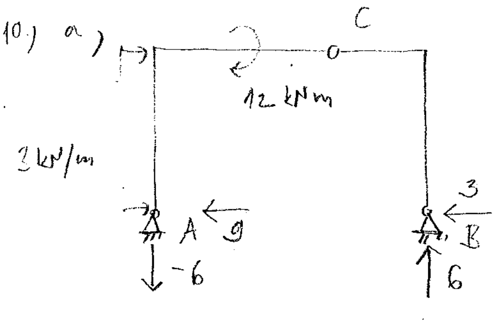
4-10.) a)



$\Sigma M_A = 0 \quad 3 \cdot 4 \cdot 2 + 12 - B_y \cdot 6 = 0$

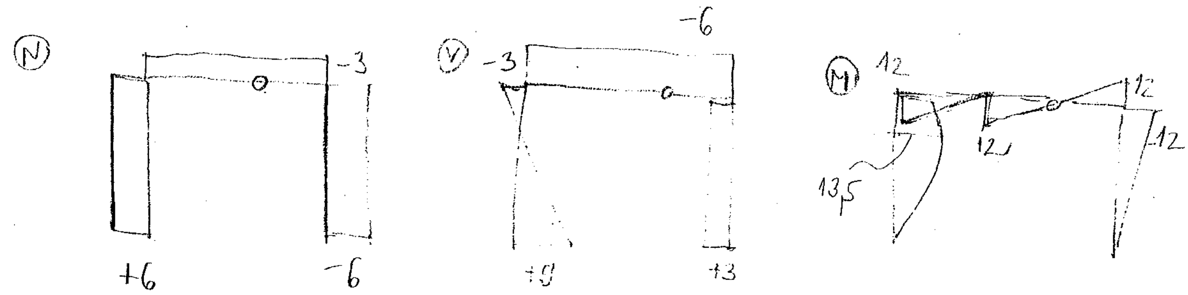
$B_y = 6 \quad A_y = -6$

$\Sigma M_{C,jobb} = 0 \quad 6 \cdot 2 - B_x \cdot 4 = 0$

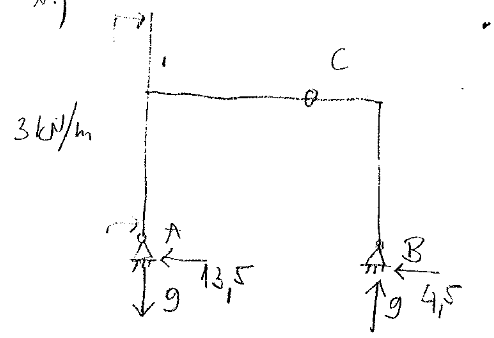
$B_x = 3$

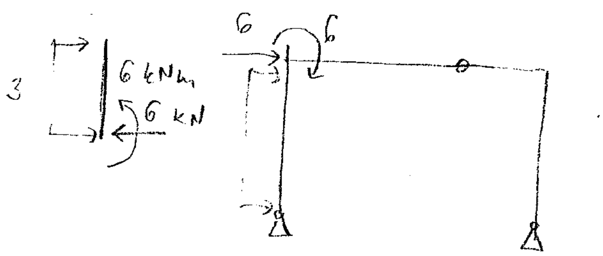
