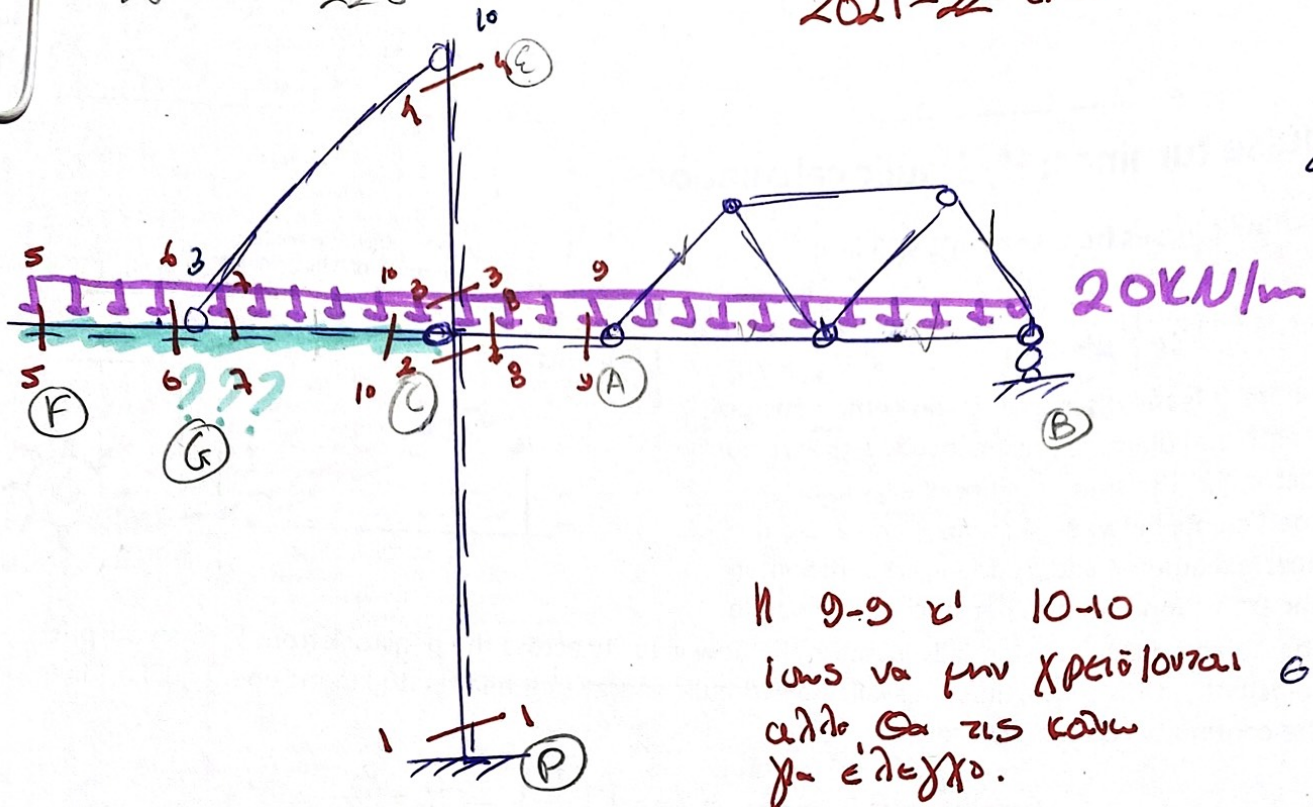
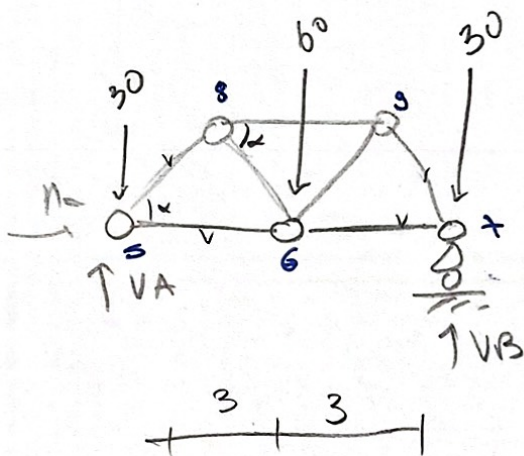
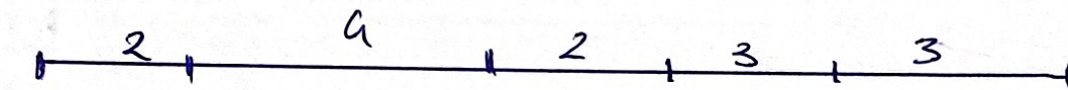


