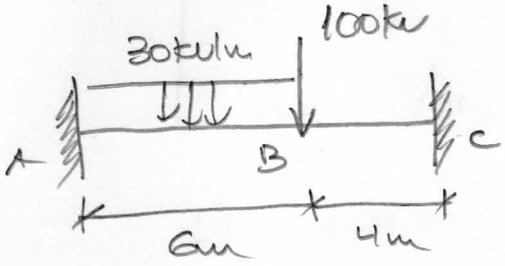
B4TE16ANC



D1: GIRO EM B

D2: DESLOC. VERTICAL EM B

Q01) k_{11}?

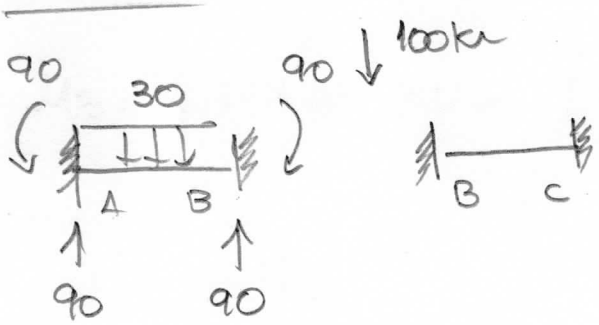
Q02) k_{12}?

Q03) M_B (CONVENÇÃO DE SINAIS)

$E = 25\,GPa$

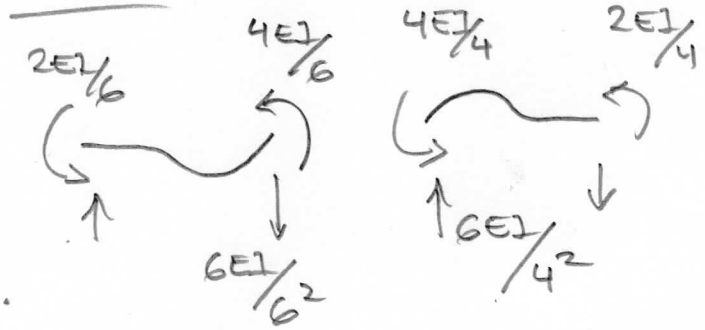
$b = 20\,cm$ $h = 50\,cm$

CASO 0



$$\{F_0\} = \begin{Bmatrix} -90 \\ +90 \end{Bmatrix} \quad \{F_u\} = \begin{Bmatrix} 0 \\ -100 \end{Bmatrix}$$

CASO 1



$$k_{11} = \frac{4}{6}EI + \frac{4}{4}EI = \frac{5}{3}EI$$

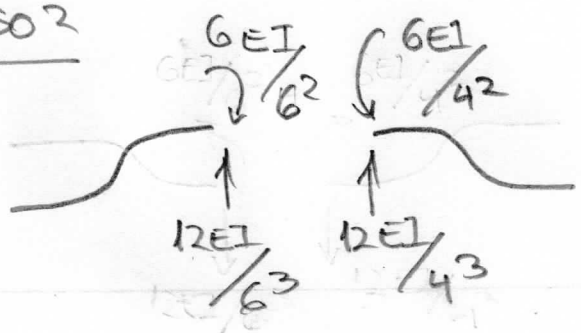
$$k_{21} = -\frac{6}{6^2}EI + \frac{6}{4^2}EI = \frac{5}{24}EI$$

$$EI = 25 \times 10^6 \times 0{,}2 \times 0{,}5^3/12 = 52083$$

$$k_{11} = 5/3 \times 52083 = 86805 \quad (Q01)$$

$$k_{12} = 5/24 \times 52083 = 10851 \quad (Q02)$$

CASO 2



$$k_{12} = -\frac{6EI}{6^2} + \frac{6EI}{4^2} = \frac{5}{24}EI$$

$$k_{22} = \frac{12EI}{6^3} + \frac{12EI}{4^3} = \frac{35}{144}EI$$

$$\begin{bmatrix} 5/3 & 5/24 \\ 5/24 & 35/144 \end{bmatrix} \begin{Bmatrix} D1 \\ D2 \end{Bmatrix} = \begin{Bmatrix} 0 + 90 = +90 \\ -100 - 90 = -190 \end{Bmatrix}$$

$D1 = 169,92/EI = 3,2625 \times 10^{-3}$ rad

$D2 = -927,36/EI = -1,7805 \times 10^{-2}$ m

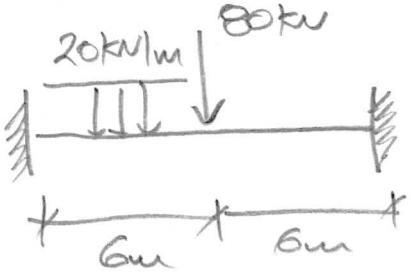
$$M_B^{BC} = 0 + EI\left(\frac{169,92}{EI}\right) + \frac{6EI}{16}\left(\frac{-927,36}{EI}\right) = -177,84 \circlearrowright$$

$M_B = +177,84$ kNm (Q03)

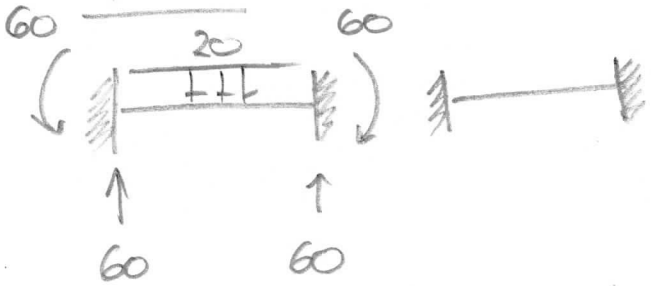
B4 TE16 ANM

$E = 20000\ MPa$

$b = 20\ cm \quad h = 60\ cm$

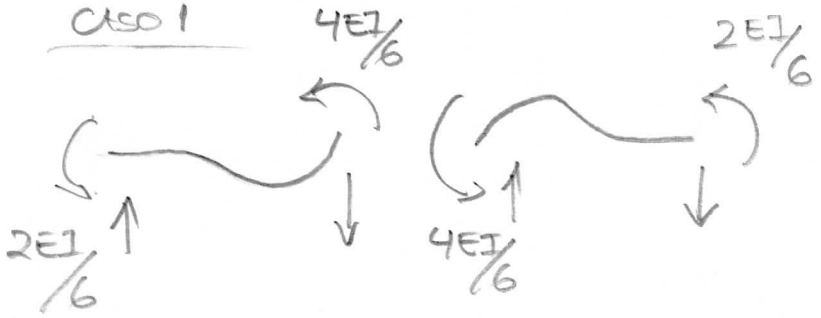


Caso 0



$F10 = -60\ kNm$ (Q01)

Caso 1



$$k_{11} = \frac{4EI}{6} + \frac{4EI}{6}$$

$$k_{11} = \frac{8}{6} EI$$

$$EI = 20\times10^{6} \times 0{,}2 \times 0{,}6^{3}/12 = 72000\ kNm^2$$

$$k_{11} = 8/6 \times 72000 = 96000\ kNm/rad \quad (Q02)$$

$$k_{11} \times D_1 + F_{10} = F_{1N}$$

$$D_1 = (F_{1N} - F_{10})/k_{11} = \frac{0 - (-60)}{8/6\ EI} = \frac{360}{8EI} = 45/EI$$

$$M_B = -60 + 4/6\ EI \times 45/EI = -30\ kNm \quad (Q03)$$