$\Sigma F_x = 0$

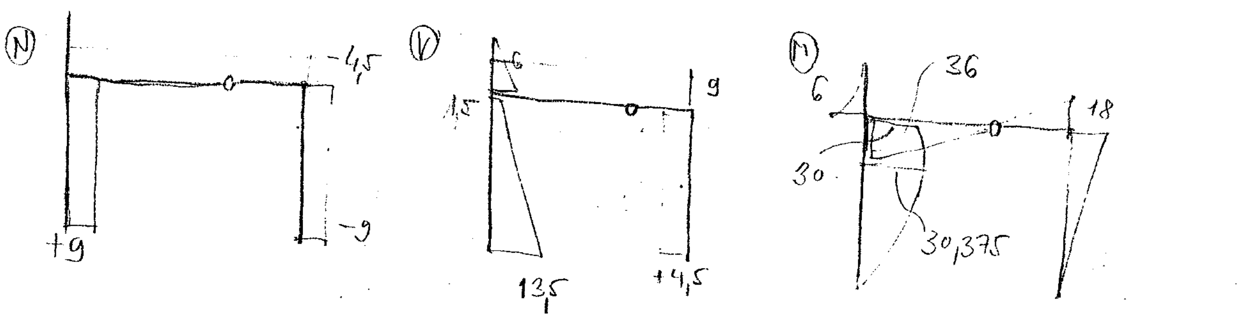
$A_x = 9$

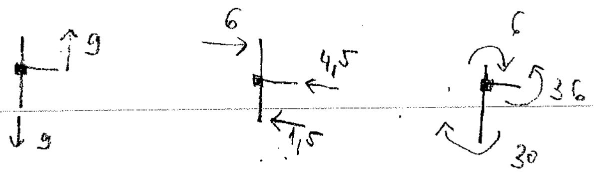


b.)

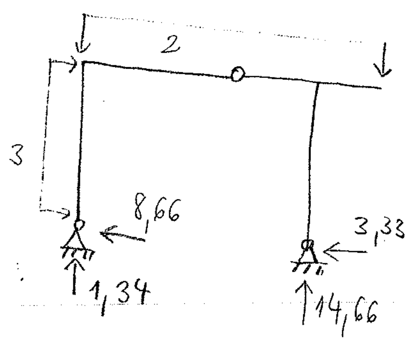


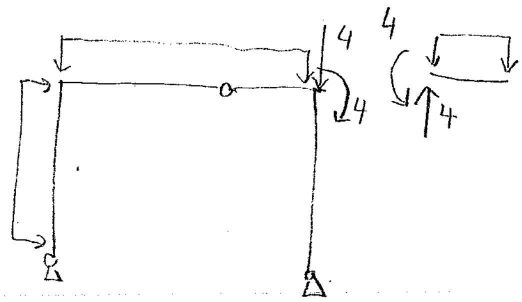


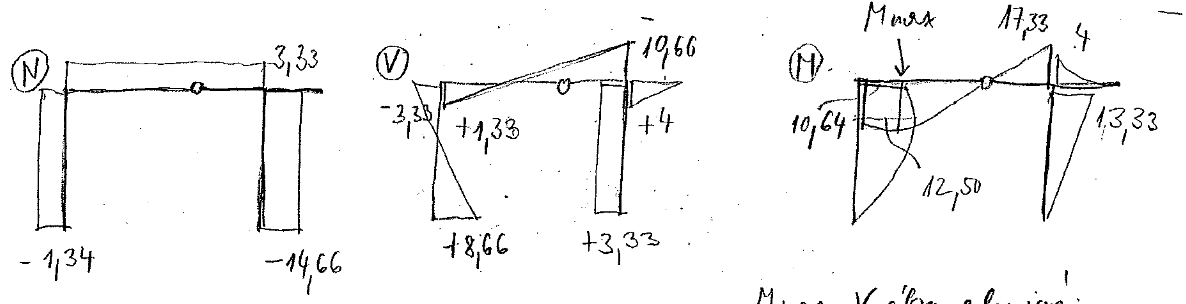




c.)



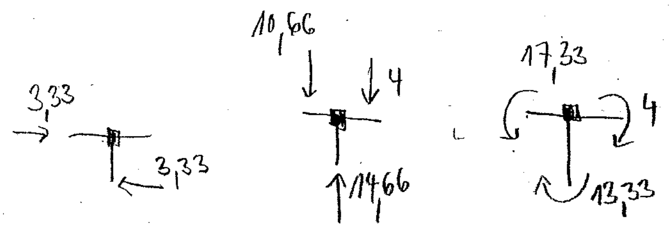




Mmax V ábra alapján:

$\frac{1,33}{x} = \frac{10,66}{6-x} \rightarrow x = 0,665$

Mmax helye



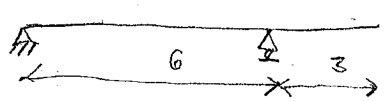
$8,66\cdot 4 + 1,34\cdot 0,665 - 3\cdot 4\cdot 2 - 2\cdot\frac{0,665^2}{2} =$

$= 11,08 = M_{max}$

4.16.) maximális teher: $\gamma_G \cdot g_K + \gamma_Q \cdot q_K = 1,35\cdot 3 + 1,5\cdot 6 = 13,05$ kN/m

minimális teher: $\gamma_G' \cdot g_K = 0,9\cdot 3 = 2,7$ kN/m

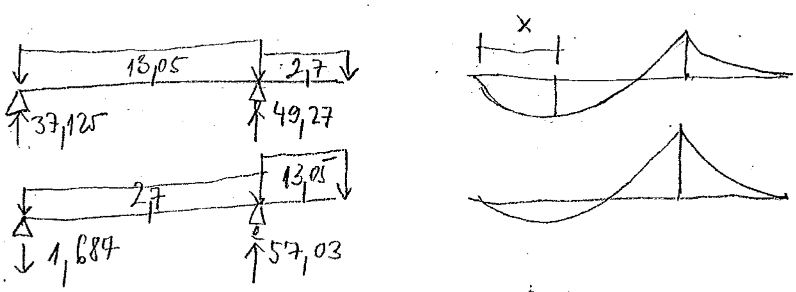
a.):



a támaszközben +Mmax, ha teher bal mezőben maximális, a konzolon minimális

a támaszközben −Mmax, ha teher bal mezőben minimális, a konzolon maximális

MBmax és konzolon −Mmax, ha a teher a konzolon maximális



$x = 2,84$

$+M_{max} = \frac{37,125^2}{2\cdot 13,05} = 52,8$ kNm

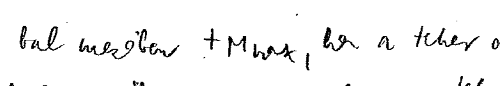
$-M_{max} = \frac{13,05\cdot 3^2}{2} = 58,72$ kNm

támasz felett

Mmax helye: ahol $V=0$

$37,125 - 13,05\cdot x = 0 \rightarrow x = 2,84$

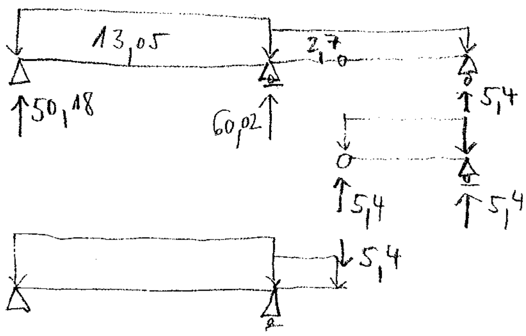
b.)

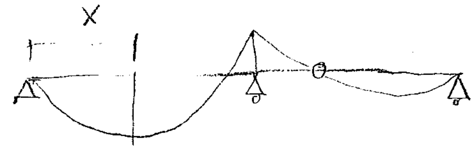


a bal mezőben +Mmax, ha a teher a bal mezőben max., a jobb mezőben min.

a bal mezőben −Mmax, ha a teher a bal mezőben min, a jobb mezőben max.

a jobb mezőben és B támasznál Mmax, ha jobb mezőben a teher max.





