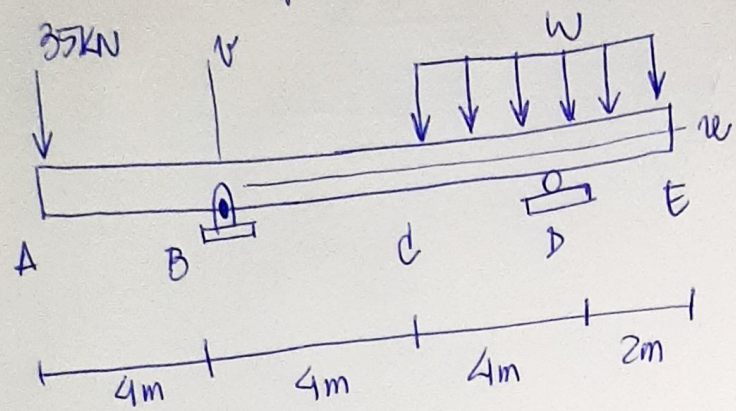
QUESTÃO 01 Deslocamento vertical no ponto A e a rotação no ponto D (superposição)



$I_z = 351,10^6\ mm^4$

$E = 200\ GPa$

$w = 80\ KN/m$

(I) Reações de apoio

$\Sigma F_V = 0$

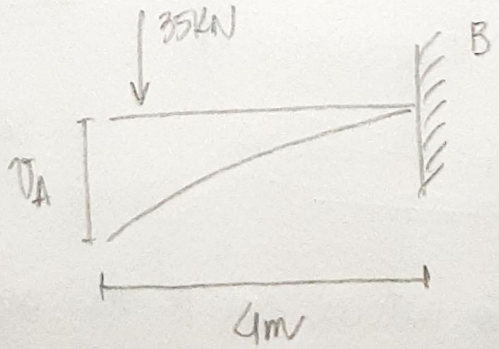
$-35 + R_B - 480 + R_D = 0 \quad \therefore \quad R_B + R_D = 515$

$\Sigma M_B = 0$

$35.4 - 480.7 + R_D \cdot 8 = 0 \quad \therefore \quad R_D = 402,5\ KN$

$R_B = 112,5\ KN$

(II) Pela tabela podemos encontrar que:



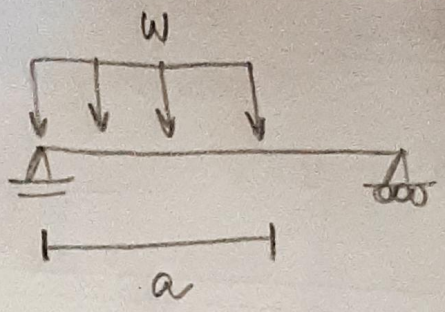
$v_A = -\frac{PL^3}{3EI}$

$= \frac{35.(4)^3}{3(7,02 \cdot 10^4)}$

$= -0,01063\ m$

Para a região AB

$$\theta_B = \frac{wa^2}{24LEI}(2L^2 - a^2)$$

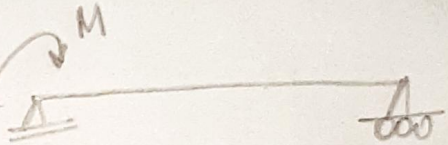


$$= \frac{80 \cdot (4)^2}{24 \cdot 8 \cdot (7{,}02 \cdot 10^4)}\left(2(8)^2 - (4)^2\right)$$

$$= 0{,}0106363 \text{ rad}$$

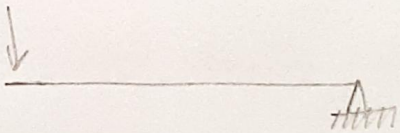
$$\therefore v_A = (4m) \cdot (0{,}0106363 \text{ rad}) = \underline{\underline{0{,}04254451 \text{ m}}}$$