$$200 - 60 = 220$$

2021-22 Εναν. Μηχανική



Η 9-9 κ' 10-10
 ίσως να μην χρειάζονται
 αλλά θα τις κάνω
 για έλεγχο.



$$\frac{ql}{2} = \frac{20 \times 3}{2} = 30 \text{ kN}$$

$$\sum F_x = 0 \Rightarrow H_A = 0$$

$$\sum F_y = 0 \Rightarrow V_A + V_B = 30 + 60 + 30 = 120 \text{ kN}$$

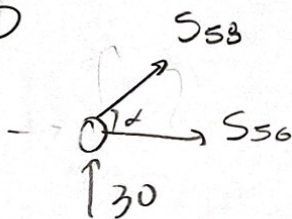
$$\sum M_B = 0 \Rightarrow (60 \times 3) + (30 \times 6) = 6V_A$$

$$\Rightarrow 180 + 180 = 6V_A$$

$$\Rightarrow V_A = 60 \text{ kN}$$

$$V_B = 60 \text{ kN}$$

#5



$$\sum F_y = 0 \Rightarrow 0,8 S_{58} = -30$$

$$\Rightarrow S_{58} = -37,5 \text{ kN}$$

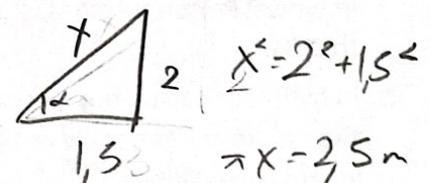
$$\Rightarrow S_{59} = -30$$

$$\sum F_x = 0 \Rightarrow S_{56} = 37,5 \times 0,6$$

$$= 22,5 \text{ kN}$$

#7 Δύο συγγενείς

$$S_{67} = 22,5 \text{ kN} \text{ κ' } S_{79} = -37,5 \text{ kN}$$



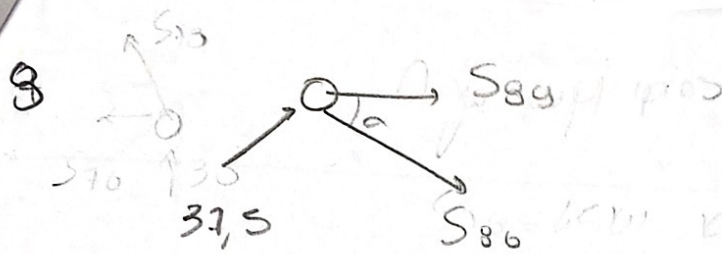
