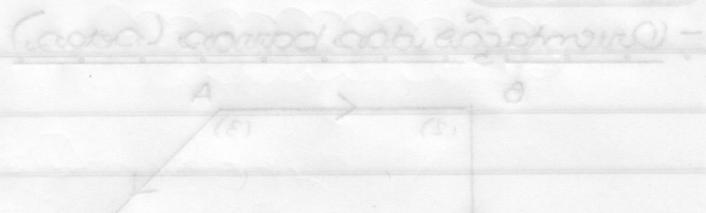
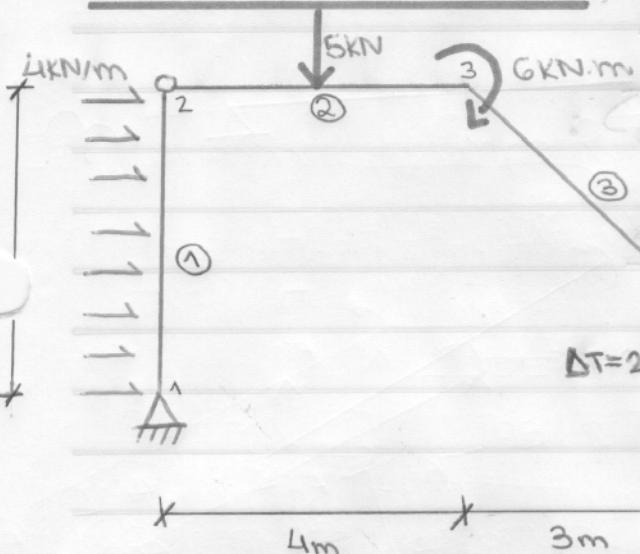


$$[K] = [R]^T \cdot [C]_{AX}^{-1} \cdot [R]$$

$$[F]^{EP} = [R]^T \cdot [F]_{AX}^{EP}$$



### Resolução de pés



Inestático → temperatura

e recaleque não afetam

$$\Delta T = 0 \quad \text{e} \quad \Delta H = 0$$

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Viga	b	h
1	0.2	0.4
2	0.3	0.3
3	0.2	0.4
4	0.2	0.05

$$E = 25000 \text{ MPa}$$

$$\alpha = 10^{-5} \text{ } ^\circ\text{C}^{-1} \quad \text{and} \quad E_c I_c = 10^4$$

$$\theta = \theta_H + \theta_H \quad \mu\text{m}$$

### Método dos deslocamentos

$$\theta = \theta_{AH} + \theta_m \quad \mu\text{rad}$$

Passo 2:

① GDL - Eq. de Equilíbrio

② Caracterizações das Vírgas

③ Equações fundamentais

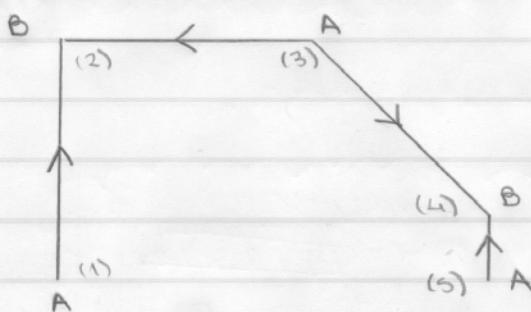
④ Sistema global de Eq. de Equilíbrio

⑤ Resolução

⑥ Fós - processamento

Ex/Problema

- Orientações das barras (setas)



$$\begin{aligned} \bar{x}_A^A \bar{x}_A^B &= \bar{\beta}_A \\ \bar{x}_A^B \bar{x}_A^C &= \bar{\beta}_A \end{aligned}$$

estágio de equilíbrio

- Para o pólice orientado assim:

①	GDL	Eq. de Equilíbrio
	$q_1$	$M_A^{(1)} = 0$
	$m_2$	$H_B^{(2)} + H_B^{(3)} = 0$
	$v_2$	$R_B^{(2)} + R_B^{(3)} = 0$
sistema {	$q_3$	$M_B^{(1)} = 0$
	$q_3$	$M_B^{(2)} = 0$
	$m_3$	$H_A^{(2)} + H_A^{(3)} = 0$
	$v_3$	$R_A^{(1)} + R_A^{(2)} = 0$
	$q_3$	$M_A^{(2)} + M_A^{(3)} = -6$
	$m_4$	$H_B^{(3)} + H_B^{(4)} = 0$
	$v_4$	$R_B^{(4)} + R_B^{(5)} = -3m$
	$q_4$	$M_B^{(3)} + M_B^{(4)} = 0$
	$q_5$	$M_A^{(4)} = 0$

② Caracterizações das vigas:

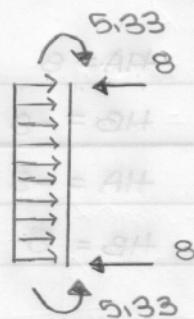
barras	EI	L	L'
1	26 667	4	1,5
2	16 875	4	2,4
3	26 667	4,24	1,59
4	52,08	1	1,92

Barras 1:  $\beta = 4/L = 2,67$

$$M_{AB} = 5,33 ; M_{BA} = -5,33$$

$$H_{AB} = -8 ; H_{BA} = -8$$

$$R_{AB} = 0 ; R_{BA} = 0$$



22/04/13

AM = AM 16

8 = 8m

0 = AM : 1

8 = 8m

Barras 2:  $\beta = 4/L = 1,67$

- $M_{AB} = -\frac{Pab^2}{L^2} = -2,5 ; M_{BA} = 2,5$

- $R_{AB} = 2,5 ; R_{BA} = 2,5$

- $H_{AB} = 0 ; H_{BA} = 0$

$$8 = 2g + 1g$$

$$2g = 8H + NH$$

$$0 = 6g + H \cdot H$$

HOVHS

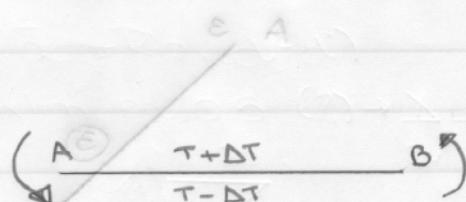
Barras 3:  $\beta = 2,5$  no eixo ab é constante em comodora

- $M_{AB} = M_{BA} = 0$

- $R_{AB} = R_{BA} = 0$

- $H_{AB} = H_{BA} = 0$

$$HO = 0$$



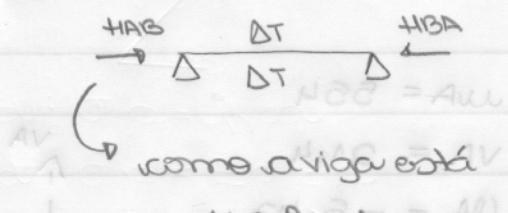
Barras 4:  $\beta = 0,021$

- $M_{AB} = \alpha \cdot \Delta T \cdot EI = -0,208$

- $M_{BA} = 0,208$

- $R_{AB} = \alpha \cdot \Delta T \cdot EA = 25$

- $R_{BA} = -25$



\*não entra recolhe aqui, só na eq fundamental  $H \cdot PA = -\partial V$

Matemática (elhar anexo) =  $A_{uv}$

1:  $MA = 0$        $HA = -8$        $RA = -1,85$

$MB = 0$        $HB = 8$        $RB = 1,85$

2:  $MA = -17$        $HA = -8$        $RA = 6,85$

$MB = 0$        $HB = 8$        $RB = -1,85$

en rod/CS

3:	$MA = M_A$	$HA = 8$	$RA = -6,55$	$\alpha = 45^\circ \Rightarrow \tan \alpha = 1$
	$MB = -8$	$HB = -8$	$RB = 6,85$	$\alpha = 45^\circ \Rightarrow \tan \alpha = 1$
4:	$MA = 0$	$HA = -8$	$RA = 9,85$	$\alpha = 45^\circ \Rightarrow \tan \alpha = 1$
	$MB = 8$	$HB = 8$	$RB = -9,85$	$\alpha = 45^\circ \Rightarrow \tan \alpha = 1$

Para Verificarem:

$$\left\{ \begin{array}{l} R_A + R_S = 8 \\ H_A + H_S = -16 \\ R_S = 32 - 10 - 6 - 21 = 0 \\ H_A = 4 + 32 = 36 \end{array} \right.$$

$$H_S = -8$$

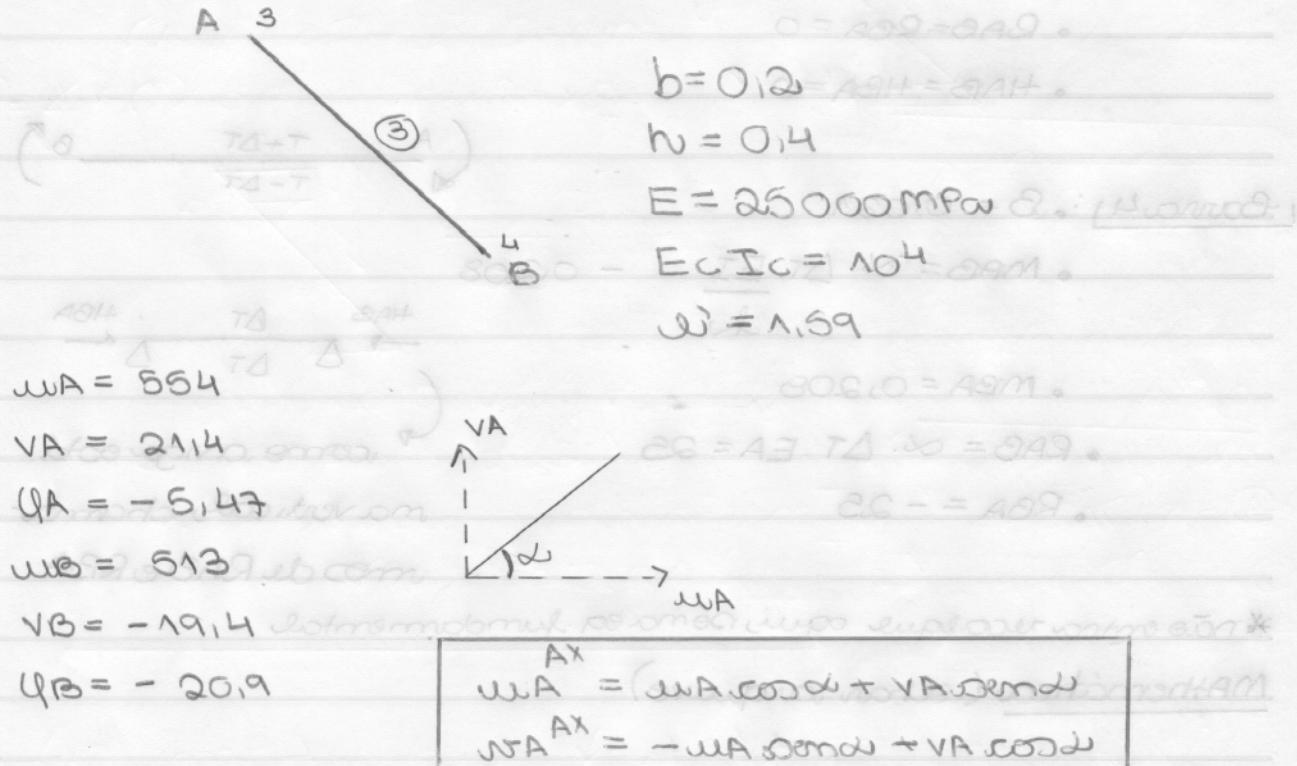
$$R_A = -1,85714$$

$$H_S = -8$$

$$R_S = 9,85714$$

24/04

Analisando a barra 3 do exercício anterior com os dados adquiridos no Mathematica:



$Ax$	$M_A = M_A \cos \alpha + V_A \sin \alpha$
$Nx$	$-M_A \sin \alpha + V_A \cos \alpha$

para  $\alpha = -\pi/4$ :  $\cos \alpha = \sqrt{2}/2$ ,  $\sin \alpha = -\sqrt{2}/2$

$Cs$	$M_A = 854$	$8 = 854$	$0 = \text{AM}$
$Cs$	$8 = 854$	$8 = 854$	$0 = \text{AM}$