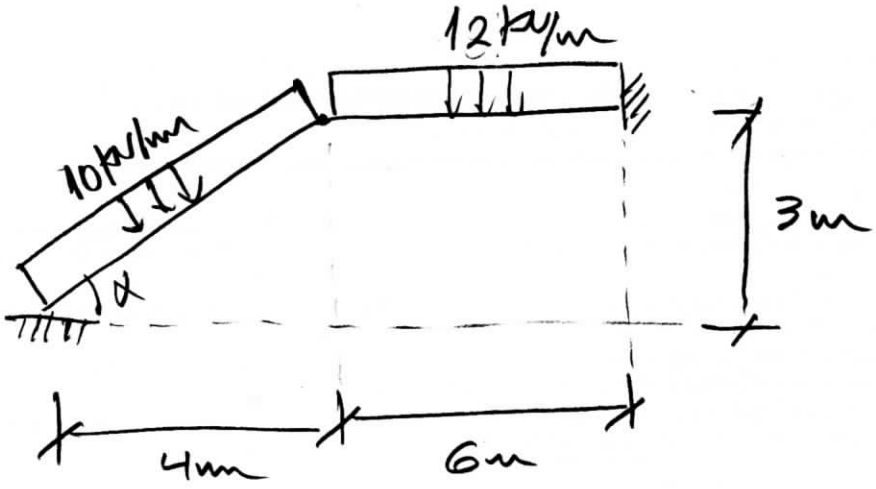
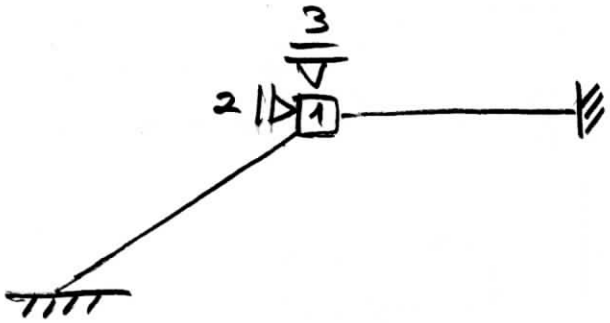
TE2-6.3

(1)



