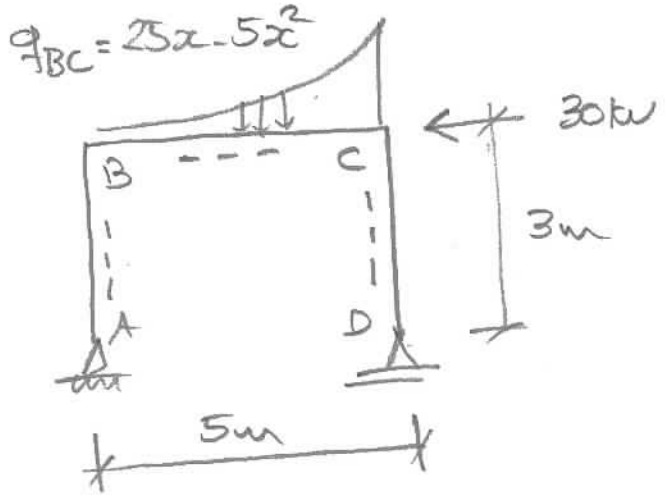
B1T4 PORT 1



$$Rq_{BC} = \int_0^5 25x - 5x^2 \, dx$$

$$= \left[25\frac{x^2}{2} - 5\frac{x^3}{3}\right]_0^5$$

$$= 25\times\frac{5^2}{2} - 5\times\frac{5^3}{3}$$

$$= 104{,}17 \text{ kN}$$ Resultante de Carga

$$x_{BC} = \int_0^5 \frac{x(25x - 5x^2)}{104{,}17} dx = 2{,}4999 \sim 2{,}5\text{m}$$ Posição da Resultante de Carga

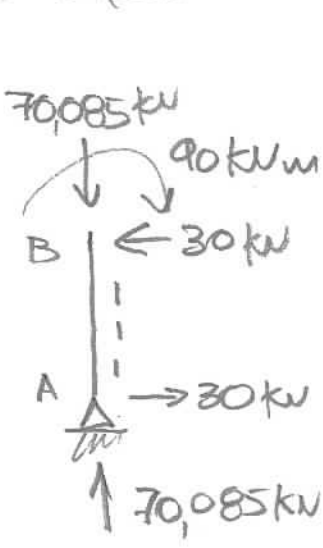
- Cálculo das Reações de Apoio;

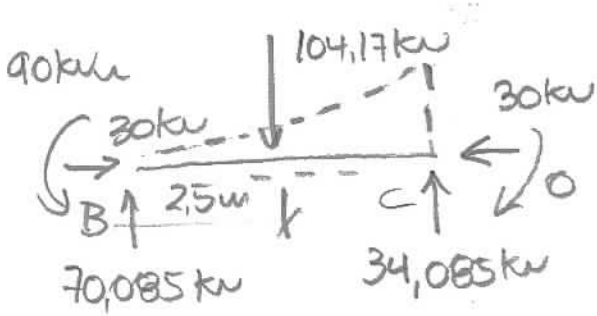
$\Sigma F_H = 0 \xrightarrow{\oplus} H_A = 30\text{kN} \rightarrow$ // Q02

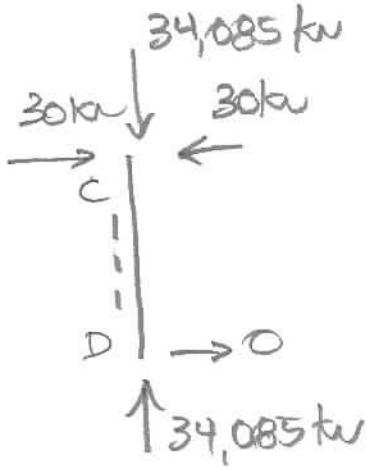
$\Sigma M_D = 0 \circlearrowright_{\oplus}$ $V_A \times 5\text{m} - 104{,}17\text{kN} \times 2{,}5\text{m} - 30\text{kN} \times 3\text{m} = 0$

