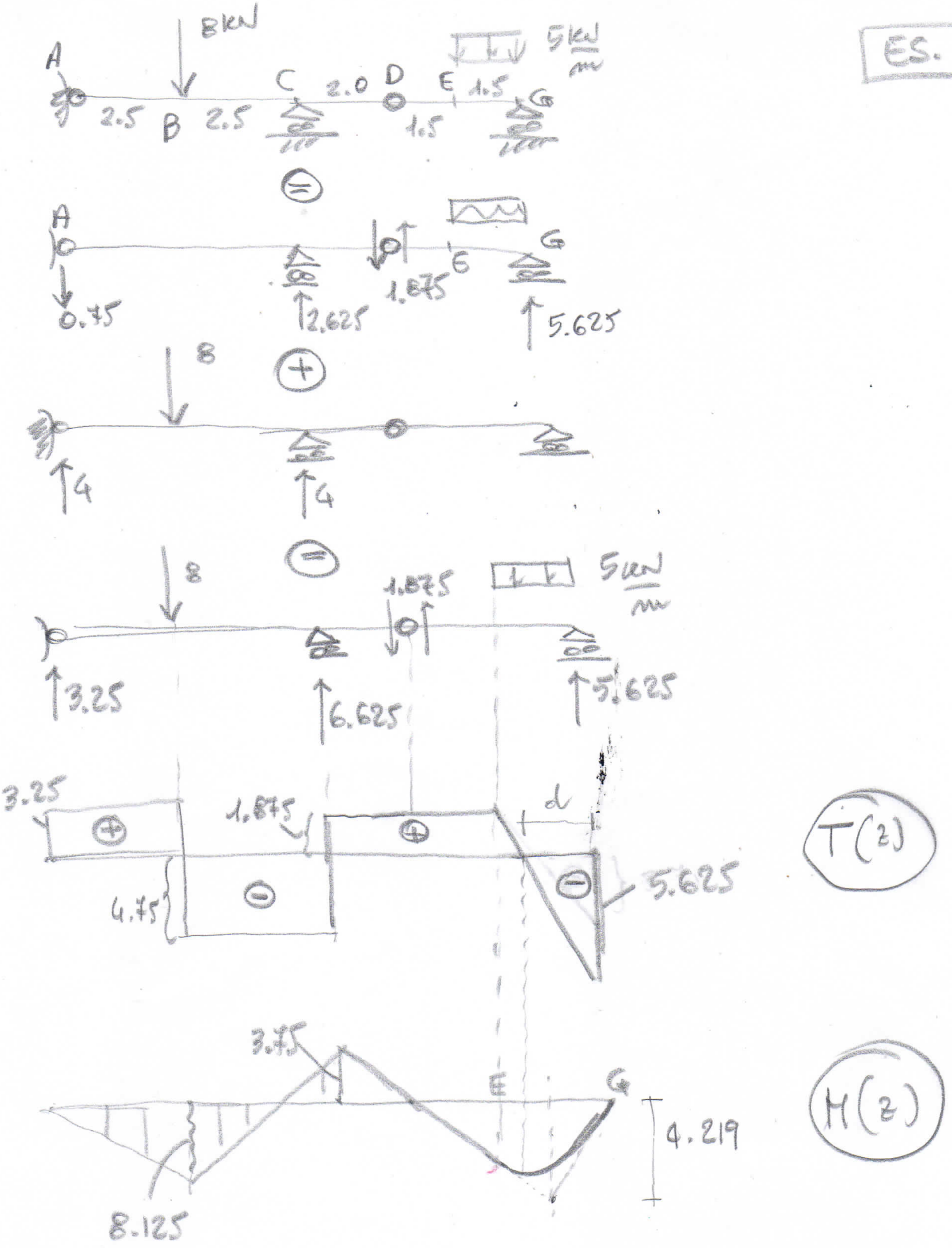
ES. 1



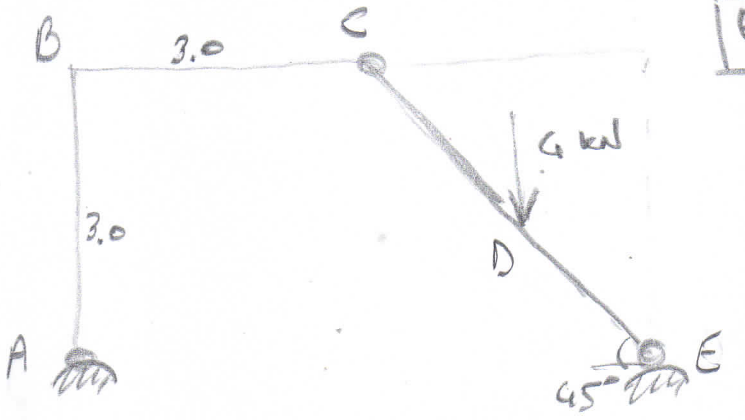
$$EG)_{0\le z\le E} \quad M(z) = 1.875\times(z+1.5) - 5\frac{z^2}{2} = 1.875z + 2.813 - 2.5z^2$$