$$\Rightarrow x = 3,5 \text{ m}$$

$$\cos \alpha = \frac{1,5}{2,5} = 0,6$$

$$\cos \alpha = \frac{1,5}{2,5} = 0,6$$

$$\sin \alpha = \frac{1,5}{2,5} = 0,6$$

$$\sin \alpha = \frac{1,5}{2,5} = 0,6$$



#3

$$\sum F_x = 0 \Rightarrow S_{89} + 37,5 \times 0,6 + 0,8 \times S_{86} = 0$$

$$\sum F_y = 0 \Rightarrow S_{86} \times 0,8 = 37,5 \times 0,8$$

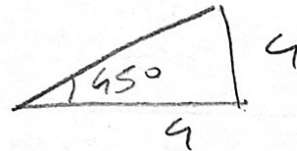
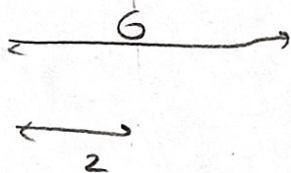
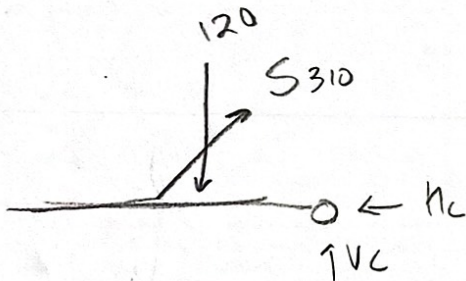
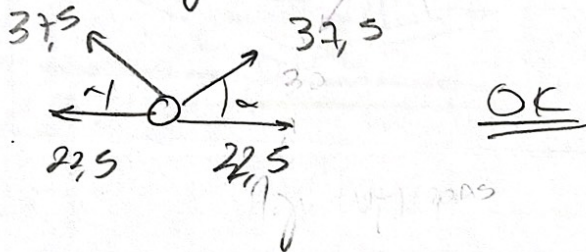
$$\Rightarrow S_{86} = +37,5 \text{ kN}$$

Ap: $S_{89} = (-37,5 \times 0,6) \times 2 = -45 \text{ kN}$

#9 Riga verticala

$S_{86} = +37,5 \text{ kN}$

#6 jo ena 200kN



$$\sum F_x = 0 \Rightarrow H_c = 0,707 S_{310}$$

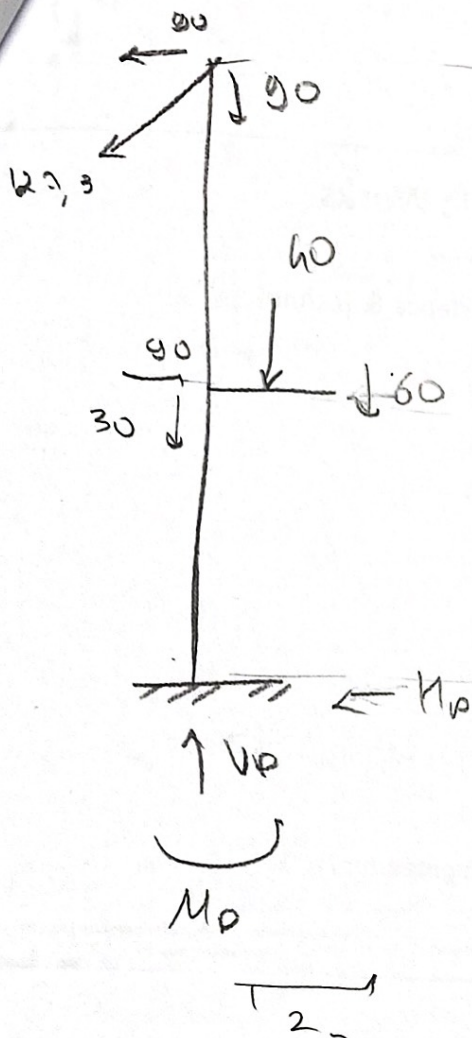
$$\sum F_y = 0 \Rightarrow 0,707 S_{310} + V_c = 120$$

