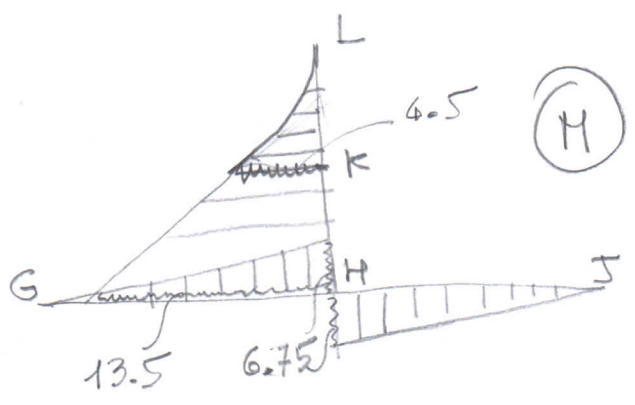
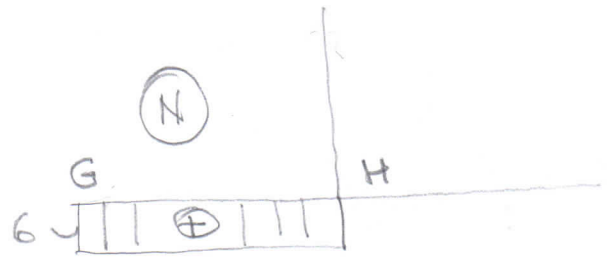
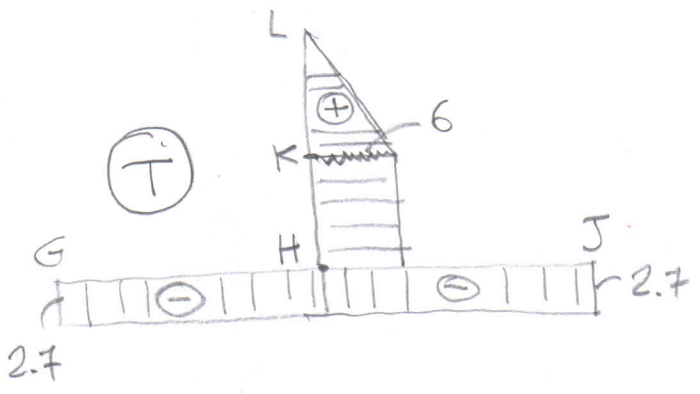
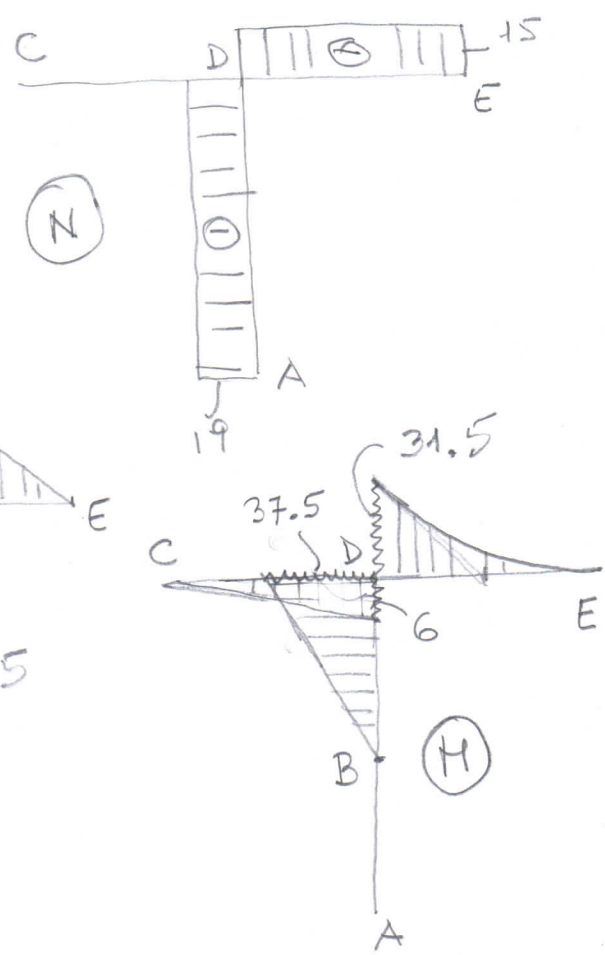