$$\frac{d}{5.625} = \frac{1.5}{7.5} \Rightarrow d = 1.125$$

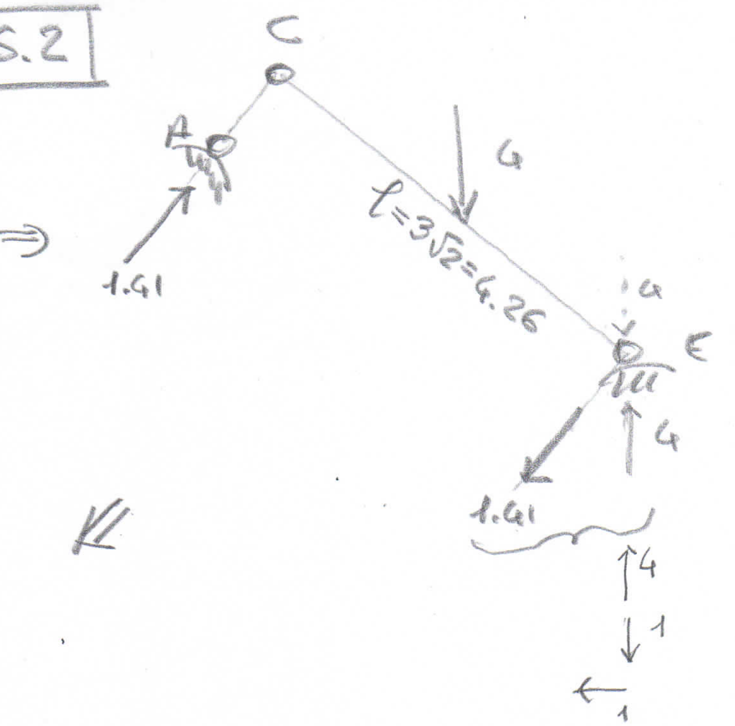
$$M_{max} = 5.625\times 1.125 - 5\times\frac{1.125^2}{2} = 3.16 \text{ kNm}$$

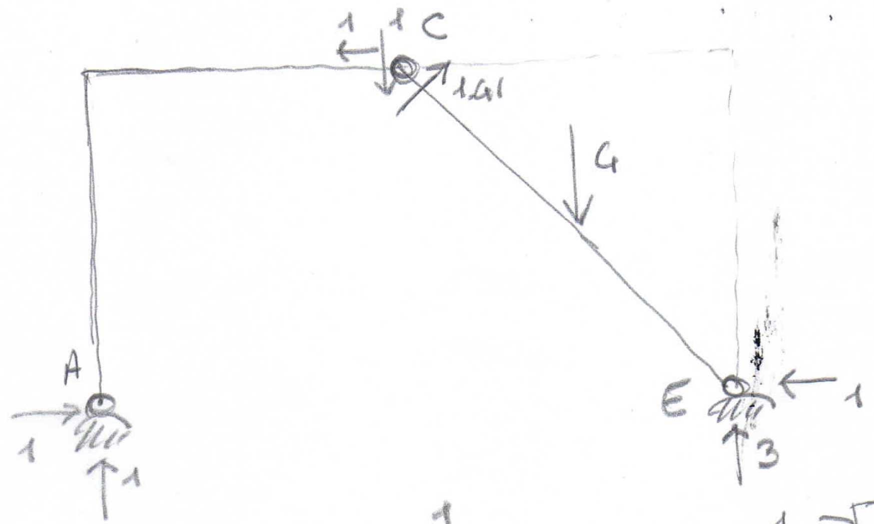
oppure $M_{max} = 5.625\times\frac{1.125}{2} = 3.16$