$V_A = \frac{1}{5}(104{,}17\times 2{,}5 + 30\times 3) = +70{,}085\text{kN}\uparrow$ // Q01

- Equilíbrio Individual das Barras:







Equação $M_{BC}(x)$: (VIII)

$$M_{BC}(x) = -90 + 70{,}085x - \iint q_{BC}(x)\,dx$$

$$M_{BC}(x) = -90 + 70{,}085x + \frac{5x^4}{12} - \frac{50x^3}{12}$$

$$M_{BC}(x) = \frac{5}{12}x^4 - \frac{50x^3}{12} + 70{,}085x - 90$$

$$\frac{dM_{BC}(x)}{dx} = 0 \rightsquigarrow \frac{20}{12}x^3 - \frac{150x^2}{12} + 70{,}085 = 0$$

Raízes da Equação de 3º grau:

$x' = 3{,}0868$ ← única raiz dentro do

$x'' = 6{,}5068$ comprimento da viga

$x''' = -2{,}0936$

$$M_{BC}(x = 3{,}0868\,m) = \frac{5}{12}(3{,}0868)^4 - \frac{50}{12}(3{,}0868)^3 + 70{,}085 \times 3{,}0868 - 90$$

$M_{BC}(x = 3{,}0868) = \oplus 41{,}617\,kN.m$

$M_{BC}(x = 0) = \ominus 90\,kN.m$

$M_{BC}(x = 5) = 8{,}333 \times 10^{-3} = 0$

Q05 $\Rightarrow$ $x = 3{,}0868\,m$

$$V_{BC}(x) = \frac{dM_{BC}(x)}{dx} = \frac{20}{12}x^3 - \frac{150x^2}{12} + 70{,}085$$

$$V_{BC}(x = 2{,}5) = \frac{20}{12} \times 2{,}5^3 - \frac{150}{12} \times 2{,}5^2 + 70{,}085 = +18{,}002\,kN$$

Rigidez Axial do Pilar AB:

$$K_{AB} = \frac{0{,}2m \times 92m \times 30 \times 10^6 kN/m^2}{3m} = 400000 kN/m$$

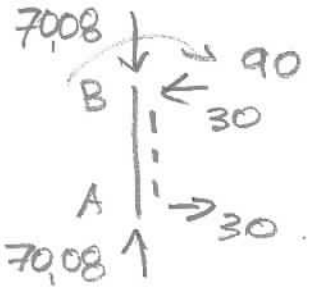
$$N_{AB} = K_{AB} \times \delta_{AB} \qquad N_{AB} = V_A$$

$$\delta_{AB} = -N_{AB}/K_{AB} = \frac{-70{,}085 kN}{400000 kN/m} = -0{,}00017521 m$$

$$\varepsilon = \frac{\Delta L}{L} = \frac{\delta_{AB}}{L} = \frac{-0{,}00017521 m}{3m} = -0{,}000058403$$

Q07

P/ BARRA AB



$$M_{AB}(x) = -30x$$

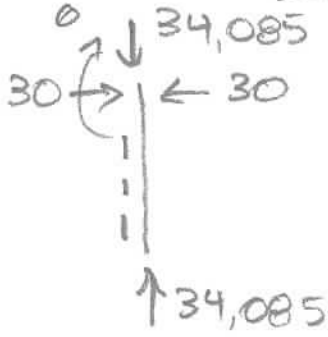
$$\frac{dM_{AB}(x)}{dx} = -30 \rightarrow$$ LOGO MÁXIMO E MÍNIMO ESTÃO NOS EXTREMOS

$M_A = -30 \times 0 = 0$ → MÁXIMO Q03

$M_B = -30 \times 3 = -90$ → MÍNIMO Q04

LOGO $x_{máximo} = 0$; Q05

P/ BARRA CD



* BARRA SOLICITADA SOMENTE POR ESFORÇO AXIAL

LOGO $V_{CD} = 0$ AO LONGO DE TODA A BARRA

Q06