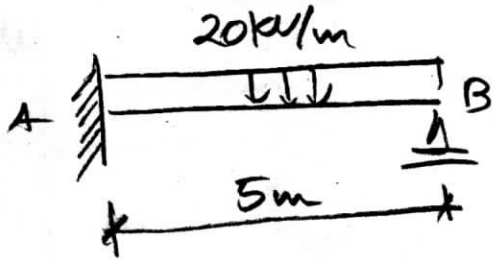
TE2-4.1



$E = 20000 MPa$

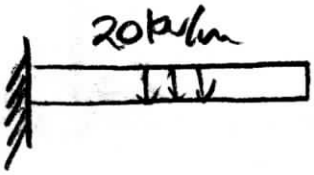
$b = 20 cm$

$h = 50 cm$

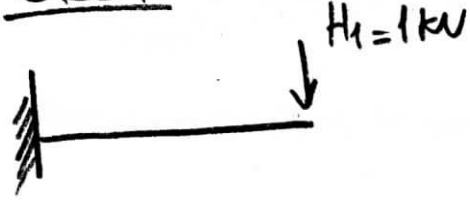
→ CONSIDERANDO SOMENTE OS EFEITOS DE MOMENTOS FLETORES

↳ ADOTANDO COMO REDUNDANTE HIPERESTÁTICA $V_B \uparrow$

Caso 0



Caso 1



M_0

$-20 \times 5^2/2 = -250 kNm$



$-20 \times 5^2/8 = -62,5 kNm$

M_1

$-5 kNm$



$EI = 20 \times 10^6 \frac{kN}{m^2} \times \frac{0,2 \times 0,5^3}{12} m^4$

$EI = 41667 kNm^2$

$$\delta_{B0} = \frac{1}{EI}\left[\frac{1}{6} L k (2j2 + j3)\right] = \frac{1}{EI}\left[\frac{1}{6} \times 5 \times (-5)(2 \times (-62,5) - 250)\right]$$

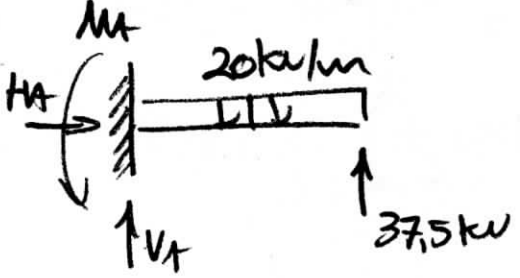
$$\delta_{B0} = 1562,5/EI$$

$$\delta_{B1} = \frac{1}{EI}\left[\frac{1}{3} L j k\right] = \frac{1}{EI}\left[\frac{1}{3} \times 5 \times -5 \times -5\right] = 41,667/EI$$

$$\delta_{B0} + \delta_{B1} \cdot V_B = 0 \qquad V_B = \frac{-\delta_{B0}}{\delta_{B1}} = \frac{1562,5/EI}{41,667/EI} = \boxed{-37,5 kN}$$

OU SEJA: $V_B = 37{,}5\,kN \uparrow$

→ TRAÇADO DO DIAGRAMA



$\oplus\uparrow \sum F_V = 0 \quad V_A - 20\,kN/m \times 5m + 37{,}5\,kN = 0$

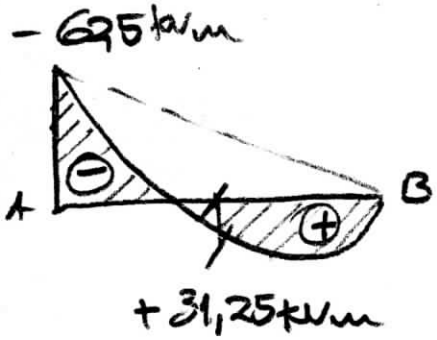
$V_A = 100\,kN - 37{,}5\,kN = \underline{62{,}5\,kN}$

$\underline{H_A = 0\,kN}$

$\circlearrowright\oplus \sum M_A = 0 \quad -M_A - 37{,}5\,kN \times 5m + 20\,kN/m \times \frac{(5m)^2}{2} = 0$

$M_A = -37{,}5 \times 5 + 10 \times 25 = \underline{62{,}5\,kN.m}$

(M)



$M_{AB_{MEIO}} = 37{,}5 \times 2{,}5 - 20 \times \frac{2{,}5^2}{2}$

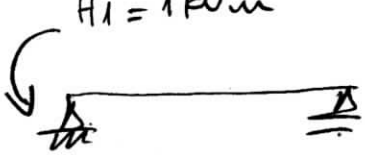
$M_{AB_{MEIO}} = 31{,}25\,kN.m$

↳ ADOTANDO COMO REDUNDANTE HIPERESTÁTICA M_A:

CASO 0



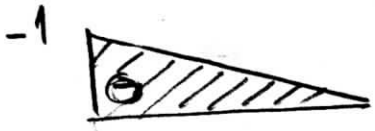
CASO 1



(M)



$20 \cdot \frac{5^2}{8} = 62{,}5$



$$\phi_{A0} = \frac{1}{EI}\left[\frac{1}{6} L k (2\bar{3}2 + \bar{3}3)\right] = \frac{1}{EI}\left[\frac{1}{6} \times 5m \times -1kNm (2 \times 62{,}5 + 0)\right]$$

$$\phi_{A0} = -104{,}17 / EI$$

$$\phi_{A1} = \frac{1}{EI}\left[\frac{1}{3} L \bar{3} k\right] = \frac{1}{EI}\left[\frac{1}{3} \times 5 \times -1 \times -1\right] = 1{,}6667 / EI$$

$$M_A \times \phi_{A1} + \phi_{A0} = 0$$

$$M_A = -\phi_{A0} / \phi_{A1} = \frac{+104{,}17/EI}{1{,}6667/EI} = \underline{62{,}5 kNm} \; \circlearrowleft \oplus$$