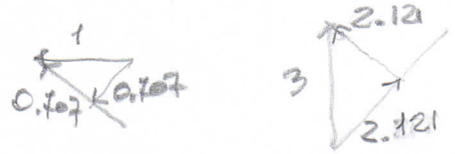
ES. 2

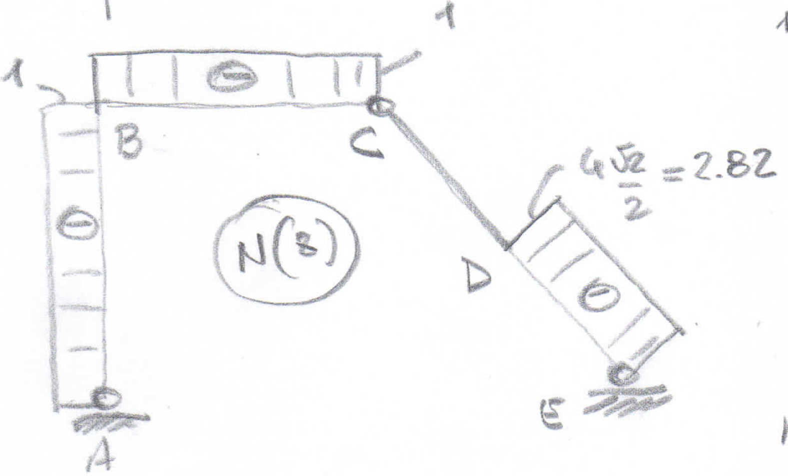


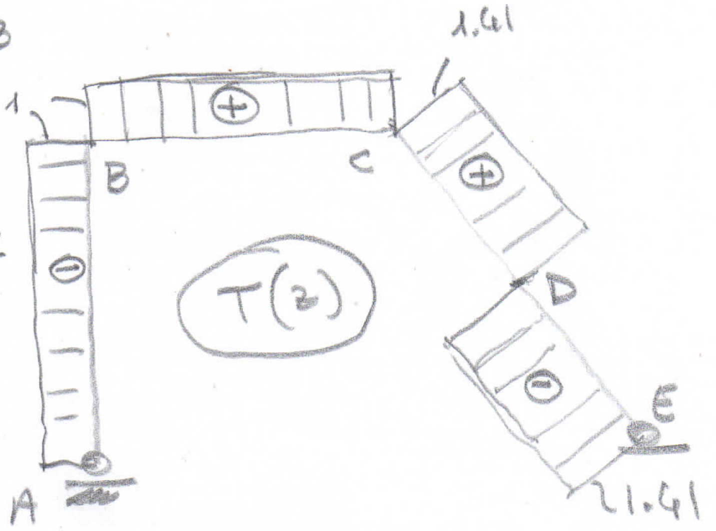
D a metà di CE

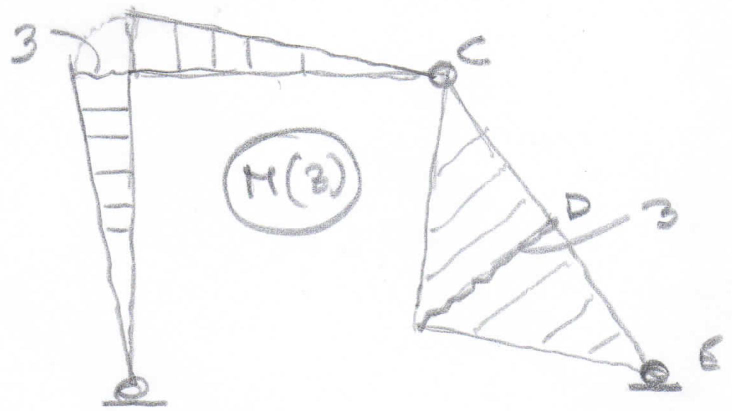






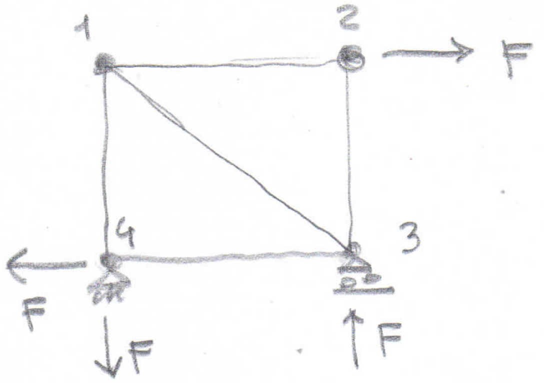






$$\Delta \ell_{CE} = \frac{2.82\times10^3 \times \frac{4.26\times10^3}{2}}{20000 \cdot 100} = 3\,mm$$

ES. 3

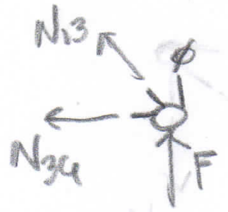


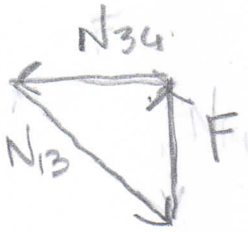
Nodo 2 (an.)