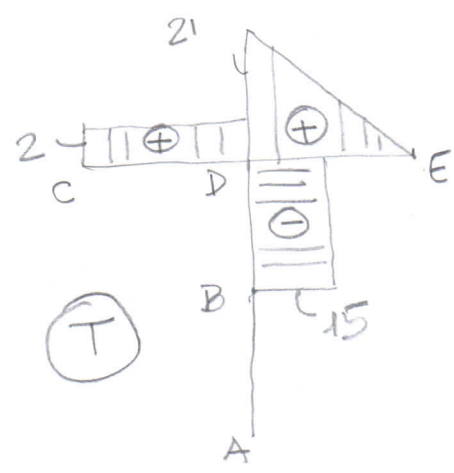
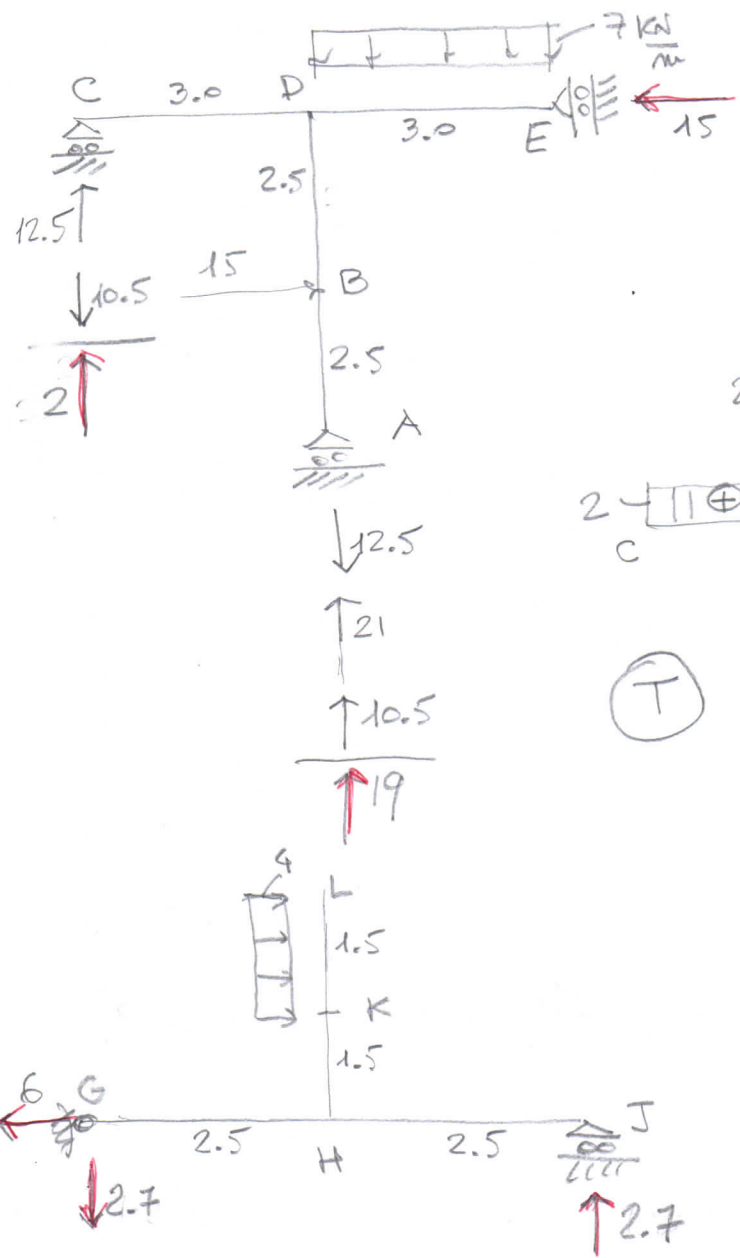
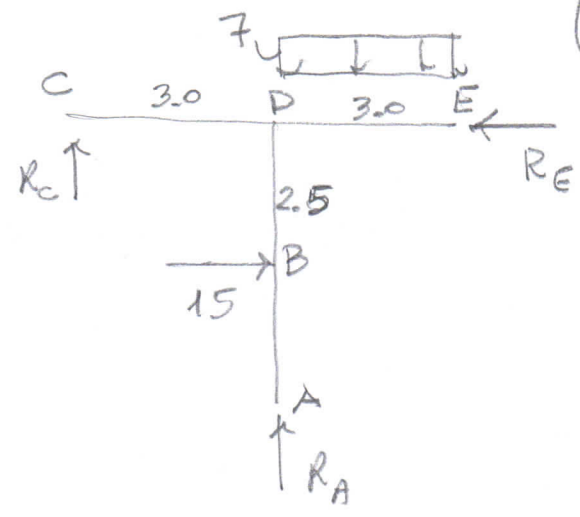


