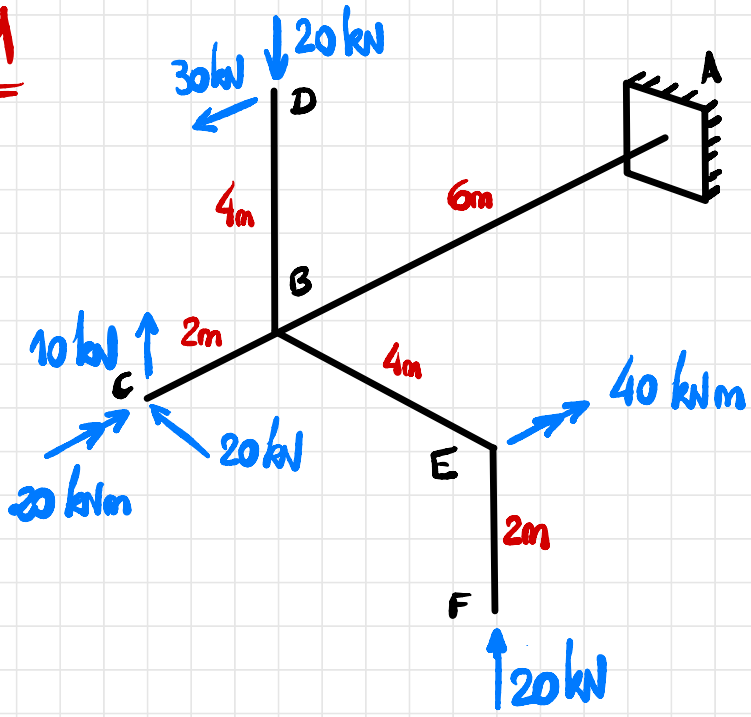
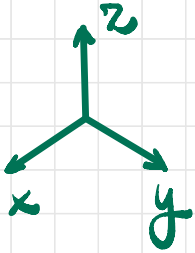
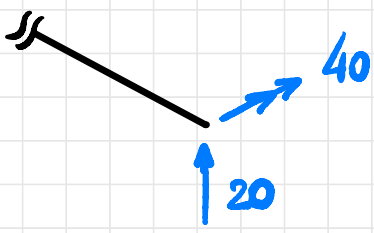
Q1

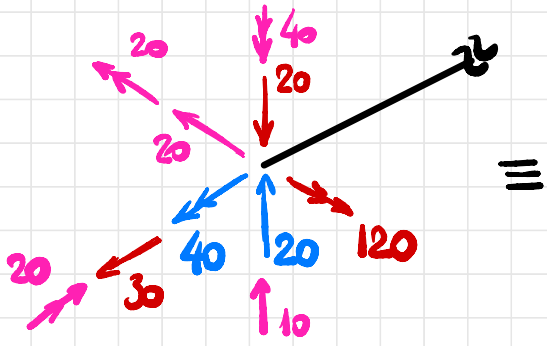




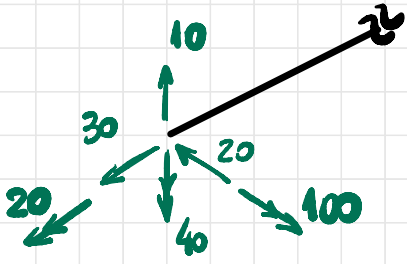
Transporte para E:

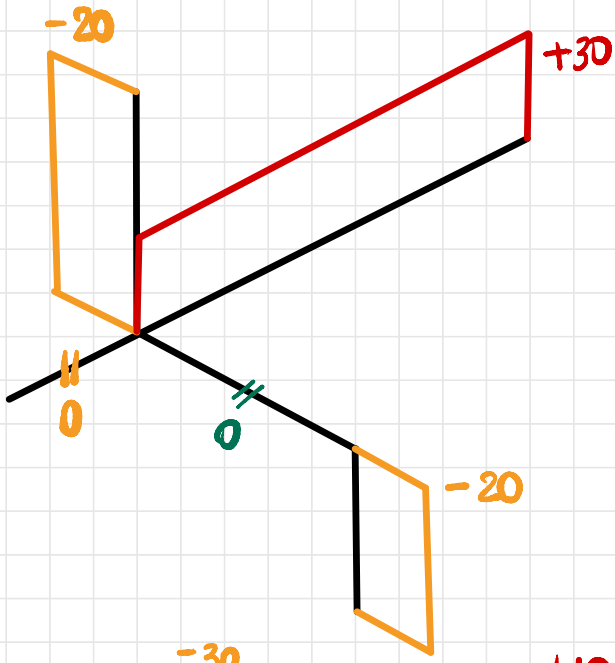


Transporte para B:

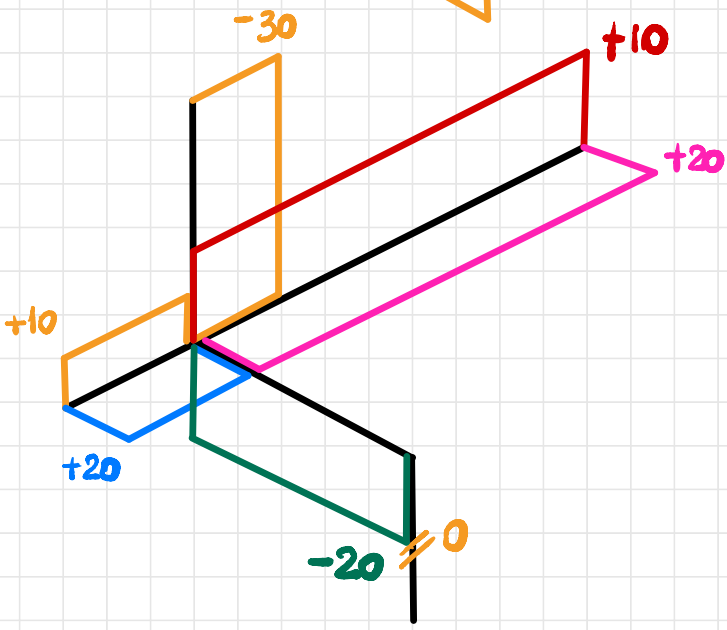


≡

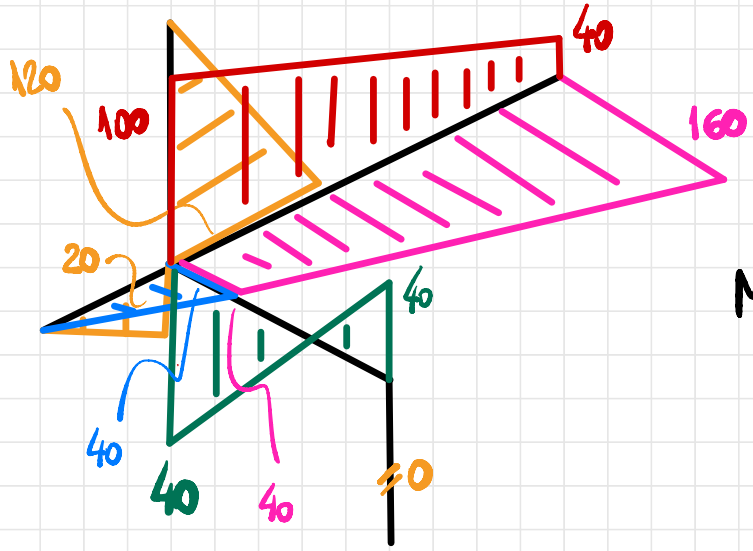




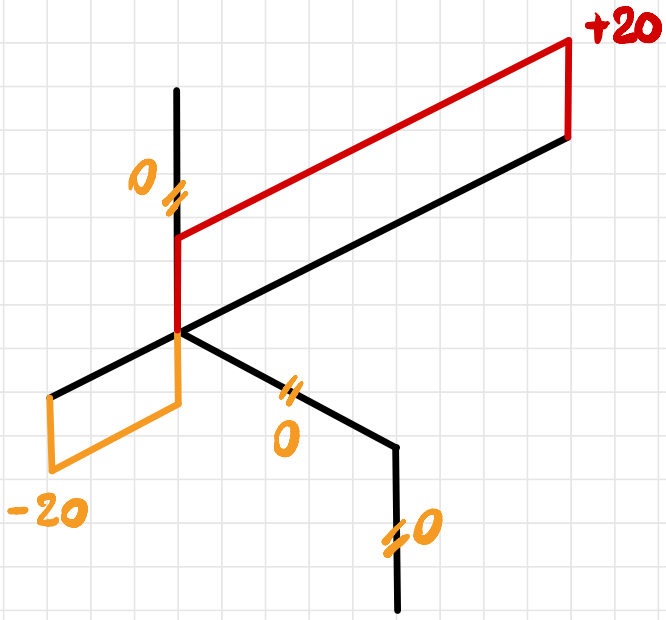
N[kN]



V[kN]

