

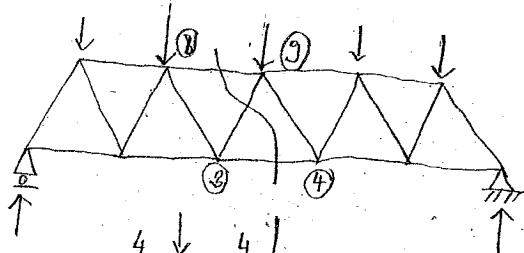
3-1.

a.) $r=23$ $r+k=27$ $27 > 26$ határozatlan
 $k=4$ $2c=26$
 $c=13$

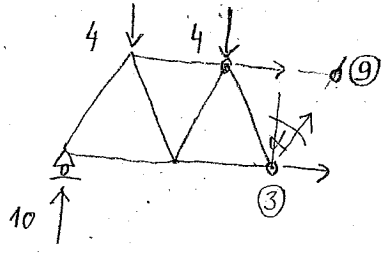
b.) $r=22$ $r+k=26$ $26=26$ határozott
 $k=4$ $2c=26$
 $c=13$

c.) $r=16$ $r+k=19$ $19 > 18$ határozatlan
 $k=3$ $2c=18$
 $c=9$

3-3. a.)



támaszerők:
 szimmetria $\rightarrow A_y = B_y = \frac{5 \cdot 4}{2} = 10 \text{ kN}$
 $A_x = B_x = 0$



nyomatéki egyensúlyi egyenlet a
 3-as csomópontnál:

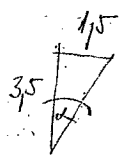
$$10 \cdot 6 + S_{8-9} \cdot 3,5 - 4 \cdot 1,5 - 4 \cdot 4,5 = 0$$

$$S_{8-9} = -10,28 \text{ kN}$$

9-es csomópontnál:

$$10 \cdot 7,5 - 4 \cdot 6 - 4 \cdot 3 - S_{3-4} \cdot 3,5 = 0$$

$$S_{3-4} = +11,14 \text{ kN}$$



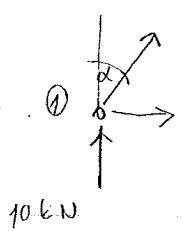
tg $\alpha = \frac{1,5}{3,5}$
 $\alpha = 23,19^\circ$

függőleges irányban felvett vetületi egyenlet:

$$10 - 4 - 4 + S_{3-9} \cdot \cos 23,19^\circ = 0$$

$$S_{3-9} = -2,17 \text{ kN}$$

b.) 1-es csomópontnál ható erők:



$\alpha = 23,19^\circ$

vetületi egyenletek:

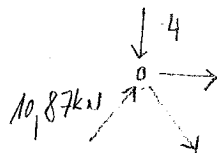
$$10 \text{ kN} + S_{1-7} \cdot \cos 23,19^\circ = 0$$

$$S_{1-7} = -10,87 \text{ kN}$$

$$S_{1-7} \cdot \sin 23,19^\circ + S_{1-2} = 0$$

$$S_{1-2} = +4,28 \text{ kN}$$

7-es csomópont:



-2-

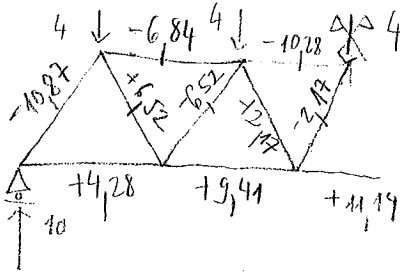
$$-10,87 \cdot \cos 23,19 + 4 + S_{2-7} \cdot \cos 23,19 = 0$$

$$S_{2-7} = +6,52 \text{ kN}$$

$$+10,87 \cdot \sin 23,19 + 6,52 \cdot \sin 23,19 + S_{7-8} = 0$$

$$S_{7-8} = -6,84$$

a) Szimmetria miatt:

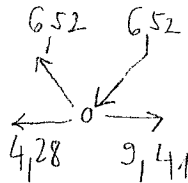


$$S_{2-8} = ?$$

$$S_{2-3} = ?$$

$$S_{3-8} = ?$$

2-es csomópont:



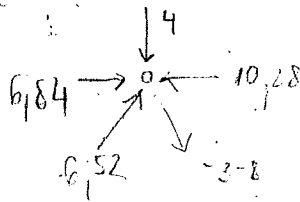
$$6,52 \cdot \cos 23,19 + S_{2-8} \cdot \cos 23,19 = 0$$

$$S_{2-8} = -6,52 \text{ kN}$$

$$4,28 + 2 \cdot 6,52 \cdot \sin 23,19 = S_{2-3}$$

$$S_{2-3} = +9,41 \text{ kN}$$

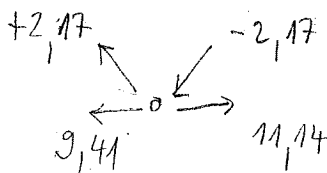
8-as csomópont:



$$S_{3-8} \cdot \cos 23,19 = 6,52 \cdot \cos 23,19 - 4$$

$$S_{3-8} = 2,17$$

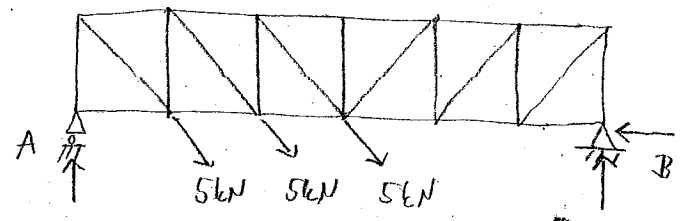
Ellenőrzés: 3-as csomópont



szimmetria feltételei egyenlet:

$$(+2,17 \cdot \sin 23,19) \cdot 2 + 9,41 \approx 11,14$$

3-5. a.)



$$\sum M_A = 0 \quad 5 \cdot \sin 45^\circ \cdot (4 + 8 + 12) - B_y \cdot 24 = 0$$

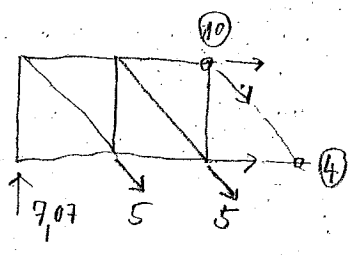
$$B_y = 3,53$$

$$\sum F_y = 0 \quad 5 \cdot \sin 45^\circ \cdot 3 - 3,53 = A_y$$

$$A_y = 7,07$$

$$\sum F_x = 0 \quad 5 \cdot \cos 45^\circ \cdot 3 = B_x$$

$$B_x = 10,6$$



$$\sum M_4 = 0$$

$$7,07 \cdot 12 + S_{10-11} \cdot 4 - 5 \cdot \sin 45^\circ \cdot (4 + 8) = 0$$

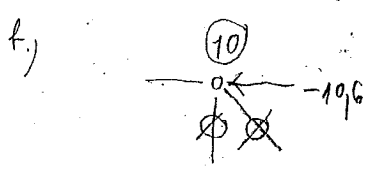
$$S_{10-11} = -10,6$$

$$\sum M_{10} = 0$$

$$7,07 \cdot 8 - 5 \cdot \sin 45^\circ \cdot (4 + 4 + 4) - S_{3-4} \cdot 4 = 0$$

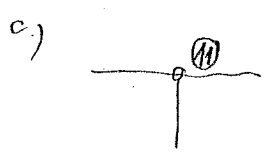
$$S_{3-4} = 3,53$$

$$\sum F_y = 0 \quad 7,07 - 2 \cdot 5 \cdot \sin 45^\circ - S_{4-10} \cdot \sin 45^\circ = 0$$