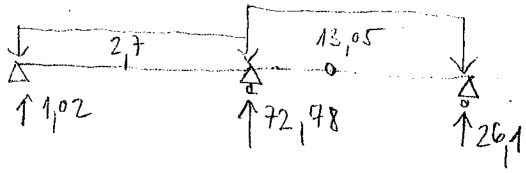
$50{,}18 - 13{,}05 \cdot x = 0 \qquad x = 3{,}84$

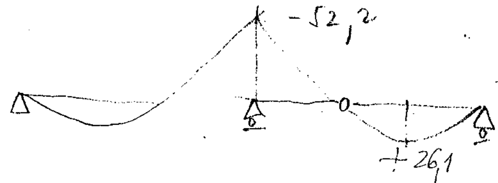
$+M_{max} = \dfrac{50{,}18^2}{2 \cdot 13{,}05} = 96{,}47 \text{ kNm}$

$\Sigma M_A = 0 \qquad 13{,}05 \cdot 8 \cdot 4 + 2{,}7 \cdot 2 \cdot 9 + 5{,}4 \cdot 10 - B \cdot 8 = 0$

$\Sigma F_y = 0 \qquad B = 65{,}02$

$A = 50{,}18$

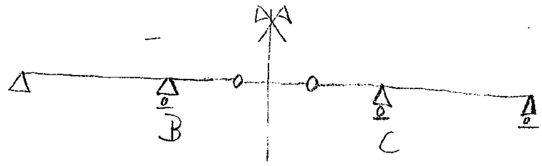




$-M_{max} = \dfrac{13{,}05 \cdot 2^2}{2} + 26{,}1 = 52{,}2$

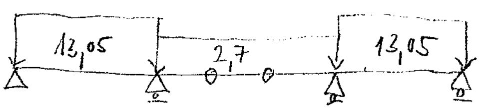
$+M_{max} = \dfrac{26{,}1^2}{2 \cdot 13{,}05} = 26{,}1$

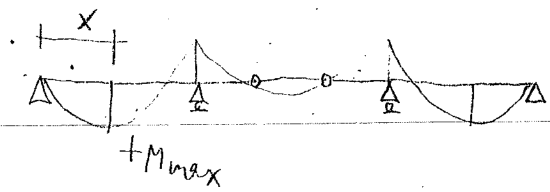
c)

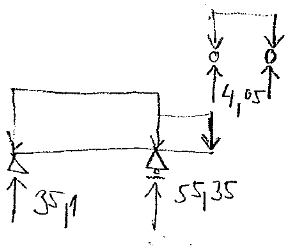


szimmetrikus tartó → ha terhelés szimm.:
M ábra szimmetrikus
V ábra antimetrikus

a két szélső mezőben $+M_{max}$, ha szélső mezőkben terhelés max, középen terhelés min
a két szélső mezőben $-M_{max}$, és középső mezőben $+M_{max}$ és $-M_{max}$, és B, C támaszon M_{max}
ha szélső mezőkben terhelés min és középső mezőben terhelés max





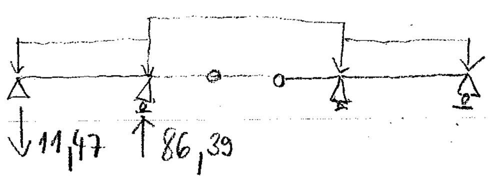


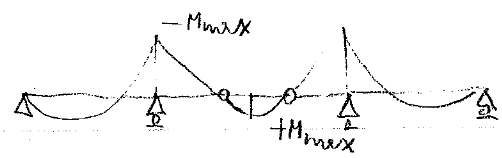
$35{,}1 - 13{,}05 \cdot x = 0$

$x = 2{,}68$

$M_{max} = \dfrac{35{,}1^2}{2 \cdot 13{,}05}$

$M_{max} = 47{,}20 \text{ kNm}$

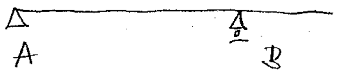




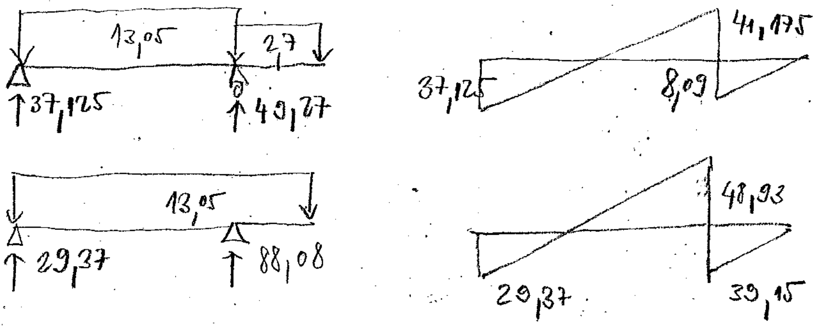
$-M_{max} = 117{,}43 \text{ kNm} \qquad +M_{max} = 14{,}68 \text{ kNm}$

4-17.