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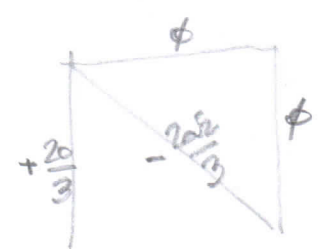
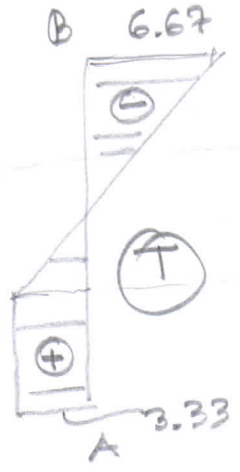
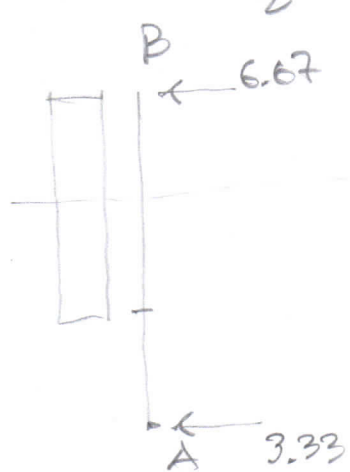
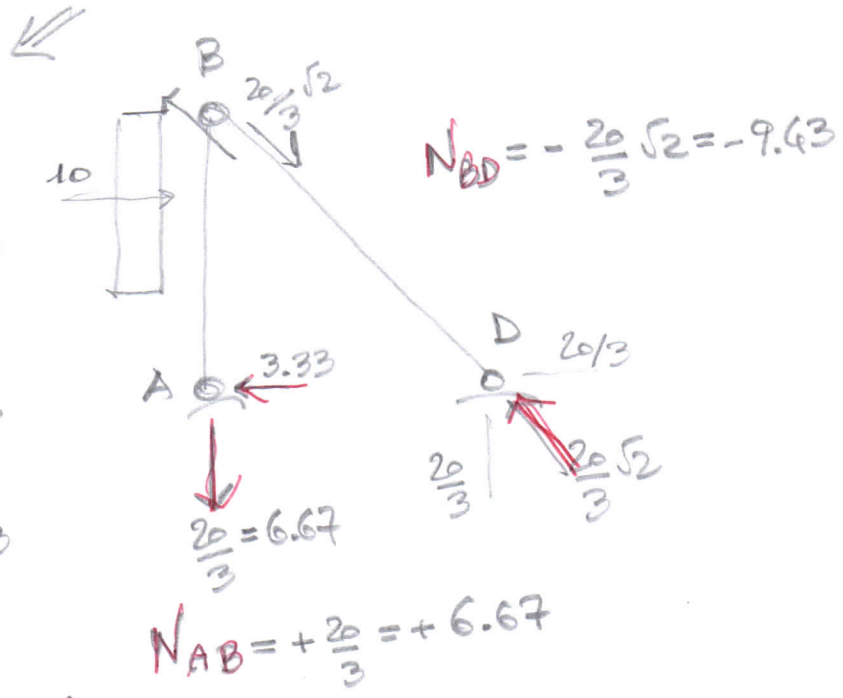
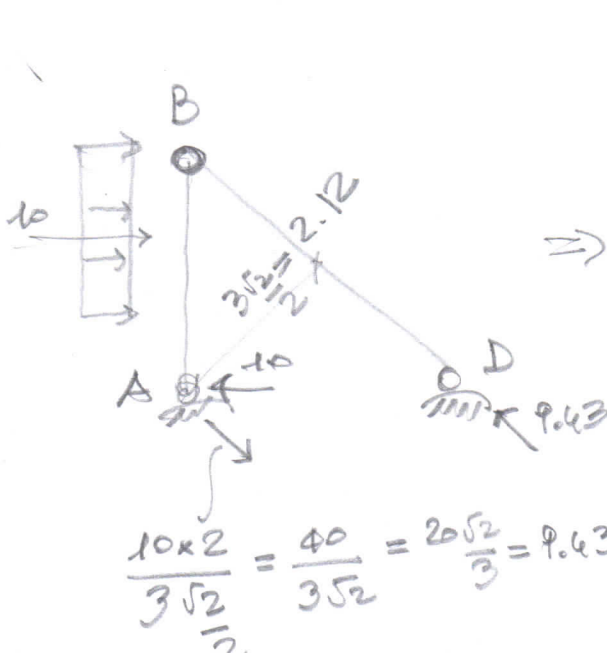
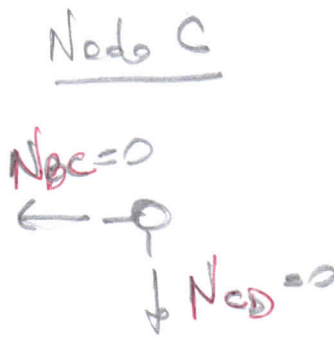
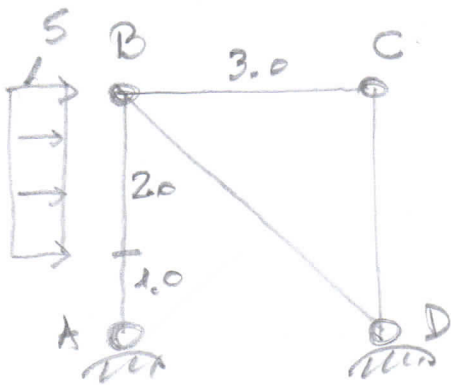
ES.1