$$\sum M_c = 0 \Rightarrow (120 \times 3) = (0,707 \times S_{310} \times 4)$$

$$\Rightarrow S_{310} = 127,3 \text{ kN}$$

Ap: $V_c = 120 - 90 = 30 \text{ kN}$

$H_c = 90 \text{ kN}$



$$\sum F_x = 0 \Rightarrow H_D = 0$$

$$\sum F_y = 0 \Rightarrow V_D = 60 + 30 + 90 + 40 = 220 \text{ kN}$$

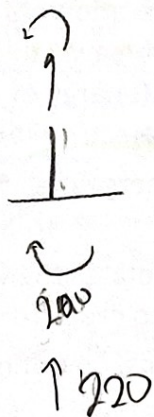
$$\sum M_D = 0 \Rightarrow M_D - (90 \times 6) + (90 \times 10) + (60 \times 2) - 40 = 0$$

$$\Rightarrow M_D = +360 - 120 - 40 = 0$$

$$\Rightarrow M_D = -200 \text{ kNm}$$

Sol's

L-2



$$M_D = 200 \text{ kNm}$$

$$Q_D = 0$$

$$N_D = -220 \text{ kN}$$

2-2

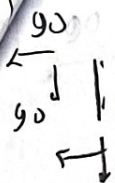


$$M_c^x = 200 \text{ kNm}$$

$$N_c^x = -220 \text{ kN}$$

$$Q_c^x = 0$$

4-4

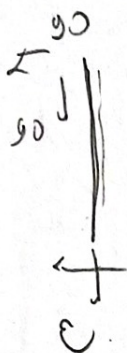


$$N_4 = -90 \text{ kN}$$

$$Q_4 = -90 \text{ kN}$$

$$M_4 = 0$$

3-3

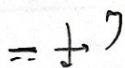


$$N_3 = -90 \text{ kN}$$

$$Q_3 = -90 \text{ kN}$$

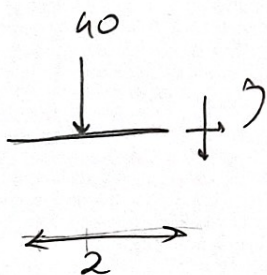
$$M_3 = 90 \times 4 = 360 \text{ kNm}$$

5-5



$$N_5 = 0, Q_5 = 0, M_5 = 0$$

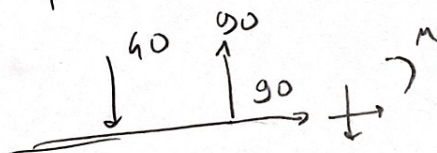
6-6



$$N_6 = 0, Q_6 = -40 \text{ kN},$$

$$M_6 = -40 \text{ kNm}$$

7-7

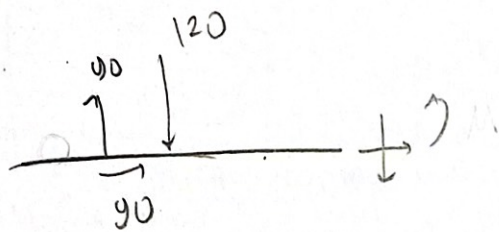


$$M_7 = -40 \text{ kNm}$$

$$N_7 = -90 \text{ kN}$$

$$Q_7 = +50 \text{ kN}$$

10-10



$$Q_c^{\alpha} = -30 \text{ kN}$$

$$N_c^{\alpha} = -90 \text{ kN}$$

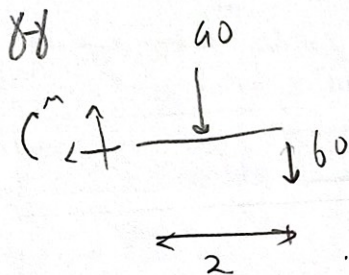
$$M_c^{\alpha} = (90 \times 4) - (120 \times 3) = 360 - 360 = 0 \quad \underline{\underline{OK}}$$