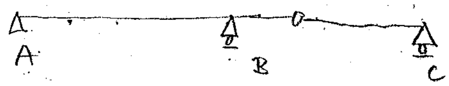
a)



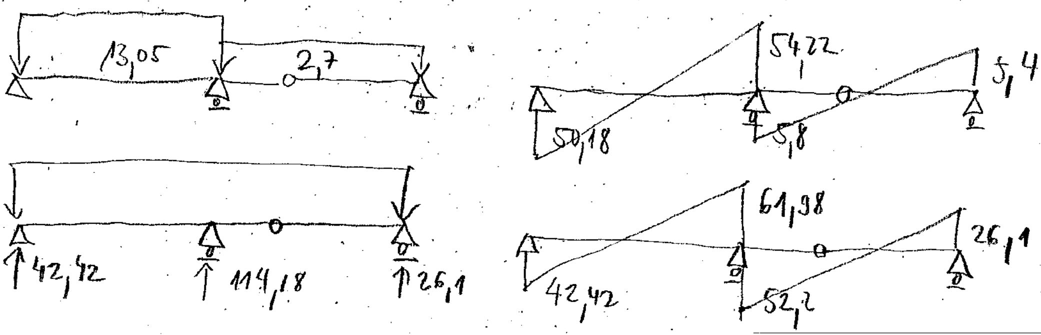
A támasznál $+V_{max}$, ha mezőben max teher és konzolon min. teher
B támasznál $-V_{max}$, ha teljes tartó leterhelt



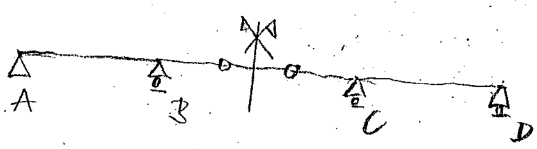
b)



A támasznál $+V_{max}$, ha bal mező max teher, jobb mező min teher.
B támasznál $-V_{max}$ és C támasznál $-V_{max}$, ha teljes tartó max teher.

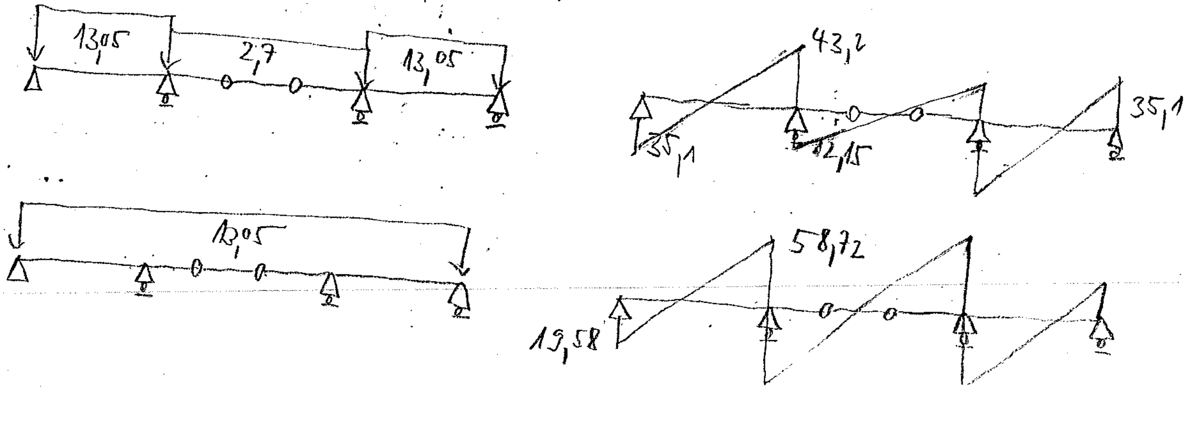


c)