p.1

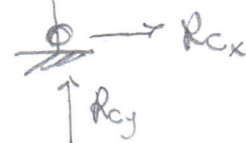
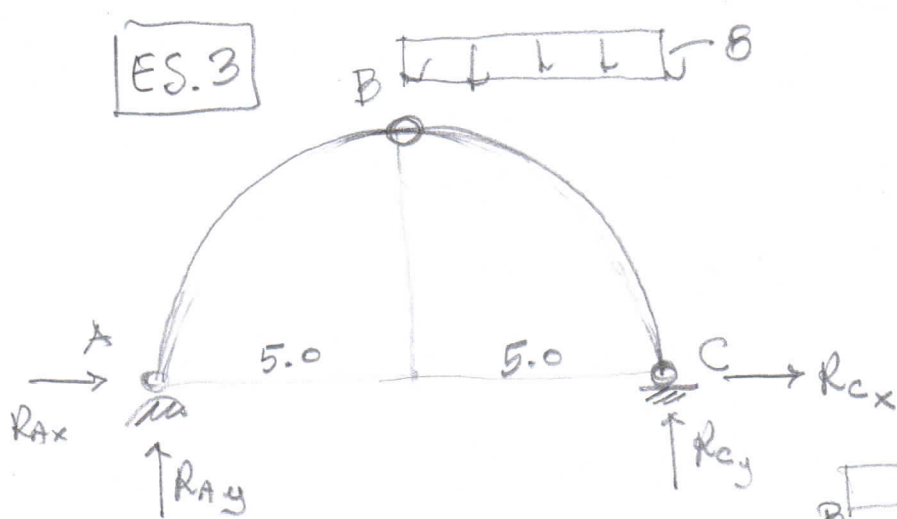




$$\begin{cases} -R_E + 15 = 0 \\ R_C + R_A - 21 = 0 \\ \text{C) } 15 \times 2.5 + R_A \cdot 3 - 21 \times 4.5 = 0 \end{cases}$$
$$R_E = 15 \text{ kN}$$
$$R_C = 21 - R_A = 2$$
$$R_A = \frac{21 \times 4.5 - 15 \times 2.5}{3} = 19$$



$w_B = \frac{6.67 \times 10^3 \times 3000}{210000 \times 200} = 0.48 \text{ mm verso l'alto}$