9-9



$$Q_A = +60 \text{ kN}$$

$$N_A = 0, M_A = 0$$

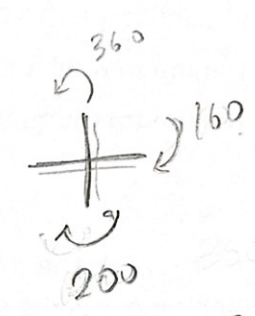
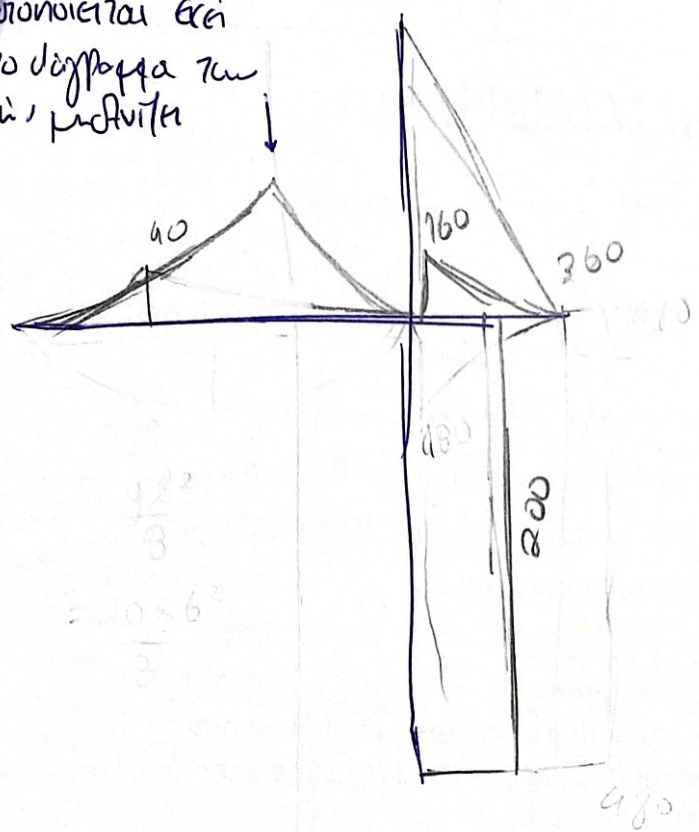


$$Q_c^{\delta} = +100 \text{ kN}, N_c^{\delta} = 0$$

$$M_c^{\delta} = -(60 \times 2) - 40 = -160 \text{ kN}$$

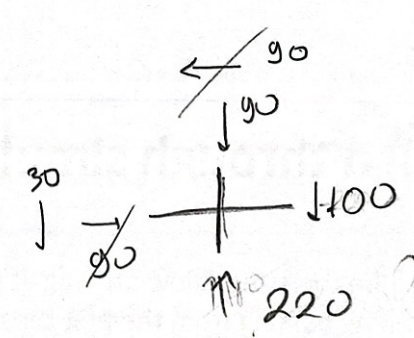
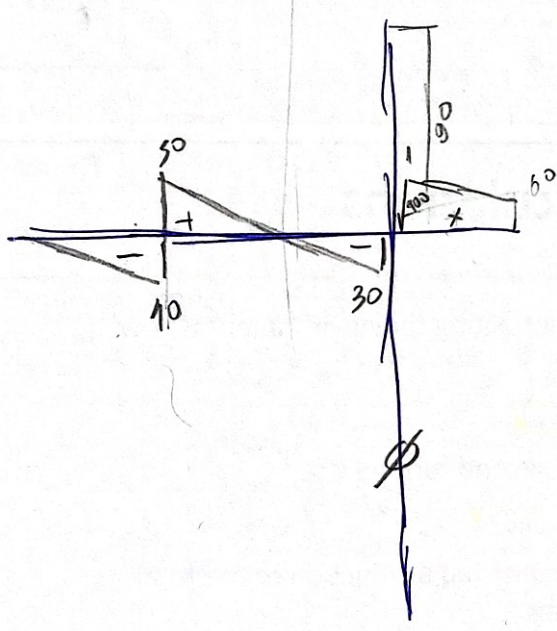
CS