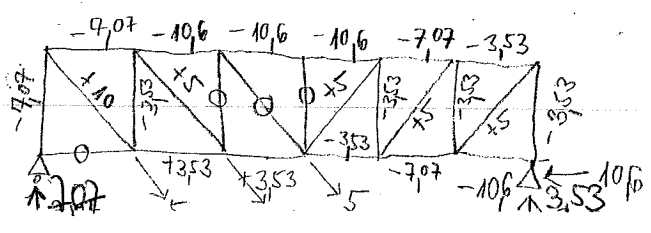
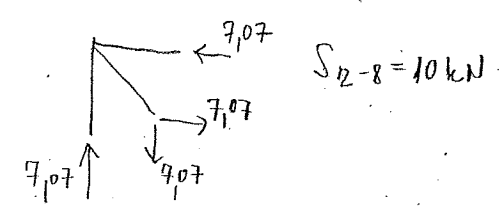
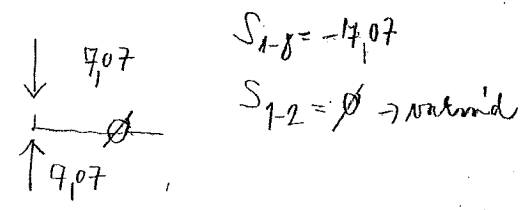
$$S_{3-10} = 0 \rightarrow \text{vakonid}$$

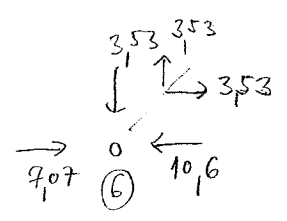
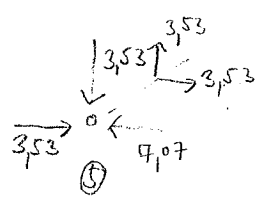
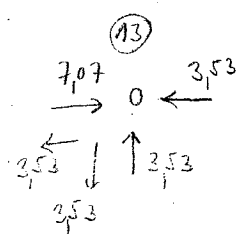
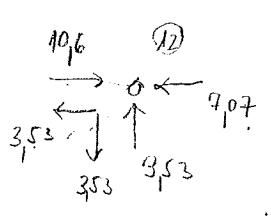
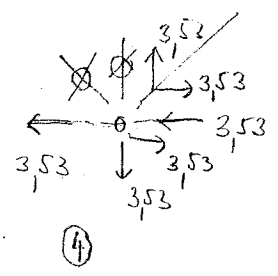
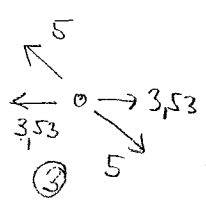
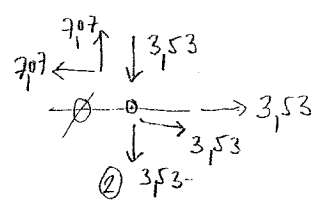
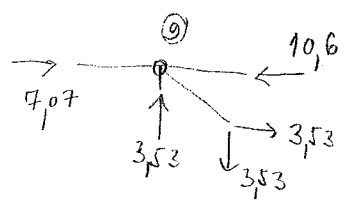
$$S_{4-10} = 0 \rightarrow \text{vakonid}$$



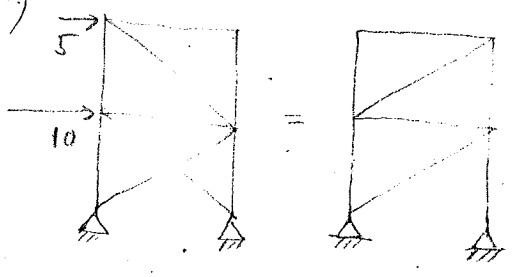
Hivél a csomópont tetszeletlen, 6. 3. nid fut be, analitici kettő egy vonalban lesz, ezért az S_{4-11} nid vakonid.

d.)