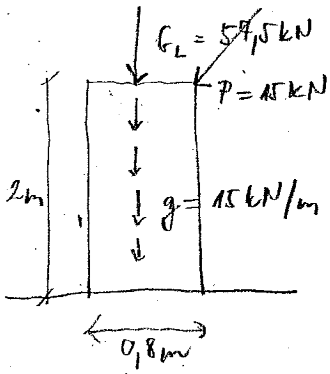


V ábra antimetrikus

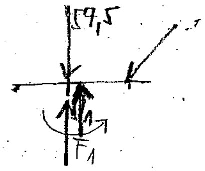
A támasznál $+V_{max}$ és D támasznál $-V_{max}$, ha szélső mezőkben max teher és középső mezőben min teher
B és C támasznál V_{max}, ha teljes tartó max terhelés



5-3.



①

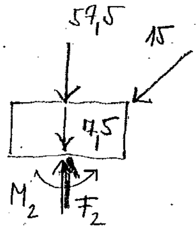


$F_1 = 57{,}5 + 15 \cdot \sin 53 = 69{,}47\,kN$

$M_1 = 15 \cdot \sin 53 \cdot 0{,}4 = 4{,}79\,kNm$

$e_1 = \frac{M}{F} = 0{,}068\,m = 6{,}89\,cm$

②

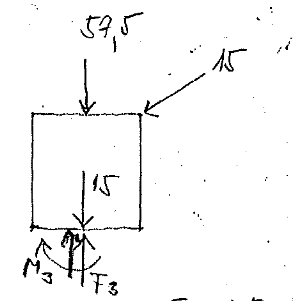


$F_2 = 57{,}5 + 15 \cdot \sin 53 + 7{,}5 = 76{,}97$

$M_2 = 15 \cdot \sin 53 \cdot 0{,}4 - 15 \cdot \cos 53 \cdot 0{,}5 = 0{,}278\,kNm$

$e_2 = 0{,}0036 = 0{,}36\,cm$

③

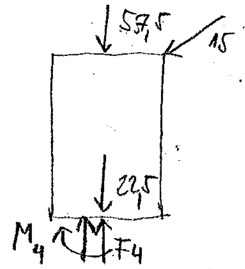


$F_3 = 57{,}5 + 15 \cdot \sin 53 + 15 = 84{,}47$

$M_3 = 15 \cdot \sin 53 \cdot 0{,}4 - 15 \cdot \cos 53 \cdot 1 = -4{,}235\,kNm$

$e_3 = -0{,}050 = -5\,cm$

④

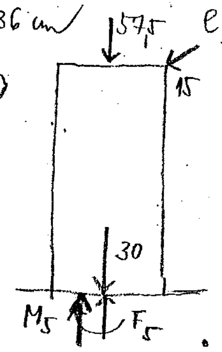


$F_4 = 57{,}5 + 15 \cdot \sin 53 + 22{,}5 = 91{,}97\,kN$

$M_4 = 15 \cdot \sin 53 \cdot 0{,}4 - 15 \cdot \cos 53 \cdot 1{,}5 = -8{,}74\,kNm$

$e_4 = -0{,}0951 = -9{,}51\,cm$

⑤

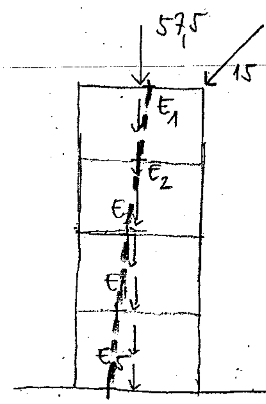


$F_5 = 57{,}5 + 15 \cdot \sin 53 + 30 = 99{,}47$

$M_5 = 15 \cdot \sin 53 \cdot 0{,}4 - 15 \cdot \cos 53 \cdot 2 = -13{,}26$

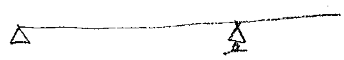
$e_5 = -0{,}133 = -13{,}33\,cm$

támaszvonal:



4-18.)

a.)