monocentrica era
 20 doppia 7m
 unita, perfetta



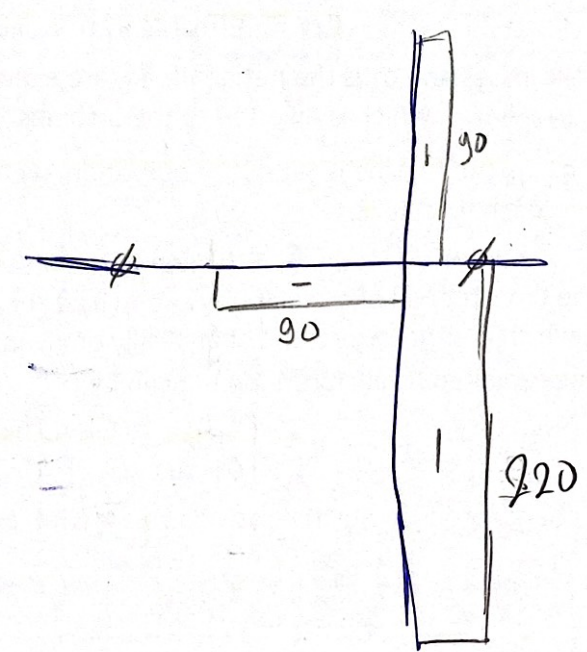
$$200 + 160 = 360$$

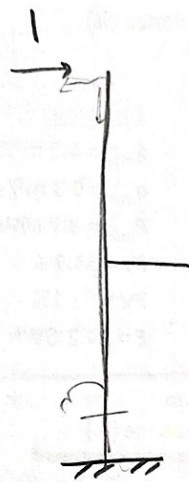
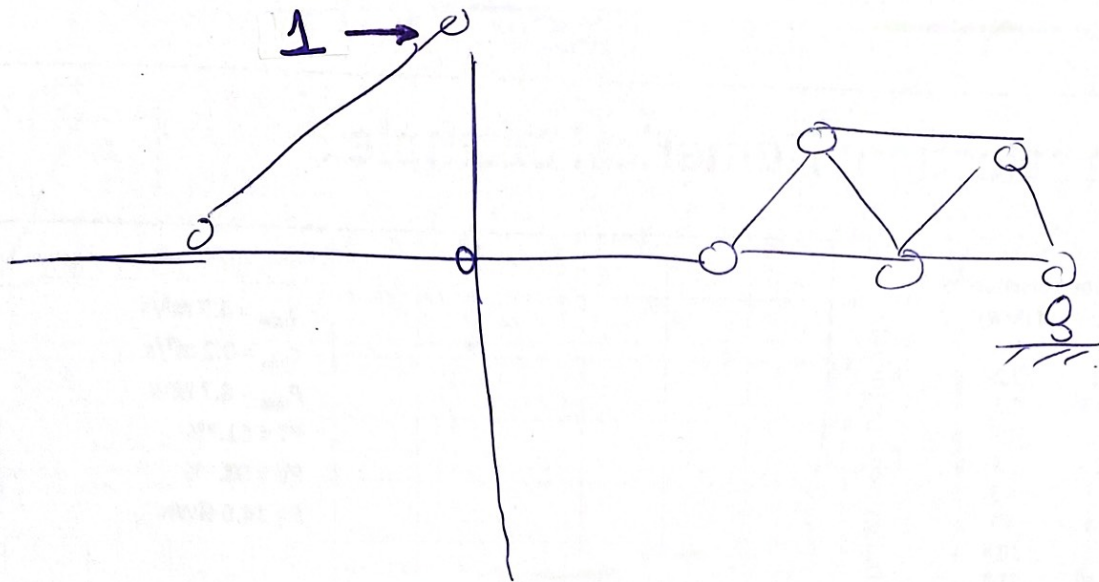
OK



$$30 + 90 + 100 = 220$$

OK

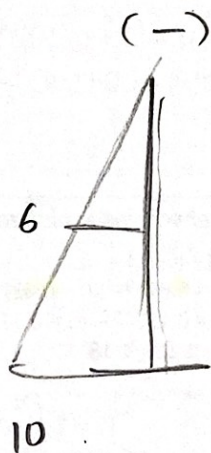




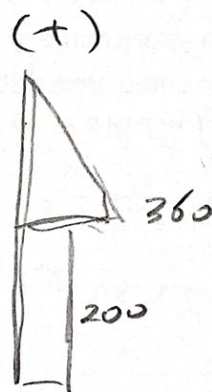
↑
10
↓

← 1
M

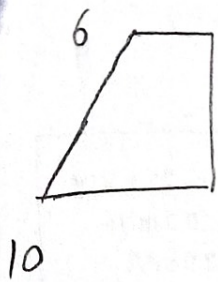
$$M = 1 \times 10 = 10$$



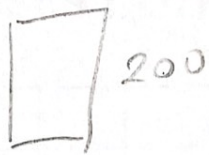
+



$$\Delta + \Delta = -l \times \frac{1}{3} \times \alpha \times \bar{\alpha} = 4 \times \frac{1}{3} \times 360 \times 6 = -2880$$



+



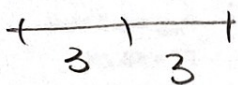
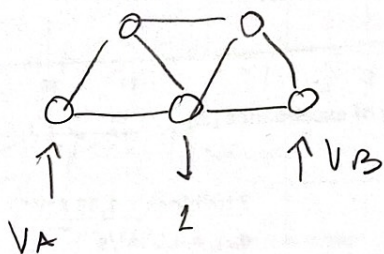
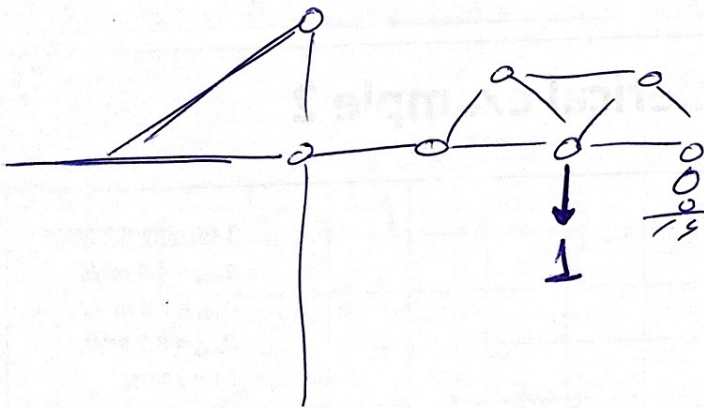
$$= \frac{1}{2} \times a$$

$$= -l \times \frac{1}{2} \times (\bar{\alpha}_1 + \bar{\alpha}_2) \times \alpha = -6 \times \frac{1}{2} \times 20 \times (6 + 10) =$$

$$= -960$$

$$\delta = \frac{-2980 - 960}{65.000} = 0,050 \text{ m} \leftarrow$$

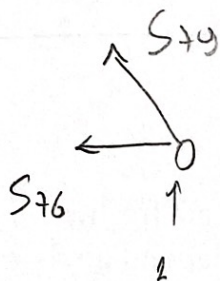
fl. vers. zur Kreisbahn.



$$\sum F_y = 0 \rightarrow V_A + V_A = 1$$

$$\sum M_B = 0 \rightarrow 0V_u = 3 \times 1$$

$$\rightarrow V_u = 0,5 = V_B$$



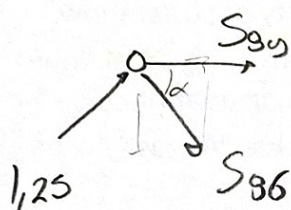
$$\sum F_y = 0 = S_{79} = \frac{-1}{0,8} = -1,25 \text{ kN}$$

$$\sum F_x = 0 = S_{76} = 1,25 \times 0,6 = 0,75 \text{ kN}$$

#5 *Apogee*

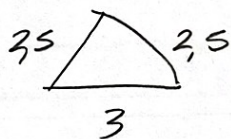
$$S_{56} = 0,75 \text{ kN} \text{ e } S_{58} = -1,25 \text{ kN}$$