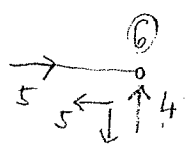
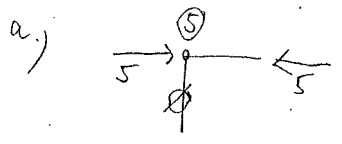


3-7.)



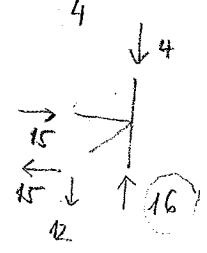
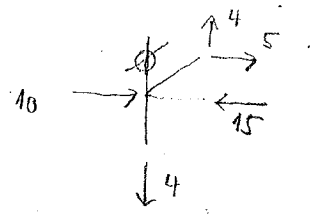
Csak a húzott részeket dolgozzuk!

$r = 8$ $8 + 4 = 12 \rightarrow$ határozott
 $b = 4$
 $c = 6$

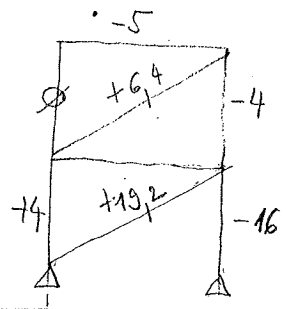


Legnagyobb ömlesztés:

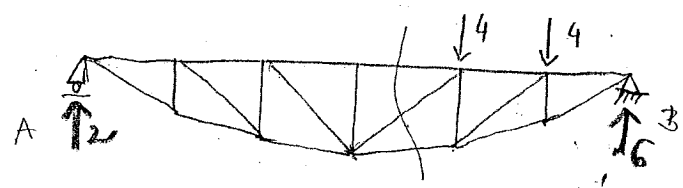
$S_{2-4} = 16 \text{ kN}$



b.) max. ferdeműt erő: $S_{1-4} = 19,20 \text{ kN}$



3-9,



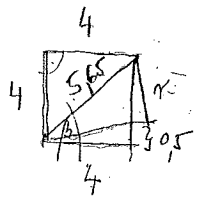
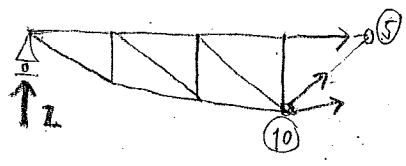
$$\sum M_A = 0 \quad B_y \cdot 24 - 4 \cdot (16 + 20) = 0$$

$$B_y = 6 \text{ kN}$$

$$\sum F_y = 0 \quad 4 + 4 - 6 - A_y = 0$$

$$A_y = 2 \text{ kN}$$

a.)

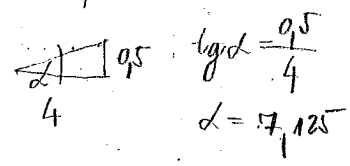


$$\sin \beta = \frac{r}{5.65}$$

$$r = 3.468$$

$$\sum M_5 = 0 \quad 2 \cdot 16 - S_{10-11} \cdot 3.468 = 0$$

$$S_{10-11} = 9.22 \text{ kN} \rightarrow$$



$$\tan \alpha = \frac{0.5}{4}$$

$$\alpha = 7.125^\circ$$

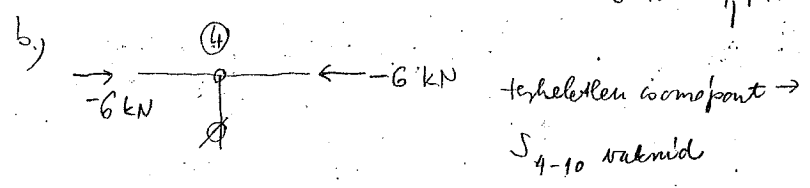
$$\beta = 90^\circ - 45^\circ - 7.125^\circ = 37.875^\circ$$

$$\sum M_{10} = 0 \quad 2 \cdot 12 + S_{4-5} \cdot 4 = 0$$

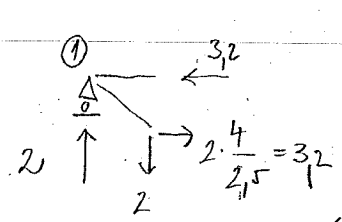
$$S_{4-5} = -6 \text{ kN} \leftarrow$$

$$\sum F_y = 0 \quad 2 + S_{10-11} \cdot \sin 7.125^\circ - S_{5-10} \cdot \sin 45^\circ = 0$$

$$S_{5-10} = 7.444 \text{ kN} \checkmark$$



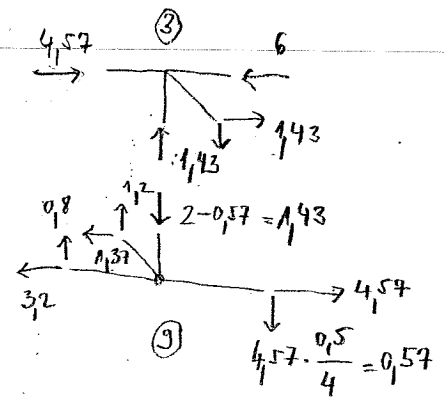
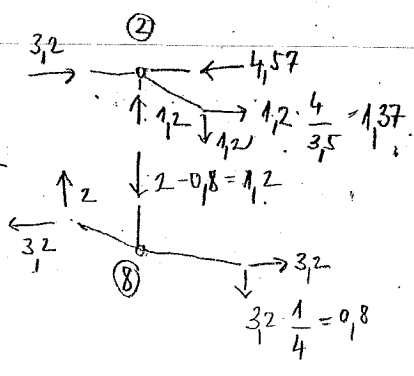
c.)

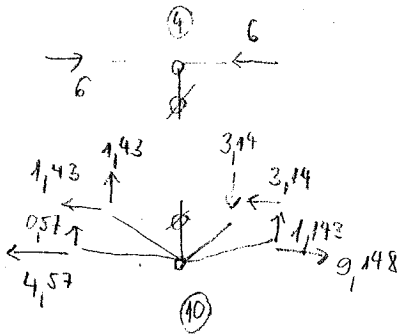
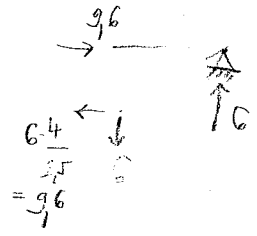
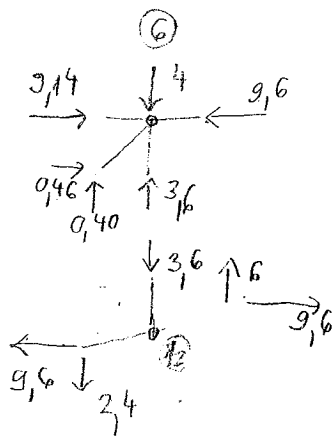
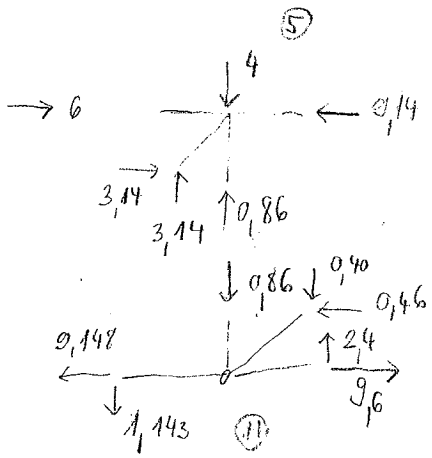