$-N_{12}+F=0 \Rightarrow N_{12}=F$

$N_{23}=0$

Nodo 3 (gr.)

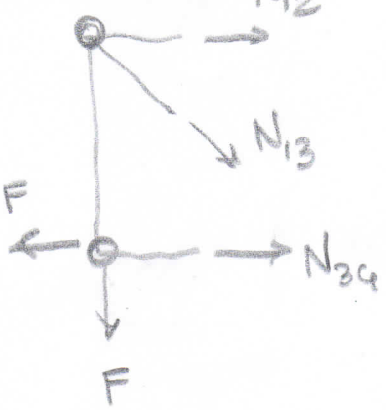




$N_{34}=F$

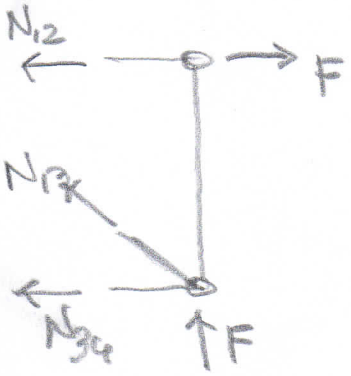
$N_{13}=-F\sqrt{2}$

Ritter



$-F-N_{13}\frac{\sqrt{2}}{2}=0 \Rightarrow N_{13}=-F\cdot\frac{2}{\sqrt{2}}=-F\sqrt{2}$

oppure:

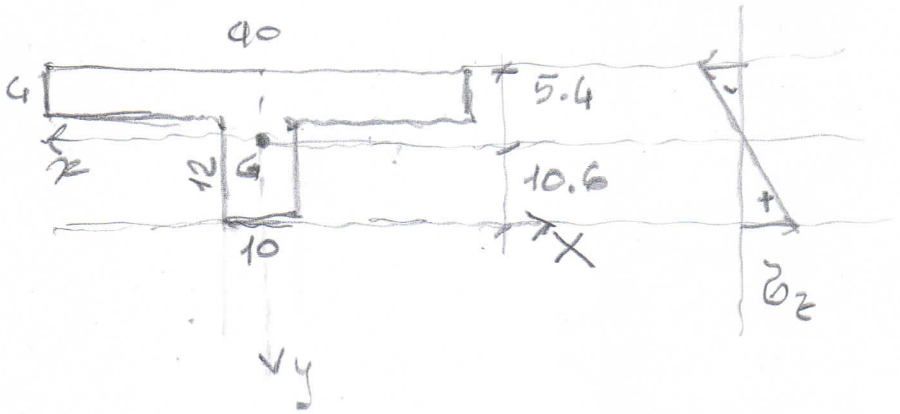


$F+N_{13}\frac{\sqrt{2}}{2}=0$

$\Downarrow$

$N_{13}=-F\cdot\frac{2}{\sqrt{2}}=-F\sqrt{2}$

ES. 4



$$A = 40 \times 4 + 12 \times 10 = 280 \text{ cm}^2$$

$$Y_G = \frac{12 \times 10 \times 6 + 40 \times 4 \times 14}{280} = \frac{2960}{280} = 10.6 \text{ cm}$$

$$I_{x_G} = \frac{10 \times 12^3}{12} + 12 \times 10 \times (10.6 - 6)^2 + \frac{40 \times 4^3}{12} + 40 \times 4 \times (14 - 10.6)^2 = 6042 \text{ cm}^4$$

$$\sigma_z = \frac{15 \times 10^6}{6042 \times 10^4} \cdot y \quad [N/mm^2] = 0.2483\, y$$

$$\left.\begin{array}{l} \sigma_z^{max} \\ \sigma_z^{min} \end{array}\right\} = 0.2483 \times \left\{\begin{array}{l} +106 \\ -54 \end{array}\right. = \left\{\begin{array}{l} 26.3 \ N/mm^2 \\ -13.4 \ \frac{N}{mm^2} \end{array}\right.$$