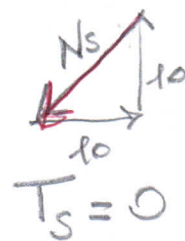
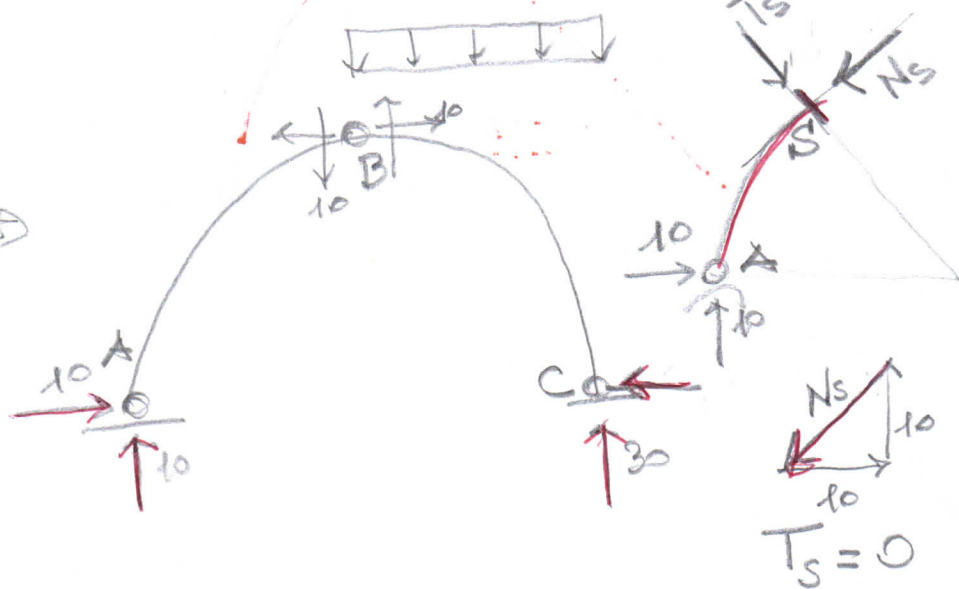
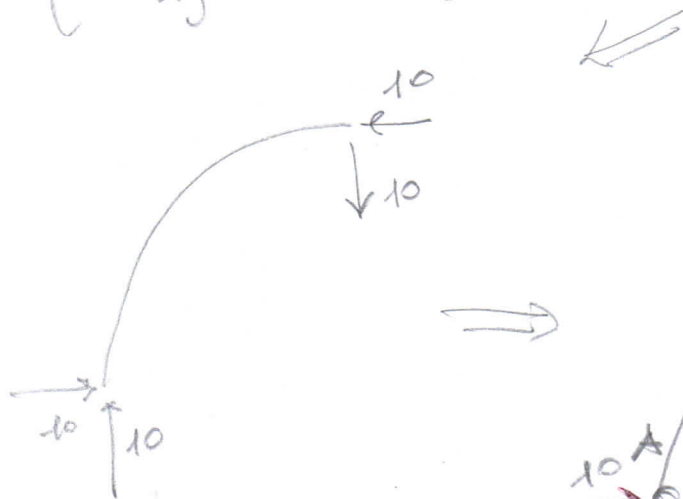
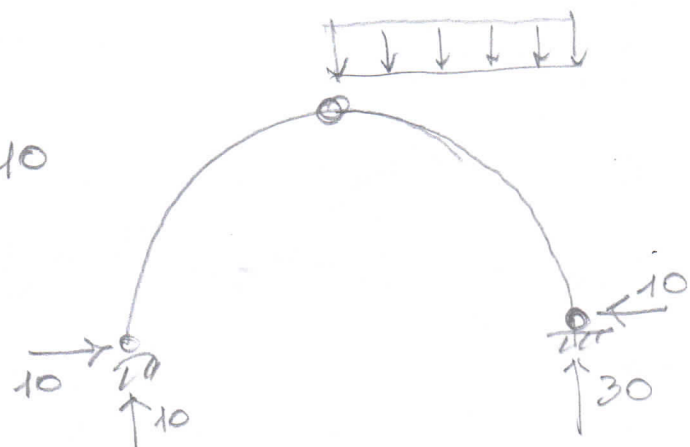