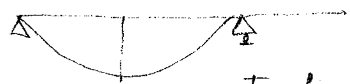


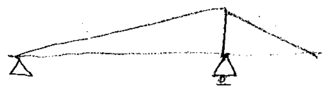
konzolon:

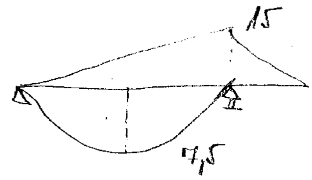
burkolóábrák:

mezőben:

M





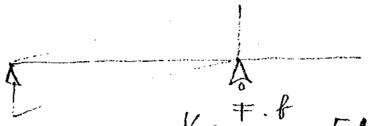


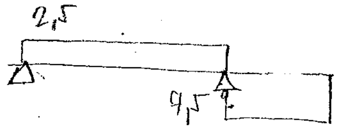
$M = \frac{F\cdot a\cdot b}{l} = \frac{5\cdot 3\cdot 3}{6} =$

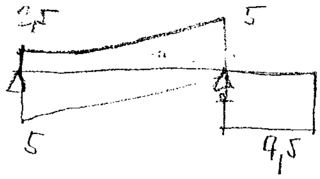
$= 7{,}5$ kNm

$M = F\cdot 3 = 15$ kN

V

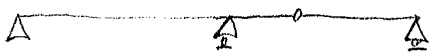






$V = \frac{F\cdot b}{l} = 5$ kN

b.)

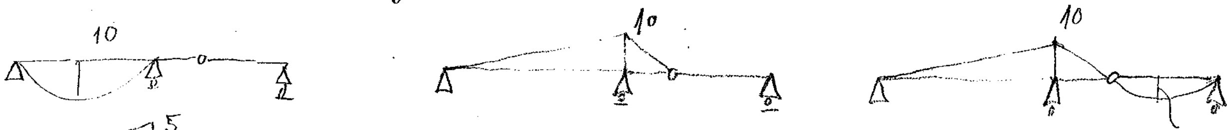


bal mezőben:

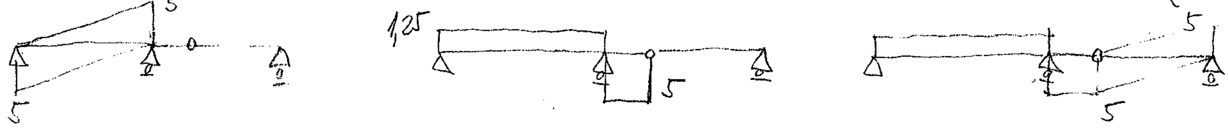
jobb mezőben, csuklótól balra:

jobb mezőben csuklótól jobbra:

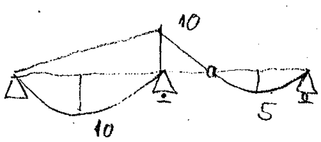
M



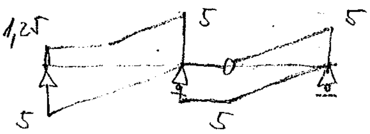
V



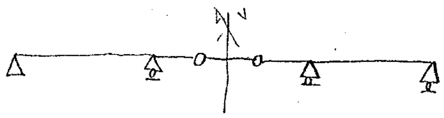
burkolóábrák: M



V



c.)

