1}{2} 5 \cdot 12\right)\left(\frac{1}{3} 4\right) \right.$

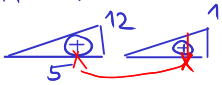


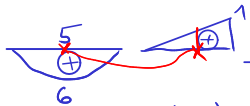


$\left. +\left(\frac{2}{3} 5 \cdot 6\right) \cdot \left(\frac{1}{2} 4\right) \right] = \frac{80}{EI_2} =$

$= \frac{80}{25 \cdot 10^6 \cdot 8 \cdot 10^{-4}} = 4 \cdot 10^{-3}\ m$

$u_d = \frac{1}{EI} \int M \bar{M}\, dx =$





$\frac{1}{EI_2} \left[+\left(\frac{1}{2} 5 \cdot 12\right)\left(\frac{2}{3} 1\right) + \left(\frac{2}{3} 5 \cdot 6\right)\left(\frac{1}{2} 1\right) \right] +$

$\frac{1}{EI_1} \left[+\left(\frac{1}{2} 1 \cdot 1\right) \cdot (12) \right] = \frac{30}{EI_2} + \frac{6}{EI_1} =$

$= \frac{30}{25 \cdot 10^6 \cdot 8 \cdot 10^{-4}} + \frac{6}{25 \cdot 10^6 \cdot 3 \cdot 10^{-4}} =$

$1{,}5 \cdot 10^{-3} + 0{,}8 \cdot 10^{-3} = 2{,}3 \cdot 10^{-3}\ m$

Vzájemně se volné konce přiblíží o $u_c + u_d = (4 + 2{,}3) \cdot 10^{-3} = 6{,}3 \cdot 10^{-3}\ m$