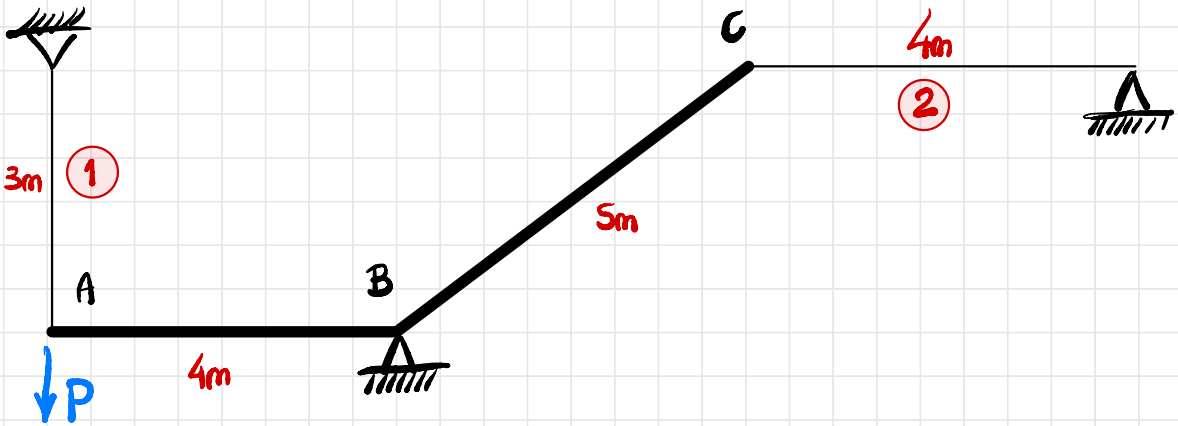


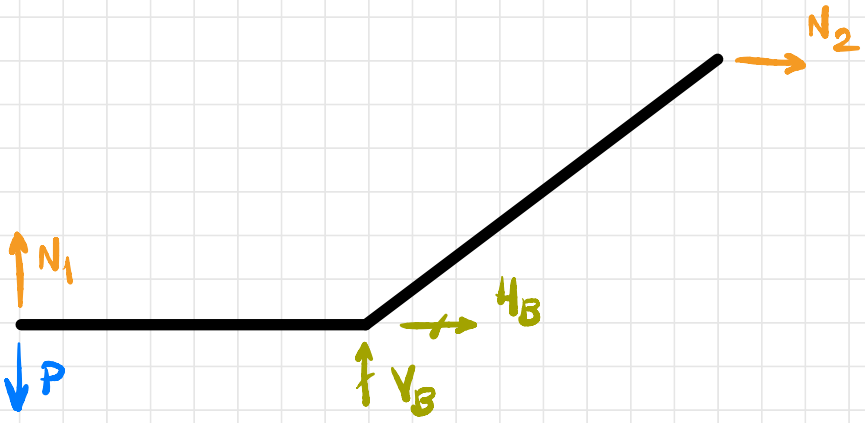
M[kNm]



T[kNm]

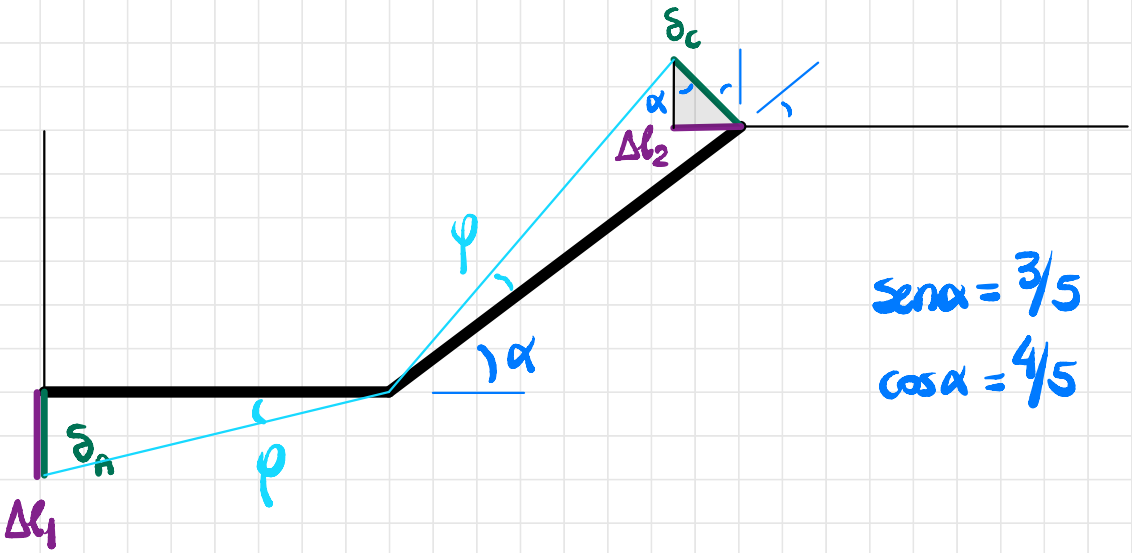
EA conhecido, qual o valor das normais?





$$\circlearrowleft + \Sigma M_B = 0: \quad P.4 - N_1.4 - N_2.3 = 0$$

$$4N_1 + 3N_2 = 4P$$



$\operatorname{sen}\alpha = 3/5$

$\cos\alpha = 4/5$

$$\delta_A = \Delta\ell_1$$

$$\delta_C = \frac{\Delta\ell_2}{\operatorname{sen}\alpha}$$

$$tg\,\varphi = \frac{\delta_A}{4} = \frac{\delta_C}{5}$$

$$\frac{\Delta\ell_1}{4} = \frac{\Delta\ell_2}{5\operatorname{sen}\alpha} \rightarrow \frac{\Delta\ell_1}{4} = \frac{\Delta\ell_2}{3}$$

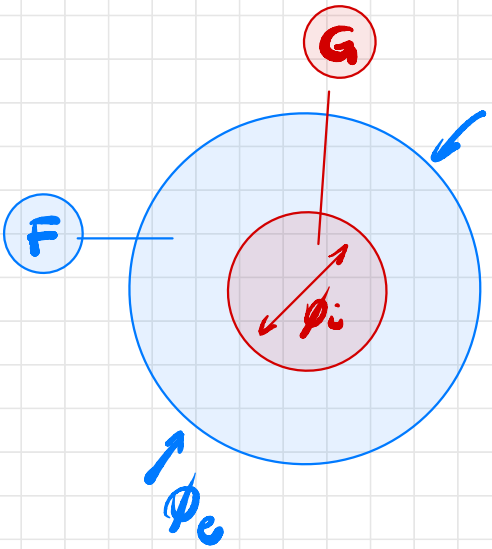
$$\frac{N_1\ell_1}{4EA} = \frac{N_2\ell_2}{3EA} \rightarrow \frac{N_1 \cdot 3}{4} = \frac{N_2 \cdot 4}{3} \rightarrow N_2 = \frac{9}{16}N_1$$

$$\therefore\ 4N_1 + 3\left(\frac{9}{16}N_1\right) = 4P$$

$$\frac{91}{16}N_1 = 4P$$

$$\therefore\ N_1 = \frac{64}{91}P\ ,\quad N_2 = \frac{36}{91}P$$

Supondo que a seção transversal do fio é composta de 2 materiais, qual é $P_{máx}$?



$\phi_i = 8\,cm$

$\phi_e = 10\,cm$

$E_F = 200\,GPa$

$E_G = 100\,GPa$

$\overline{\sigma}_F = 300\,MPa$

$\overline{\sigma}_G = 100\,MPa$

$$EA_{eq} = \sum EA = E_F A_F + E_G A_G$$

$$EA_{eq} = 200.10^9 . \frac{\pi}{4}(0,1^2 - 0,08^2) + 100.10^9 . \frac{\pi}{4} . 0,08^2$$

$$EA_{eq} = 1,8.\pi.10^8 + 1,6\pi.10^8$$

$$EA_{eq} = 1068,14\ MN$$

Deformação máxima:

$$\bar{\varepsilon}_F = \frac{\bar{\sigma}_F}{E_F} \qquad \bar{\varepsilon}_G = \frac{\bar{\sigma}_G}{E_G}$$

$$\bar{\varepsilon}_F = \frac{300.10^6}{200.10^9} \qquad \bar{\varepsilon}_G = \frac{100.10^6}{100.10^9}$$

$$\bar{\varepsilon}_F = 1,5.10^{-3} \qquad \bar{\varepsilon}_G = 1.10^{-3}$$

Logo $\bar{\varepsilon} = \min(\bar{\varepsilon}_F, \bar{\varepsilon}_G) = 10^{-3}$

$$\therefore \max(\varepsilon_1, \varepsilon_2) \leq \bar{\varepsilon}$$

$$\varepsilon_1 \leq \bar{\varepsilon} \rightarrow \frac{N_1}{EA_{eq}} \leq \bar{\varepsilon}$$

$$\therefore N_1 \leq EA_{eq}\bar{\varepsilon}$$

$$N_1 \leq 1068{,}14\ 10^{6} \cdot 10^{-3}$$

$$N_1 \leq 1068{,}14\ kN$$

$$\frac{64P}{91} \leq 1068{,}14$$

$$\therefore \boxed{P \leq 1518{,}8\ kN}$$