$$S_{1-2} = -3.2 \text{ kN}$$

$$S_{1-8} = +3.77 \text{ kN}$$

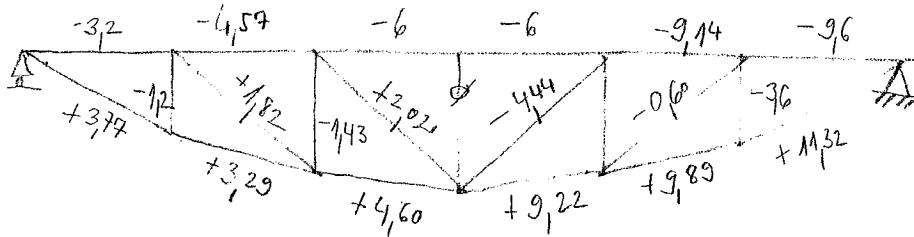
$$S_{2-8} = -1.2 \text{ kN}$$



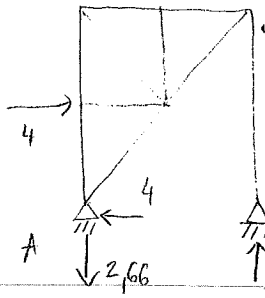


$$\sum F_y = 0 \quad 3,14 - 1,43 - 0,57 - 1,143 = 0$$

$$\sum F_x = 0 \quad 0,148 - 4,57 - 1,143 - 3,14 = 0$$



3-12.)
a.)

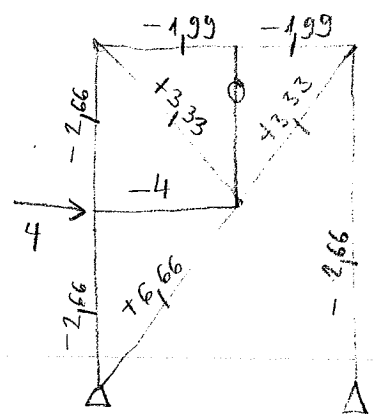
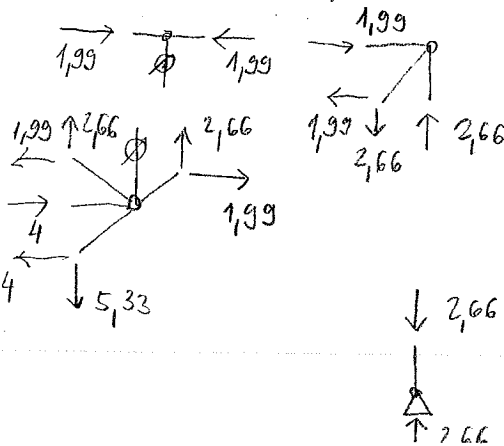
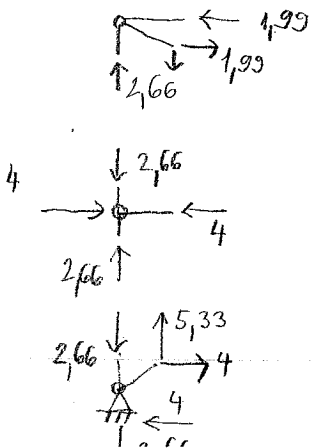


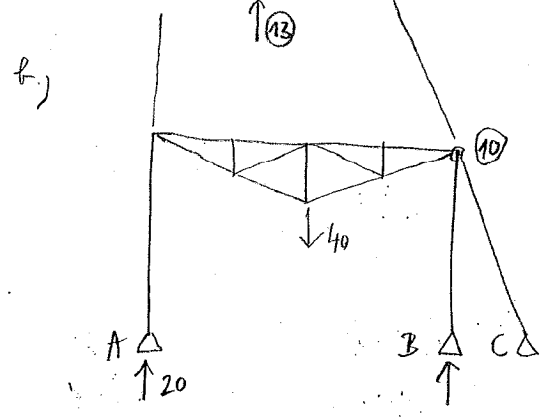
$$\sum M_A = 0 \quad 4 \cdot 4 - B_y \cdot 6 = 0$$

$$B_y = 2,66 \quad A_y = -2,66$$

$$A_x = 4$$

B → csak függőleges erő lehet csak = vízsz. Nincsenek más, ami felvenne a vízszintes erőt