$$\theta_B = \frac{ML}{6EI}$$



$$M = (80) \cdot (2) \cdot 1$$
$$= 160 \text{ KN.m}$$

$$= \frac{(160) \cdot (8)}{6(7{,}02 \cdot 10^4)} = 0{,}0030389 \text{ rad}$$



$$v_A = -(4)(0{,}0030389 \text{ rad})$$

$$= \underline{\underline{-0{,}0121557 \text{ m}}}$$

$$\theta_B = \frac{140 \cdot 8}{3 \cdot (7{,}02 \cdot 10^4)} = 0{,}00532 \text{ rad}$$

$$v_A = -4 \cdot (0{,}00532) = \underline{\underline{-0{,}0212726 \text{ m}}}$$

O deslocamento vertical em A vai ser a soma de todos os deslocamentos, logo:

$$v_A = -0{,}0106363 - 0{,}0212726 + 0{,}04254451 - 0{,}0121557$$

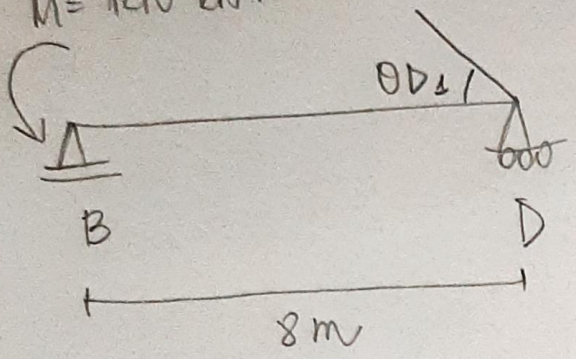
$$= -0{,}0015195 \text{ m} = 1{,}520 \text{ mm p/ baixo}$$

Rotação em D:

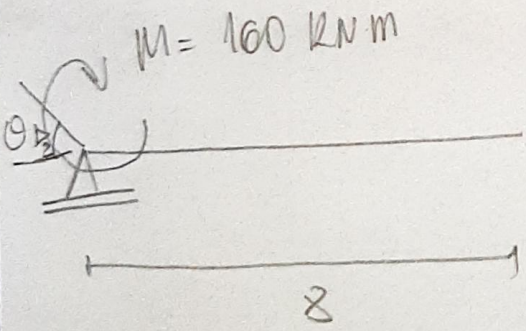
(I) Rotação em B

$$\theta_B = -\frac{M_0 L}{3EI} = -0{,}305°$$

M = 1410 KN·m



$$\theta_{D_1} = \frac{WL^3}{24EI} = 0{,}005 \text{ rad}$$



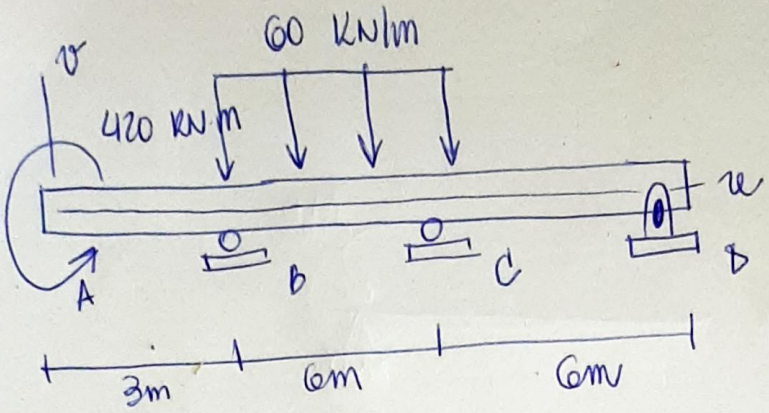
$$\theta_{D2} = \frac{ML}{6EI} = -0{,}003 \text{ rad}$$

$$(-0{,}003)(-4) = 0{,}012 \text{ m}$$

$$\theta_D = \theta_{D1} + \theta_{D2} = 0{,}005 - 0{,}003 = 0{,}002 \text{ rad}$$

$$= 0{,}172°$$

2ª QUESTÃO — Reacções de apoio usando o método das forças



(I) Reacções de apoio:

$\sum F_V = 0$

$R_B + R_C + R_D - 360 = 0 \quad \therefore \quad R_B + R_C + R_D = 360$

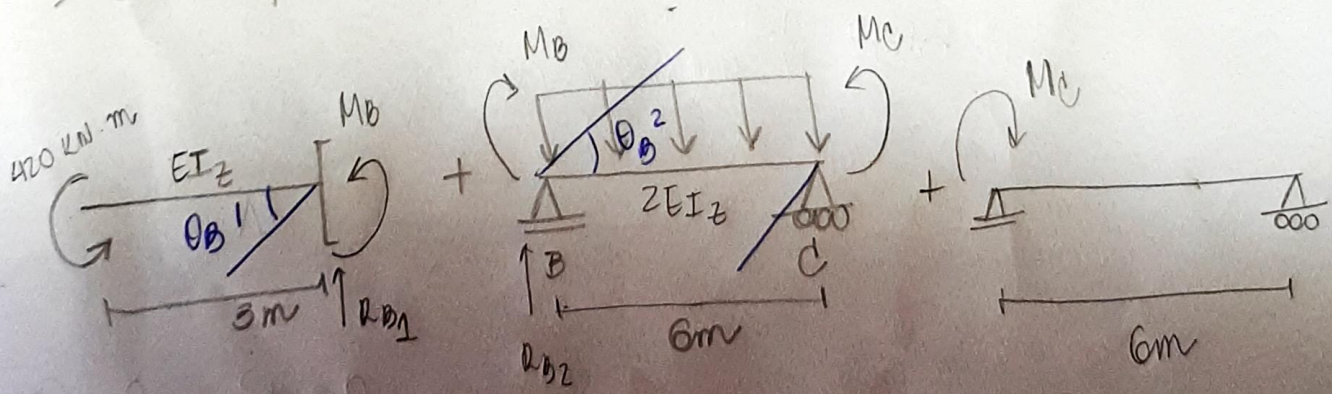
$\sum M_B = 0$

$420 - 360 \cdot 3 + R_C \cdot 6 + R_D \cdot 12 = 0$

$6R_C + 12R_D = 660$

1) $gr = 1$

2) Sistema principal:



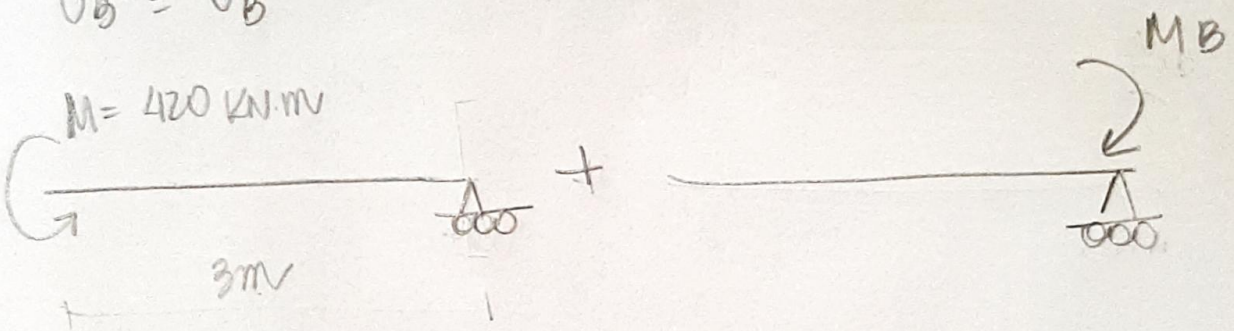
3) $\theta_B = \theta_B$

condições de contorno:

$v_B = 0$

$v_C = 0$

$\theta_B^1 = \theta_B^2$



PELA TABELA:

$$\frac{ML}{2EI} + \frac{M_B L}{2EI}$$

$$= \frac{8L^3}{24EI} + \frac{M_B L}{2EI}$$

$$M_B = 410 \text{ KN.m}$$