#9



$$\sum F_y = 0 = S_{86} = 1,25 \times 0,8 = 1 \text{ kN}$$

$$\sum F_x = 0 = S_{89} = -1,25 \times 0,6 - 1 \times 0,6 = -0,75 - 0,6 = -1,35 \text{ kN}$$



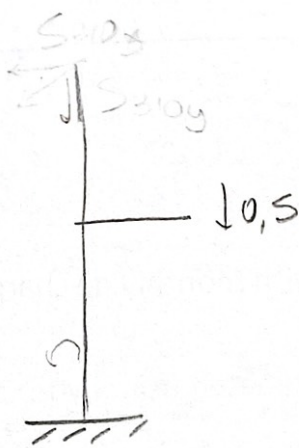
#9 $S_{89} = 1 \text{ kN}$ *Apogee*

$$\begin{aligned} \frac{S_{NN}}{dx} &= \left(\begin{matrix} S_{59} \text{ e } S_{97} \\ 37,5 \times 1,25 \times 2,5 \end{matrix} \right) \times 2 + \left(\begin{matrix} S_{56} \text{ e } S_{67} \\ 3 \times 0,75 \times 2,5 \end{matrix} \right) \times 2 \\ &+ \left(\begin{matrix} S_{69} \text{ e } S_{99} \\ 1 \times 37,5 \times 2,5 \end{matrix} \right) \times 2 + \left(\begin{matrix} S_{89} \\ 1,35 \times 3 \times 4,5 \end{matrix} \right) \end{aligned}$$

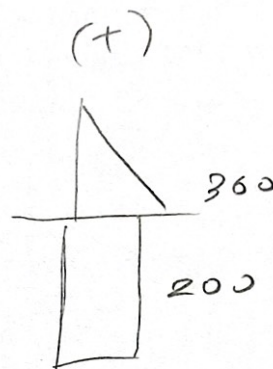
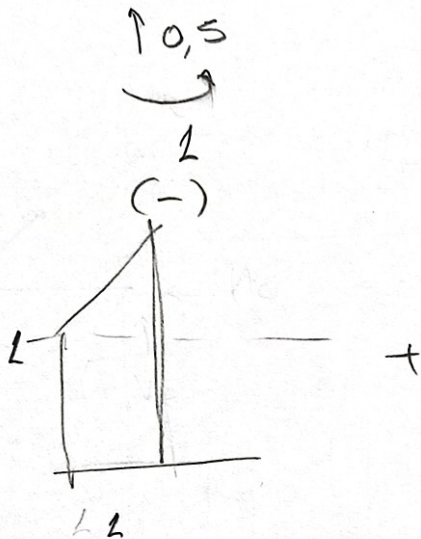
$$= +225 + 101,25 + 187,5 + 182,25 = 696$$

δ *Apogee*

$$= \frac{696}{1050} = 0,66 \text{ m}$$



$$M_D - 0,5 \times 2 = 0 \Rightarrow M_D = 1 \text{ kN}$$



$$\left(\triangle + \triangle \right) \times l = 4 \times \frac{1}{3} \times 1 \times 360 = -480$$

$$\left(\square + \square \right) \times l = 6 \times 1 \times 200 = +1200$$

$$\delta \leftarrow \text{деформация} = - \frac{1680}{65000} = -0,026 \text{ m}$$

$$\begin{aligned} \delta^a + \delta^p &= -0,026 + 0,66 = \\ &= +0,63 \text{ m} \\ &\downarrow \leftarrow \text{деформация} \end{aligned}$$