$$\sum M_{10} = 0 \quad A_y \cdot 12 - 40 \cdot 6 = 0$$

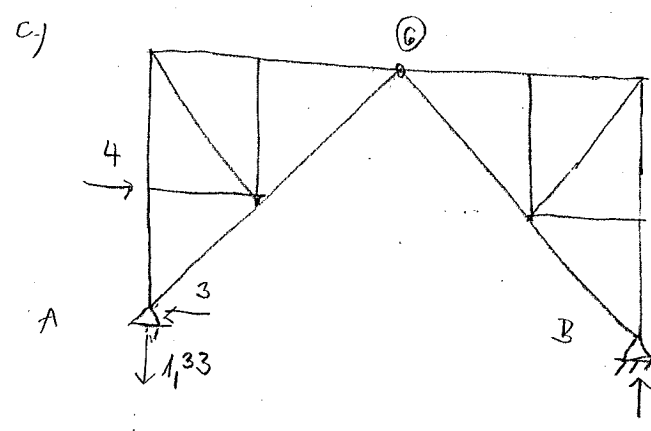
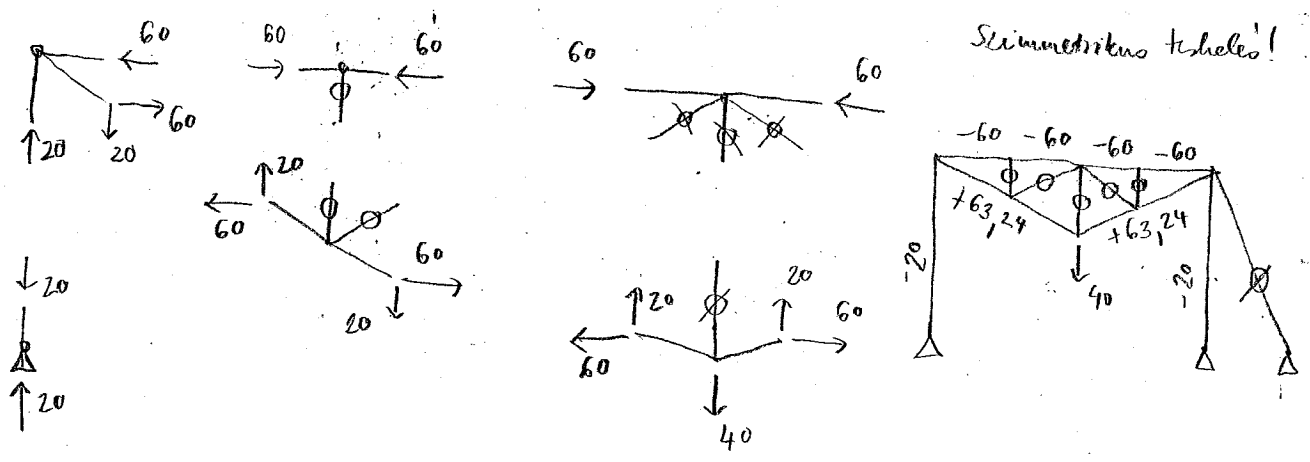
$$A_y = 20 \text{ kN}$$

$$\sum M_{13} = 0 \quad 40 \cdot 6 - B_y \cdot 12 = 0$$

$$B_y = 20 \text{ kN}$$

$$\sum F_y = 0 \rightarrow C_y = 0$$

mind mindig vizsgáljuk ezt, esetleg C-ben nem lehet mindennél!



$$\sum M_A = 0$$

$$4 \cdot 4 - B_y \cdot 12 = 0$$

$$B_y = 1,33$$

$$A_y = -1,33$$

$$\sum M_{6 \text{ jobb}} = 0 \quad 1,33 \cdot 6 - B_x \cdot 8 = 0$$

$$B_x = 1,0 \quad A_x = 3$$