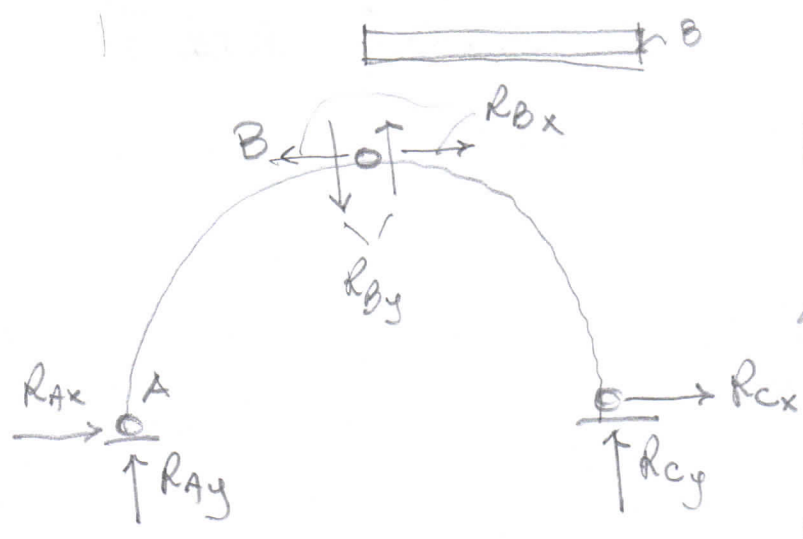
$$\begin{cases} R_{Ax} + R_{Cx} = 0 \\ R_{Ay} + R_{Cy} - 40 = 0 \end{cases}$$

A) $R_{Cy} \times 10 - 40 \times 7.5 = 0$

ans. $R_{Cy} \times 5 + R_{Cx} \times 5 - 40 \times 2.5 = 0$

$$\begin{cases} R_{Cy} = \frac{40 \times 7.5}{10} = 30 \\ R_{Cx} = \frac{40 \times 2.5 - R_{Cy} \times 5}{5} = -10 \\ R_{Ax} = -R_{Cx} = 10 \\ R_{Ay} = 40 - R_{Cy} = 10 \end{cases}$$





$$\left\{ \begin{array}{l} R_{Ax} - R_{Bx} = 0 \\ R_{Ay} - R_{By} = 0 \\ A) R_{Ax} \cdot 5 - R_{Ay} \cdot 5 = 0 \\ R_{Bx} + R_{Cx} = 0 \\ R_{By} + R_{Cy} - 40 = 0 \\ B) R_{Cx} \cdot 5 + R_{Cy} \cdot 5 - 40 \times 2.5 = 0 \end{array} \right.$$

$$R_{Ax} = R_{Bx}$$

$$R_{Ay} = R_{By}$$

$$R_{Ax} = R_{Ay} \Rightarrow R_{Bx} = R_{By}$$

$$R_{Cx} = -R_{Cy}$$

$$R_{Cy} = 40 - R_{By}$$

$$-5R_{By} + 5 \times 40 - 5R_{By} - 100 = 0 \Rightarrow R_{By} = \frac{200 - 100}{10} = 10$$