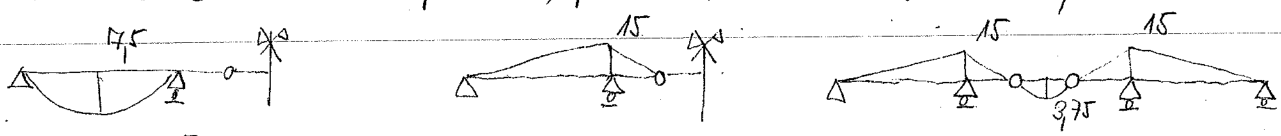


bal mezőben:

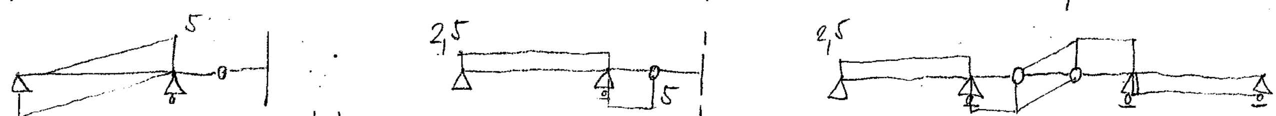
középső mezőben, csuklótól balra:

középső mezőben, csuklók között:

M



V

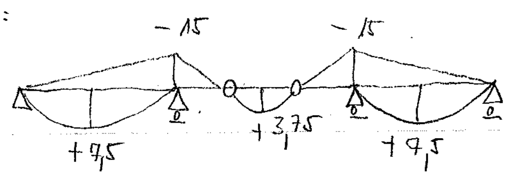


antimetrikus

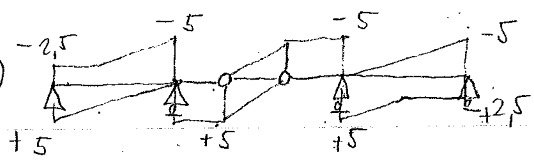
antimetrikus!

burkolóábrák:

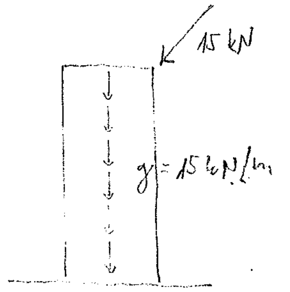
M



V

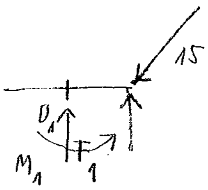


5-4,



A nyomatékok megegyeznek az előző feladatban számítottal!

①

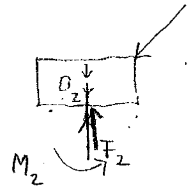


$F_1 = 15 \cdot \sin 53 = 11{,}97$ kN

$M_1 = 15 \cdot \sin 53 \cdot 0{,}4 = 4{,}79$ kNm

$e_1 = \frac{M_1}{F_1} = 0{,}40$ m $= 40$ cm

②

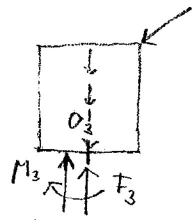


$F_2 = 15 \cdot \sin 53 + 15 \cdot 0{,}5 = 19{,}47$

$M_2 = 0{,}278$ kNm

$e_2 = 0{,}0142 = 1{,}42$ cm

③

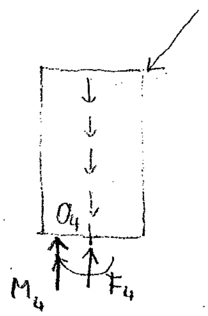


$F_3 = 15 \cdot \sin 53 + 15 \cdot 1 = 26{,}97$

$M_3 = -4{,}235$ kNm

$e_3 = 15{,}7$ cm

④

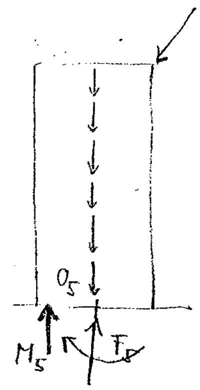


$F_4 = 15 \cdot \sin 53 + 15 \cdot 1{,}5 = 34{,}48$ kN

$M_4 = -8{,}74$ kNm

$e_4 = -0{,}253$ m $= -25{,}3$ cm

⑤



$F_5 = 15 \cdot \sin 53 + 15 \cdot 2 = 41{,}98$ kN

$M_5 = -13{,}26$ kNm

$e_5 = -31{,}58$ cm

támaszvonal: