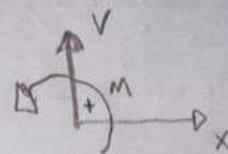
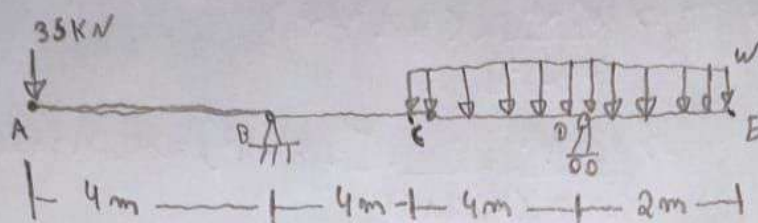
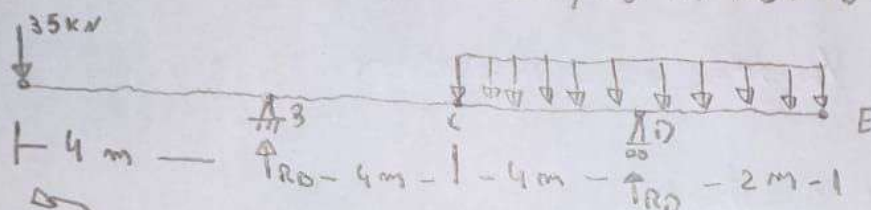


## Linhas dos pontos Felix

1)  $I_z \Rightarrow 351 \cdot 10^6 \text{ mm}^4$ ;  $E \Rightarrow 200 \text{ GPa}$ ;  $W \Rightarrow 80 \frac{\text{KN}}{\text{m}}$ ;  $E \cdot I_z \Rightarrow 7,02 \cdot 10^4 \text{ KN} \cdot \text{m}^2$



calculando as reações:  $\sum F_y = 0 \Rightarrow R_B + R_D - 35 - 6 \cdot W = 0$

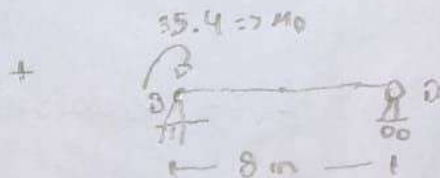
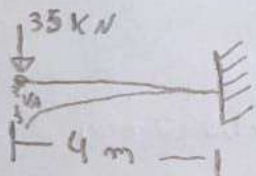


$\sum M_B = 0 \Rightarrow 3 \cdot R_D - W \cdot 6 \cdot [4 + \frac{6}{2}] + 35 \cdot 4 = 0$

$R_D \Rightarrow 3200 \Rightarrow 402,5 \text{ KN}$

Da equação de equilíb.  $R_B \Rightarrow 6 \cdot W + 35 - R_D \Rightarrow 112,5 \text{ KN}$

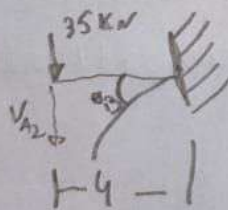
Quando um engaste em B, a partir da força de 35 kN, temos. Viga AB.



$\theta_B \Rightarrow \frac{M \cdot L}{3 \cdot E \cdot I}$

$V_{A1} \Rightarrow -\frac{P \cdot L}{3 \cdot E \cdot I} \Rightarrow -\frac{(35) \cdot 4}{3 \cdot 7,02 \cdot 10^4} \Rightarrow -0,01064 \text{ m}$

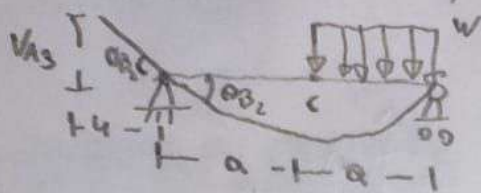
Considerando que é um regime de pequenas deformações e pequenos deslocamentos, temos:



$\theta_B \Rightarrow \frac{V_{A2}}{(-4)} \Rightarrow V_{A2} \Rightarrow -4 \cdot \theta_B$

$V_{A2} \Rightarrow -4 \cdot \left( \frac{140 \cdot 8}{3 \cdot (7,02 \cdot 10^4)} \right) \Rightarrow -0,0212726 \text{ m}$

Considerando a região BCD, onde  $a \Rightarrow 4$



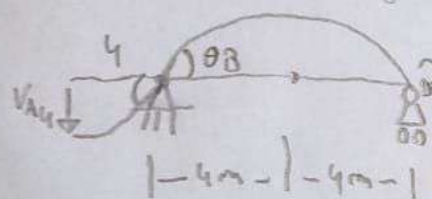
$$\theta_{B2} \Rightarrow \frac{w \cdot a^2}{24 \cdot E \cdot I} \cdot (2 \cdot l^2 - a^2)$$

$$\Rightarrow \frac{30 \cdot 4^2}{24 \cdot 8 \cdot (7,02 \cdot 10^3)} \cdot [2 \cdot 8^2 - 4^2] \Rightarrow 0,0106363 \text{ rad}$$

Considerando um regime de pequenas rotações e deslocamentos, temos

$$\theta_{B2} = \frac{V_{A3}}{4} \Rightarrow V_{A3} \Rightarrow \theta_{B2} \cdot 4 \Rightarrow 0,0425451 \text{ m}$$

Considerando agora a situação:



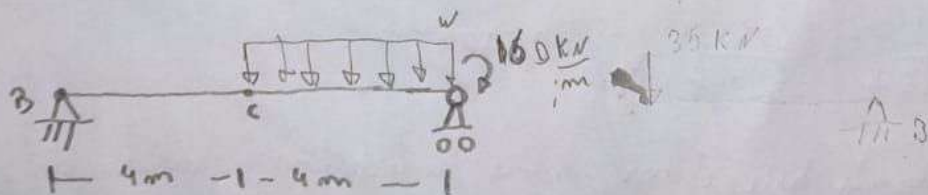
onde o momento foi criado pela outra parte da carga distribuída.

$$\theta_{B3} \Rightarrow \frac{M \cdot l}{6 \cdot E \cdot I}$$

$$\theta_{B3} \Rightarrow \frac{V_{A4}}{(-4)} \Rightarrow V_{A4} \Rightarrow (-4) \cdot \theta_{B3} \Rightarrow (-4) \cdot \frac{160 \cdot 8}{6 \cdot (7,02 \cdot 10^3)} \Rightarrow -0,0121557 \text{ m}$$

a)  $\delta_A \Rightarrow V_{A1} + V_{A2} + V_{A3} + V_{A4} \Rightarrow -0,00158 \text{ m} \Rightarrow -1,53 \text{ mm}$

b)



Rotações D não são dadas por:

R. em relação distribuída

$$\theta_{CD} \Rightarrow \frac{3 \cdot w \cdot l^3}{128 \cdot 7,02 \cdot 10^3} \Rightarrow 0,137 \text{ rad}$$

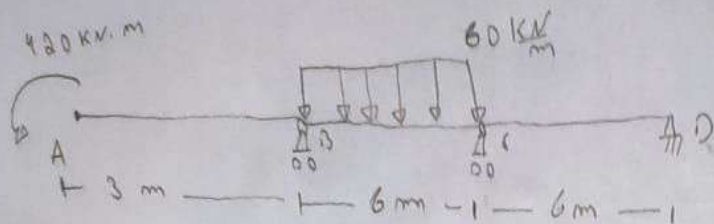
Rotação em relação ao momento

$$\theta_1 \Rightarrow \frac{M \cdot l^3}{3 \cdot E \cdot I} \Rightarrow \frac{160 \cdot 8}{3 \cdot 7,02 \cdot 10^3} \Rightarrow 0,0061 \text{ rad}$$

$$\theta_D \Rightarrow -\theta_{CD} + \theta_1 \Rightarrow -0,0076 \text{ rad}$$



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$$BC \Rightarrow 2 \cdot E \cdot I_2$$

$$AB \Rightarrow E \cdot I_2$$

$$CD \Rightarrow E \cdot I_1$$

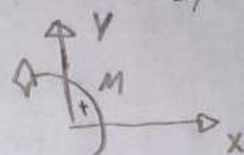
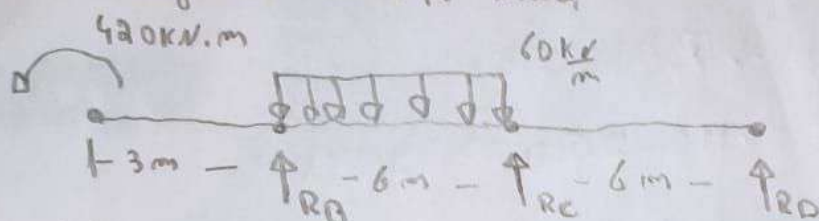


Diagrama de corpo livre



Equilíbrio

$$\sum F_z = 0 \Rightarrow R_B + R_C + R_D - 60 \cdot 6 = 0$$

$$R_C \Rightarrow 360 - R_B - R_D$$

$$\sum M_B = 0 \Rightarrow 420 - 60 \cdot 6 \cdot 3 + R_C \cdot 6 + R_D \cdot 18 = 0$$

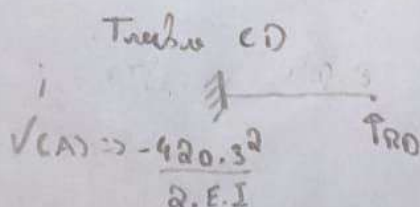
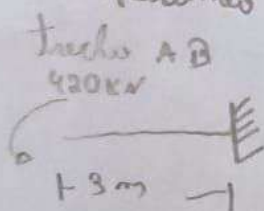
$$R_C \cdot 6 + R_D \cdot 18 \Rightarrow 660 \text{ kN.m}$$

$$R_C + 2 \cdot R_D \Rightarrow 110 \text{ kN.m}$$

Condições de contorno

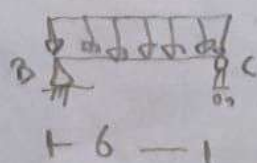
$$v(0) = 0; v(6) = 0; v(12) = 0$$

aplicando o método das forças e considerando superposição



$$\Rightarrow v = -\frac{R_D \cdot 6^3}{3 \cdot E \cdot I}$$

trecho BC:



$$\Rightarrow v_c = \frac{5 \cdot 60 \cdot 6^4}{384 \cdot 2 \cdot E \cdot I}$$

CONC

Pela compatibilidad

$$-v + v_c = 0$$

$$\frac{RD \cdot 6^3}{3 \cdot E \cdot I} = \frac{5 \cdot 60 \cdot 6^4}{384 \cdot 2 \cdot E \cdot I}$$

$$RD \Rightarrow 7,03125 \text{ KN}$$

$$RC \Rightarrow 110 - 2 \cdot RD \Rightarrow 95,94 \text{ KN}$$

$$RB \Rightarrow 60,6 - RC - RD \Rightarrow 257,03 \text{ KN}$$