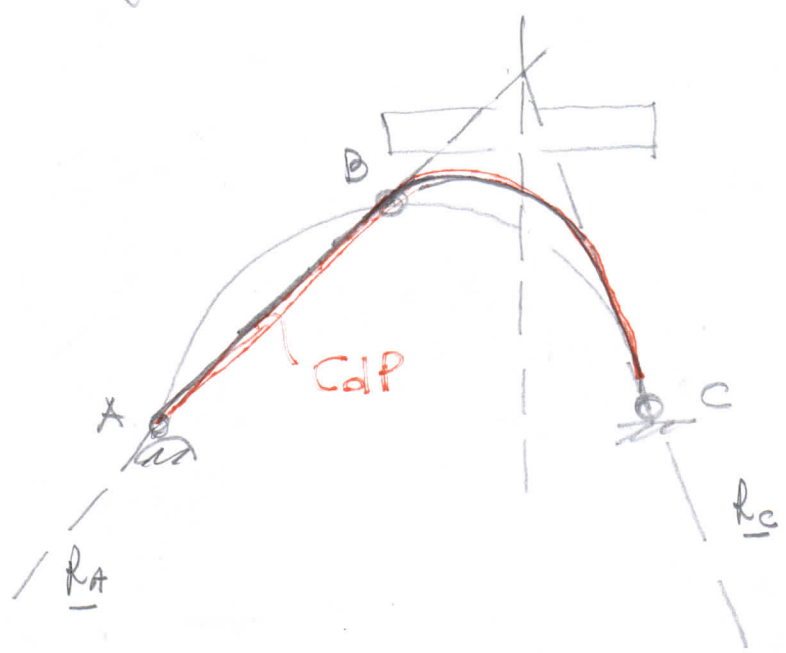
$$R_{Ax} = 10$$

$$R_{Ay} = 10$$

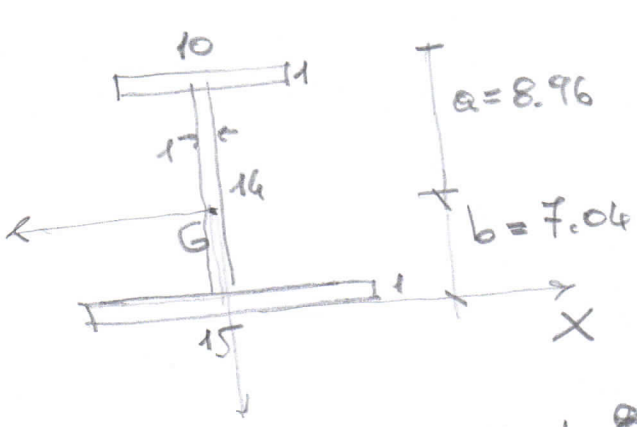
$$R_{Bx} = 10$$

$$R_{Cx} = -10$$

$$R_{Cy} = 40 - 10 = 30$$



ES.4

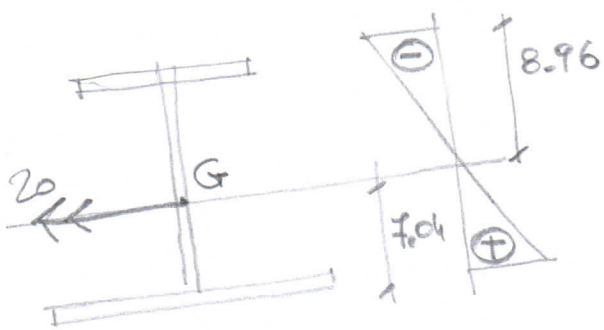


$$A = 10 \times 1 + 14 \times 1 + 15 \times 1 = 39 \text{ cm}^2$$

$$S_x = 10 \times 1 \times 15.5 + 14 \times 1 \times 8 + 15 \times 1 \times 0.5 = 274.5 \text{ cm}^3$$

$$b = \frac{274.5}{39} = 7.04 \text{ cm} \Rightarrow a = 16 - 7.04 = 8.96 \text{ cm}$$

$$I_x = 10 \times \frac{1^3}{12} + 10 \times 1 \times (15.5 - 7.04)^2 + 1 \times \frac{14^3}{12} + 14 \times (8 - 7.04)^2 + 15 \times \frac{1^3}{12} + 15 \times (0.5 - 7.04)^2 = 1601 \text{ cm}^4$$



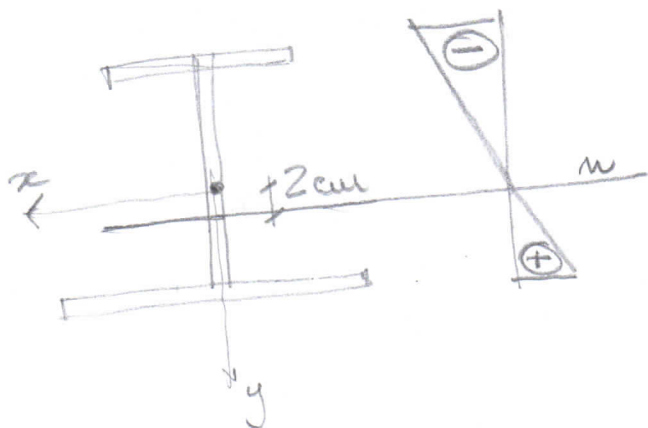
$$\sigma_z^{\max} = \frac{20 \times 10^6}{1601 \times 10^4} \cdot (7.04) = 88 \frac{\text{N}}{\text{mm}^2}$$

$$\sigma_z^{\min} = \frac{20 \times 10^6}{1601 \times 10^4} \cdot (-8.96) = -112 \frac{\text{N}}{\text{mm}^2}$$

$$N = -100 \text{ kN} \quad M_x = 20 \text{ kNm}$$

$$y_m = - \frac{-100 \times 10^3}{39 \times 100} \frac{1601 \times 10^4}{20 \times 10^6} = 21 \text{ mm} = 25.64 / 1.249$$

$$\sigma_z^{\max} = \frac{-100 \times 10^3}{39 \times 100} + \frac{20 \times 10^6}{1601 \times 10^4} \cdot 7.04 = 62 \frac{\text{N}}{\text{mm}^2}$$



$$\sigma_z^{\min} = \quad + \quad + \quad + \quad (-8.96) = -138 \frac{\text{N}}{\text{mm}^2}$$