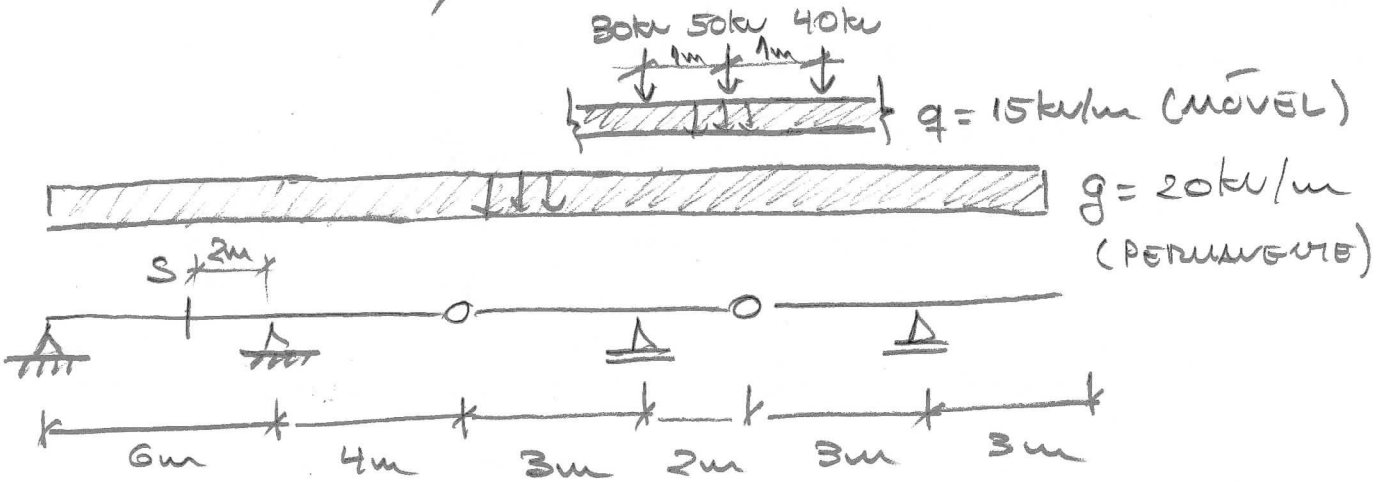
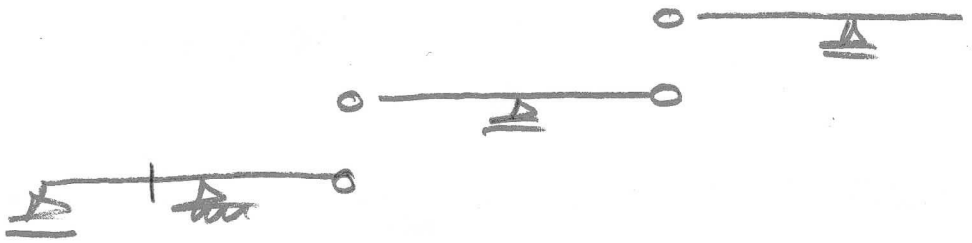
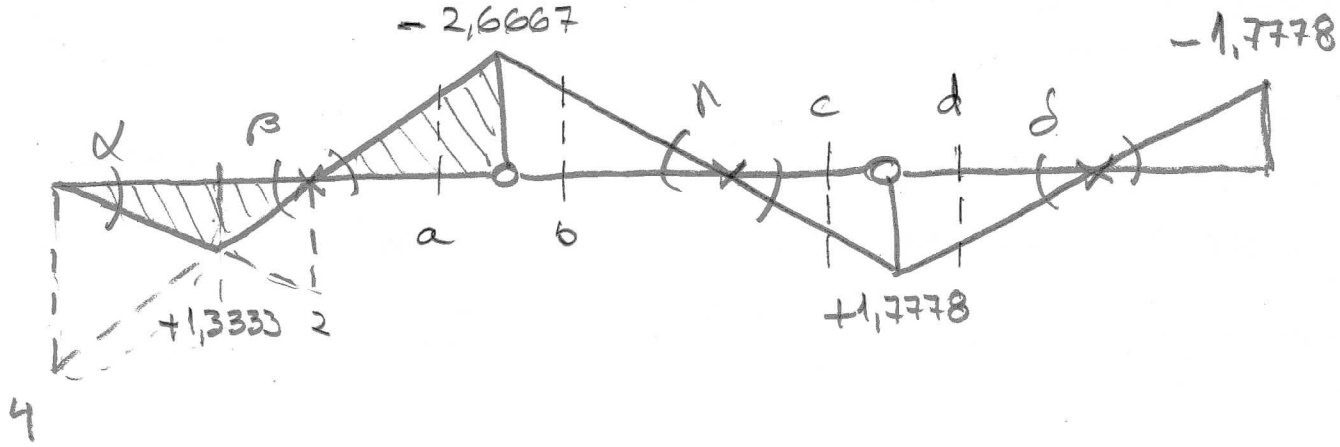
TE17-B3-1000 => CALCULAR $M_{SMÁX}$ E $M_{SMÍN}$;



(1) ESQUEMA FUNCIONAL:



(2) TRAÇADO DA LI $M_S(x)$:



$tg\alpha = 2/6$ $tg\beta = 4/6$ $tg\gamma = 8/3 = 8/9$ $tg\delta = \frac{16/9}{3} = 16/27$

$2/6 \times 4 = 8/6 = 4/3 = 1,3333$ | $8/9 \times 2 = 16/9 = 1,7778$

$4/6 \times 4 = 16/6 = 8/3 = 2,6667$ | $16/27 \times 3 = 16/9 = 1,7778$

$a = tg\beta \times 3 = 4/6 \times 3 = 12/6 = 2\ (-)$

$b = tg\gamma \times 2 = 8/9 \times 2 = 16/9 = 1,7778\ (-)$

$c = tg\gamma \times 1 = 8/9 \times 1 = 8/9 = 0,88889\ (+)$

$d = tg\delta \times 2 = 16/27 \times 2 = 32/27 = 1,1852\ (+)$

$A\oplus = 6m \times 1,3333m/2 + 5m \times 1,7778m/2$

$A\oplus = 8,4444\ m^2$

$A\ominus = 7m \times (-2,6667m)/2 + 3m \times (-1,7778m)/2$

$A\ominus = -12,000\ m^2$

* PERM.: $20kN/m \times (8,4444 + (-12,000))m^2 = -71,112\ kNm$

MSmáx:

$50kN \times 1,7778m + 40kN \times 1,1852m + 30kN \times 0,88889m$

$+ 15kN/m \times 8,4444m^2 - 71,112\ kNm = +218,52\ kNm$

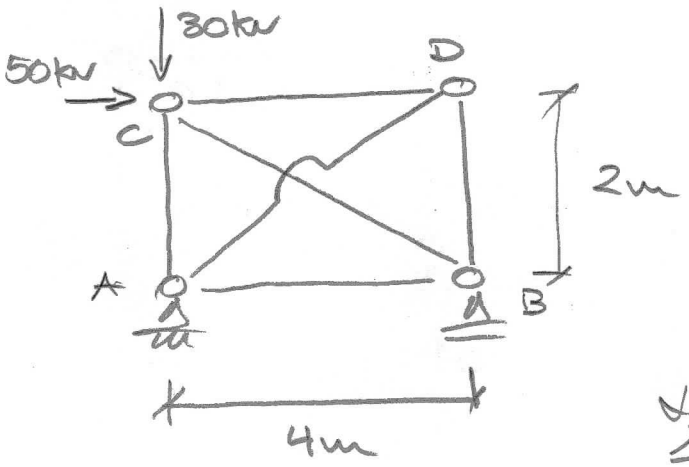
MSmín:

$50kN \times (-2,6667m) + 40kN \times (-2m) + 30kN \times (-1,7778m)$

$+ 15kN/m \times (-12,000m^2) - 71,112\ KNm = -517,78\ kNm$

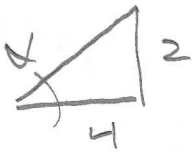
RESPOSTA: $M_{S1}\ [-517,78 ; +218,52]\ kNm$

TE17 - B3 - 2000



→ CALCULAR O ESFORÇO AXIAL NA BARRA BC;

→ TODAS AS BARRAS POSSUEM O MESMO MÓDULO DE RIGIDEZ AXIAL EA;

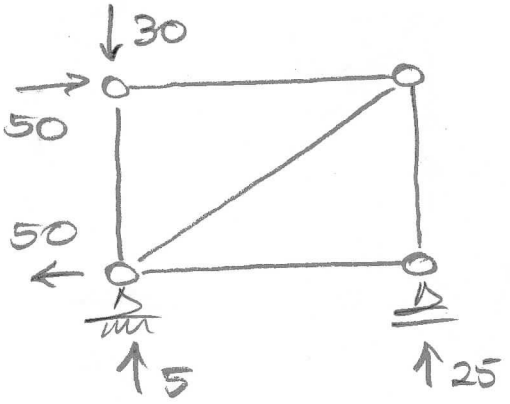


$MP = \sqrt{4^2+2^2} = \sqrt{20}$

$\cos\alpha = 4/\sqrt{20}$

$\operatorname{sen}\alpha = 2/\sqrt{20}$

CASO 0



$\Sigma M_A = 0$ ↺ ⊕ $V_B \times 4 - 50 \times 2 = 0$

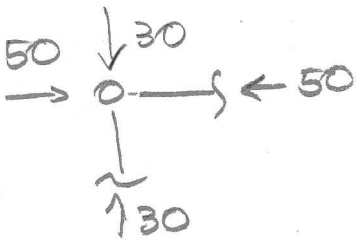
$V_B = 1/4 \times 100 = 25\,kN \uparrow$

$\Sigma F_V = 0$ ↑ ⊕ $V_A + 25 - 30 = 0$

$V_A = 30 - 25 = 5\,kN \uparrow$

$\Sigma F_H = 0$ → ⊕ $H_A = 30\,kN \leftarrow$

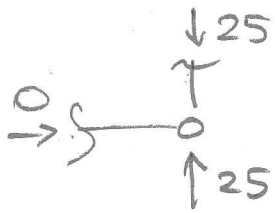
NÓ C



$N_{CD_0} = -50\,kN$

$N_{AC_0} = -30\,kN$

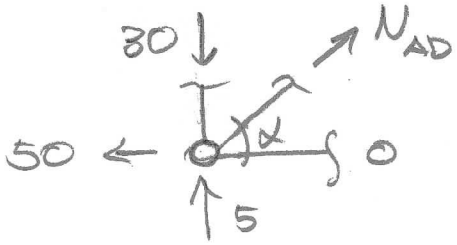
NÓ B



$N_{AB_0} = 0$

$N_{BD_0} = -25\,kN$

NÓ A

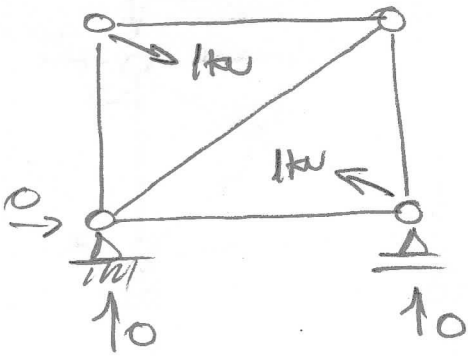


$N_{AD} \cos\alpha - 50 = 0$

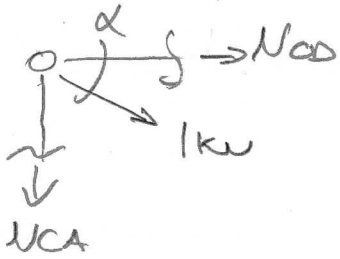
$N_{AD} = 50/4\sqrt{20} = \underline{25\sqrt{5}}$ ⊕

$25\sqrt{5} \times 2/\sqrt{20} + 5 - 30 = 0$

CASO 1



Nó C:

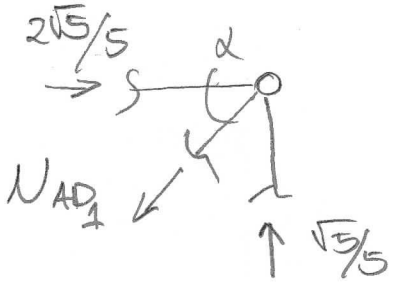


$$N_{CD_1} = -1kN \times 4/\sqrt{20} = -\frac{2\sqrt{5}}{5}$$

$$N_{CA_1} = -1kN \times 2/\sqrt{20} = -\sqrt{5}/5$$

Nó B: IDEM ⇒ $N_{AB_1} = -2\sqrt{5}/5$ $N_{BD_1} = -\sqrt{5}/5$

Nó D:



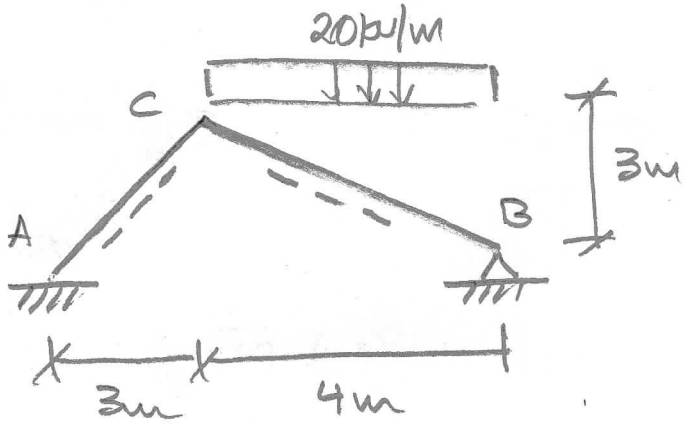
$N_{AD_1} = 1kN$ (+)

Barra	N_0	N_1	L	δ_{10} $N_0 N_1 L/EA$	δ_{11} $N_1^2 L/EA$
AB	0	$-2\sqrt{5}/5$	4	0	3,2
AC	−30	$-\sqrt{5}/5$	2	$+12\sqrt{5}$	0,4
CD	−50	$-2\sqrt{5}/5$	4	$+80\sqrt{5}$	3,2
BD	−25	$-\sqrt{5}/5$	2	$+10\sqrt{5}$	0,4
AD	$25\sqrt{5}$	+1	$2\sqrt{5}$	250	$2\sqrt{5}$
				478,08/EA	11,672/EA

$$N_{BC} \cdot \frac{11,672}{EA} + \frac{478,08}{EA} = -\frac{N_{BC} \times 2\sqrt{5}}{EA}$$

$$N_{BC} = \frac{-478,08}{11,672 + 2\sqrt{5}} = \boxed{-29,613\,kN}$$

TE17 - B3 - 3000



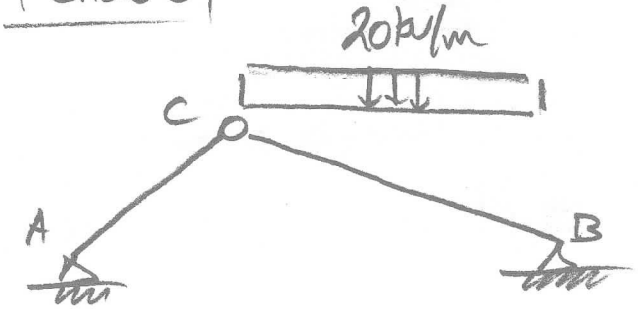
→ CONSIDERAR SOMENTE EFEITOS DE FLEXÃO;

→ TODAS AS BARRAS POSSUEM A MESMA RIGIDEZ FLEXURAL;

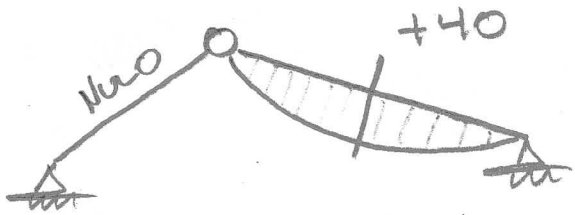
PEDE-SE:

CALCULAR O MOMENTO FLETOR NO PONTO C (SINAL CONFORME CONVENÇÃO)

CASO 0

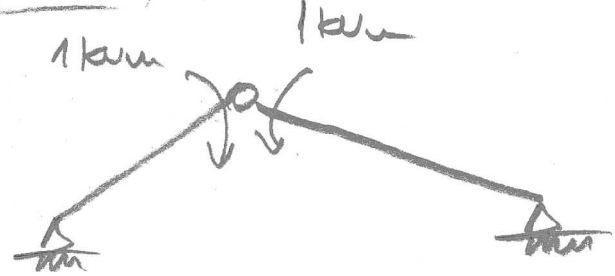


M_0

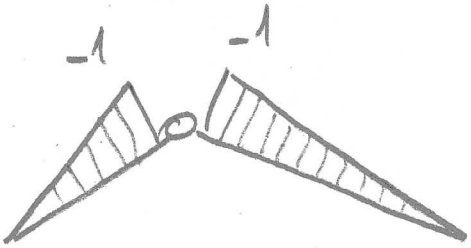


$M_{BC\ MEIO} = 20 \times 4^2/8 =$

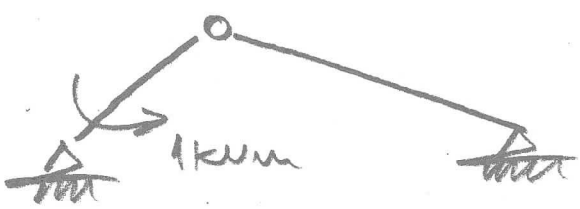
CASO 1



M_1



CASO 2



M_0



$L_{AC} = \sqrt{3^2+3^2} = \sqrt{18}$

$L_{BC} = \sqrt{3^2+4^2} = 5$

$S_{10} = \frac{1}{6} \times 5m \times (-1) \times (2 \times 40 + 0) = -400/6 = -66,666$

$S_{20} = 0$

$f_{11} = \frac{1}{3}\sqrt{18}\,(-1)^2 + \frac{1}{3} \times 5m \times (-1)^2 = 3,08088$

$f_{22} = \frac{1}{3}\sqrt{18}\,(-1)^2 = 1,4142$

$f_{12} = \frac{1}{6}\sqrt{18}\,(-1)(-1) = 0,70711$

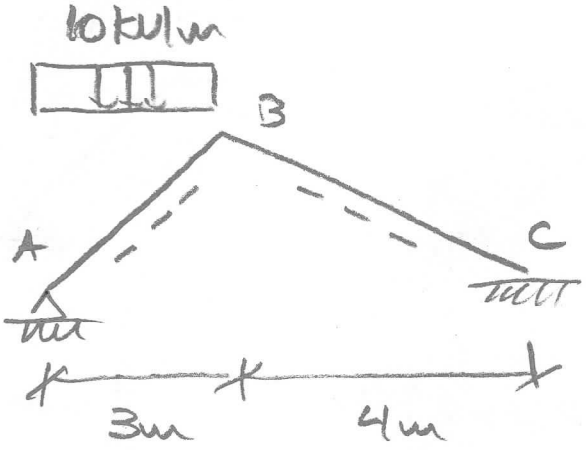
Sistema de Equações de Compatibilidade:

$$\begin{bmatrix} 3,08088 & 0,70711 \\ 0,70711 & 1,4142 \end{bmatrix} \begin{Bmatrix} M_C \\ M_A \end{Bmatrix} = \begin{Bmatrix} +66,667 \\ 0 \end{Bmatrix}$$

$M_C = +24,444\ kNm \qquad M_A = -12,222\ kNm$

Resposta: $\boxed{M_C = -24,444\ kNm}$

TE17-53-4000

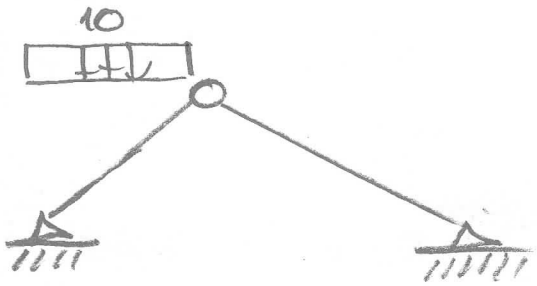


3m

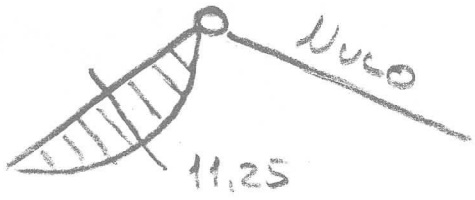
- TODAS AS BARRAS POSSUEM O MESMO EI;
- CONSIDERAR SOMENTE EFEITOS DE FLEXÃO

PEDE-SE: CALCULAR O MOMENTO FLETOR NO PONTO C; (SINAL CONFORME CONVENÇÃO DE DIAGRAMAS)

CASO 0



M_0 [kNm]

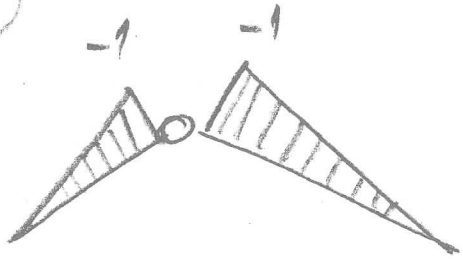


$M_{AB\,MÁX} = 10 \times 3^2/8 = 11{,}25$

CASO 1



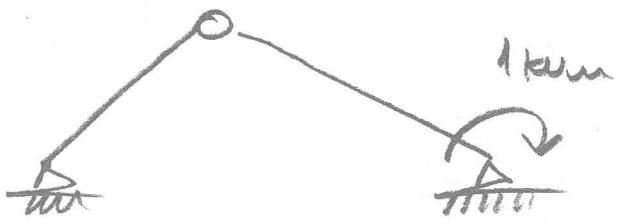
M_1



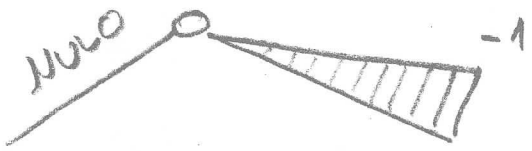
$L_{AB} = \sqrt{3^2+3^2} = \sqrt{18}\,m = 4{,}2426\,m$

$L_{BC} = \sqrt{3^2+5^2} = 5\,m$

CASO 2



M_2



$$S_{10} = \frac{1}{6}\sqrt{18} \times (-1)(2 \times 11{,}25 + 0) = -15{,}910$$

$$S_{20} = 0$$

$$f_{11} = \frac{1}{3}\times\sqrt{18}\,(-1)^2 + \frac{1}{3}\times 5\times(-1)^2 = 3{,}0810$$

$$f_{22} = \frac{1}{3}\times 5\times(-1)^2 = 1{,}6667$$

$$f_{12} = \frac{1}{6}\times 5\times(-1)(-1) = 0{,}83333$$

$$\begin{bmatrix} 3{,}0810 & 0{,}83333 \\ 0{,}83333 & 1{,}6667 \end{bmatrix} \begin{Bmatrix} M_B \\ M_C \end{Bmatrix} = \begin{Bmatrix} +15{,}91 \\ 0 \end{Bmatrix}$$

$M_B = 5{,}9714$ kNm

$M_C = -2{,}9857$ kNm

$$\boxed{M_C = +2{,}9857 \text{ kNm}}$$