- BARRAS EXTENSÍVEIS
- b x h IGUAL P/ TODAS AS BARRAS
- E IGUAL P/ TODAS AS BARRAS



$b = 15\,cm$

$h = 40\,cm$

$E = 25000\,MPa$

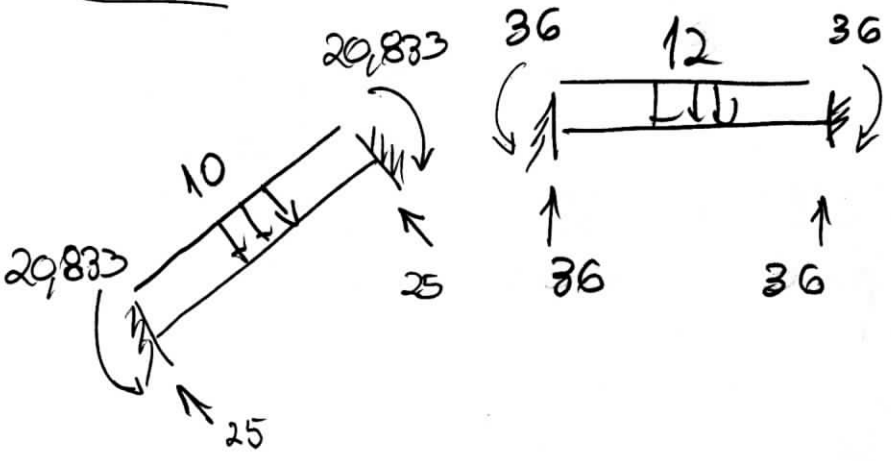
$q\ell/2 = 10 \times 5/2 = 25$

$q\ell^2/12 = 10 \times 5^2/12 = 20{,}833$

$q\ell/2 = 12 \times 6/2 = 36$

$q\ell^2/12 = 12 \times 6^2/12 = 36$

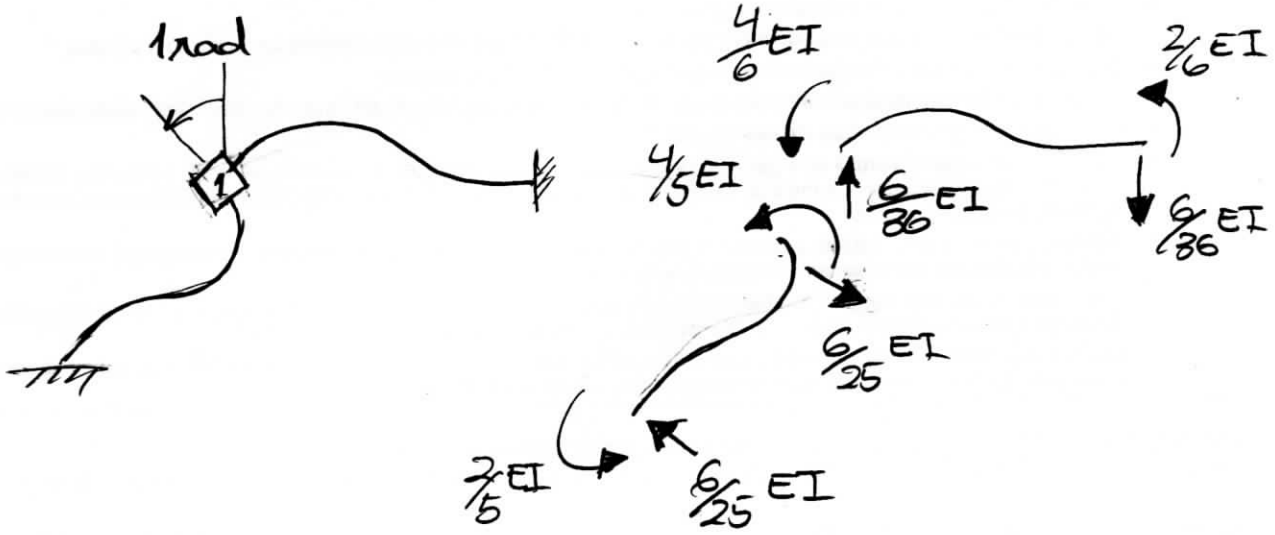
ASOO:



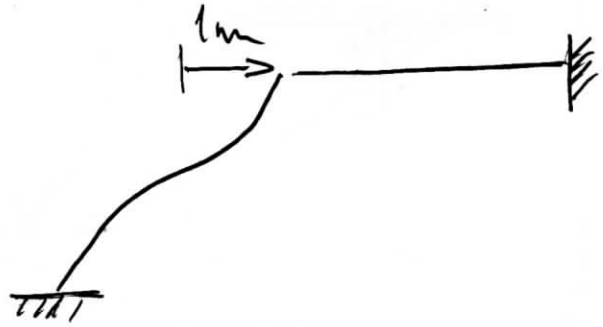
$\cos\alpha = 4/5$

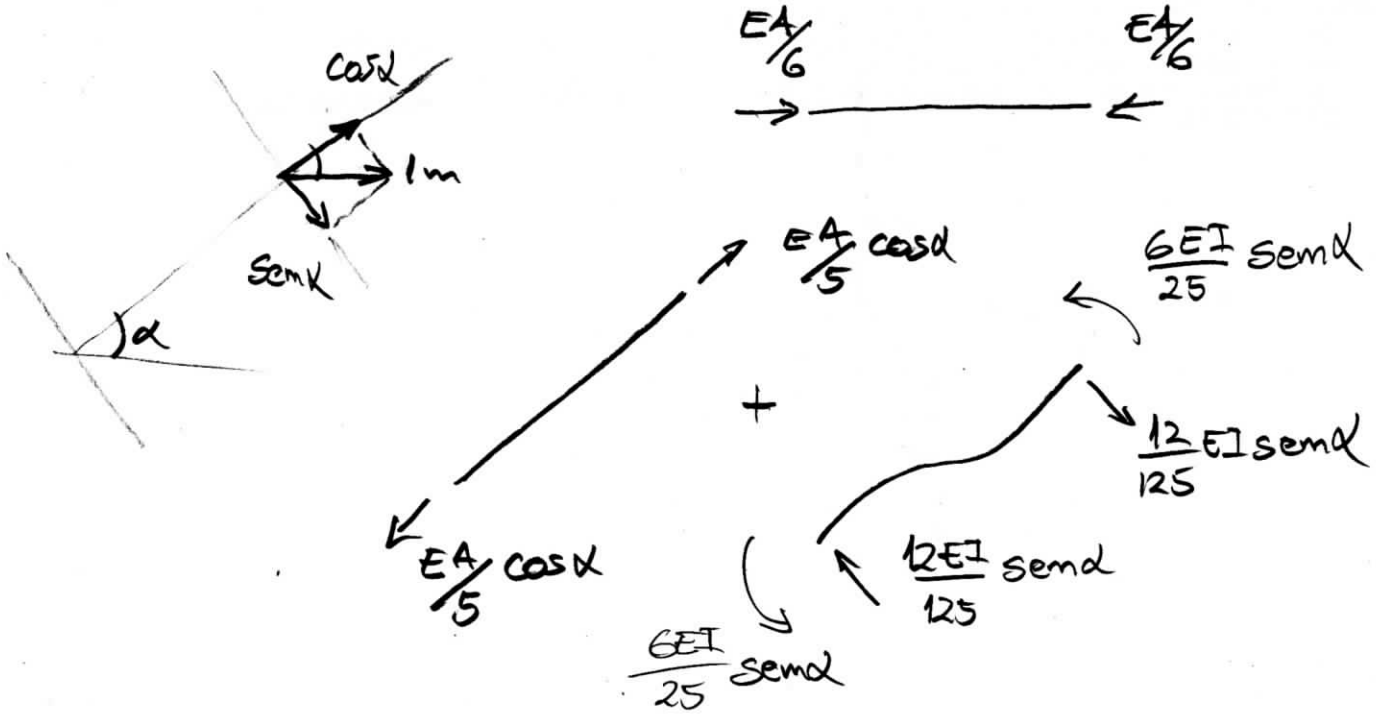
$\operatorname{sen}\alpha = 3/5$

Caso 1:

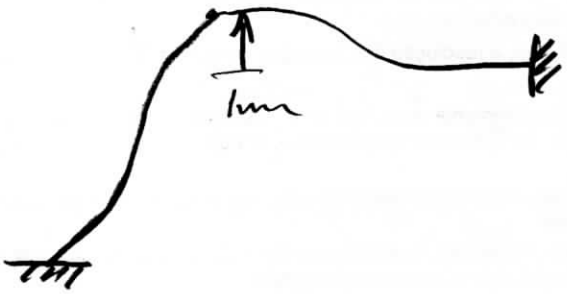

1 rad
1
4/6 EI
2/6 EI
4/5 EI
6/36 EI
6/36 EI
6/25 EI
2/5 EI
6/25 EI

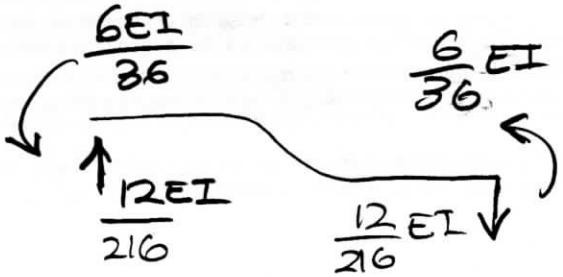
Caso 2:

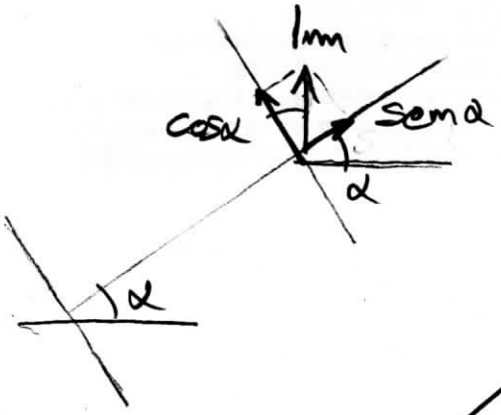

1m

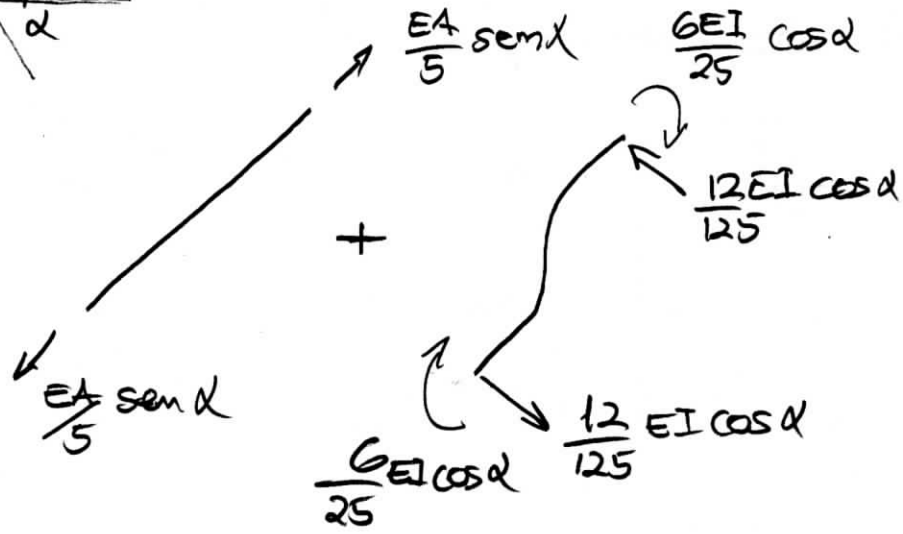

EA/6
EA/6
cosα
1m
senα
α
EA/5 cosα
6EI/25 senα
+
12EI/125 senα
EA/5 cosα
12EI/125 senα
6EI/25 senα

CASO 3 :









$$\{F\} = \begin{cases} F_1 = 36 - 20,833 = +15,167\ kN\,m \\ F_2 = -25\,\text{sen}\alpha = -25 \times 3/5 = -15\ kN \\ F_3 = 36 + 25\cos\alpha = 36 + 25 \times 4/5 = +56\ kN \end{cases} \quad \checkmark \quad \checkmark \quad \checkmark$$

$[K] = ?$

$k_{11} = (4/5 + 4/6)\,EI = \underline{22/15\,EI}$ //

$k_{12} = 6/25\,EI \operatorname{sen}\alpha = 6/25 \times 3/5\,EI = \underline{18/125\,EI}$ //

$k_{13} = -6/25\,EI\cos\alpha + 6/36\,EI = \underline{-19/750\,EI}$ //

$k_{22} = EA/6 + EA/5\,\cos^2\alpha + 12/125\,EI\,\operatorname{sen}^2\alpha$

$\underline{\frac{221}{750}EA + \frac{108}{3125}EI}$ //

$k_{23} = EA/5\,\operatorname{sen}\alpha\cos\alpha - 12/125\,EI\cos\alpha\operatorname{sen}\alpha$

$= \underline{12/125\,EA - \frac{144}{3125}EI}$ //

$k_{33} = 12/216\,EI + EA/5\,\operatorname{sen}^2\alpha + 12/125\,EI\cos^2\alpha.$

$= \underline{\frac{6581}{56250}EI + 9/125\,EA}$ //

$EI = 0{,}15 \times 94^3/12 \times 25 \times 10^6 = 20.000\ kN\,m^2$

$EA = 0{,}15 \times 94 \times 25 \times 10^6 = 1500.000\ kN$

$$\begin{bmatrix} k_{11} = 29333 & k_{12} = 2880 & k_{13} = -50667 \\ k_{21} = \text{SIM.} & k_{22} = 442691 & k_{23} = 143078 \\ k_{31} = \text{SIM.} & k_{32} = \text{SIM.} & k_{33} = 110340 \end{bmatrix}$$

E

$$\begin{bmatrix} 29333 & 2880 & -50667 \\ 2880 & 442691 & 143078 \\ -50667 & 143078 & 110340 \end{bmatrix} \begin{Bmatrix} D_1 \\ D_2 \\ D_3 \end{Bmatrix} = \begin{Bmatrix} -15,167 \\ +15 \\ -56 \end{Bmatrix}$$

D1 = -5.67898 E -4 rad
D2 = 3.48512 E -4 m
D3 = 9.62046 E -4 m