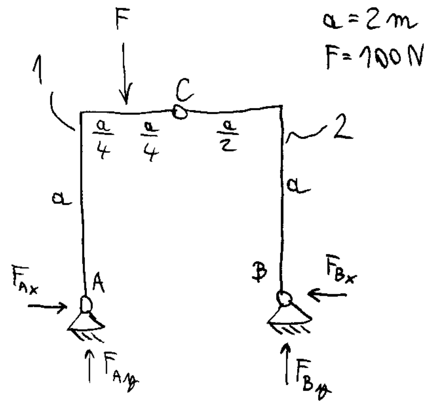
1. példa: A 2010.04.08.-ai gyakorlat 2. feladata.

Számítsuk ki a reakcióerőket! Rajzoljuk meg a nyomatéki ábrát!



1) $\sum M_A = 0 = -F\frac{a}{4} + F_{By}\,a$

$$F_{By} = \frac{F}{4} = \frac{100}{4} = 25\ \text{N}\ (\uparrow)$$

2) $\sum F_y = 0 = F_{Ay} + F_{By} - F$

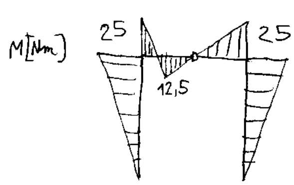
$$F_{Ay} = F - F_{By} = 100 - 25 = 75\ \text{N}\ (\uparrow)$$

3) $\sum M_C^{(2)} = 0 = F_{By}\frac{a}{2} - F_{Bx}\,a$

$$F_{Bx} = \frac{F_{By}}{2} = \frac{25}{2} = 12{,}5\ \text{N}\ (\leftarrow)$$

4) $\sum F_x = 0 = F_{Ax} - F_{Bx}$

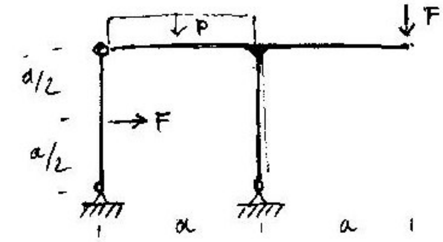
$$F_{Ax} = F_{Bx} = 12{,}5\ \text{N}\ (\rightarrow)$$

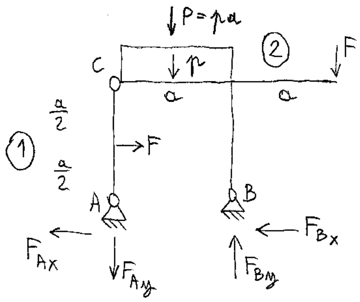


Megjegyzés: A támaszok vízszintesen egy vonalban vannak.

2. példa: A 2010.04.08.-ai gyakorlat 3. feladata.

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!



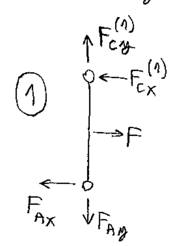


$F = pa$

1.) $\sum M_B = 0 = -F\cdot\frac{a}{2} + P\cdot\frac{a}{2} - F\cdot a + F_{Ay}\cdot a =$

$= -(pa)\frac{a}{2} + (pa)\frac{a}{2} - (pa)a + F_{Ay}\,a$

$\boxed{F_{Ay} = pa\ (\downarrow)}$



2.) $\sum F_y = 0 = -F_{Ay} - P - F + F_{By} = -(pa) - (pa) - (pa) + F_{By}$

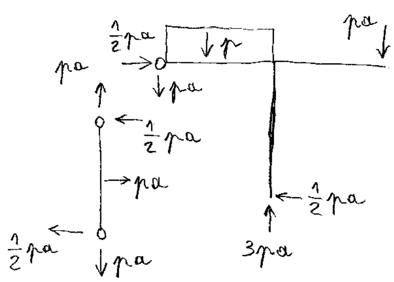
$\boxed{F_{By} = 3pa\ (\uparrow)}$

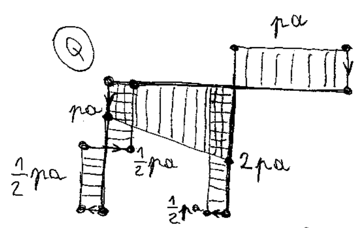
3.) $\sum M_C^{(1)} = 0 = -F_{Ax}\cdot a + F\cdot\frac{a}{2} = -F_{Ax}\,a + (pa)\frac{a}{2} \rightarrow \boxed{F_{Ax} = \frac{1}{2}pa\ (\leftarrow)}$

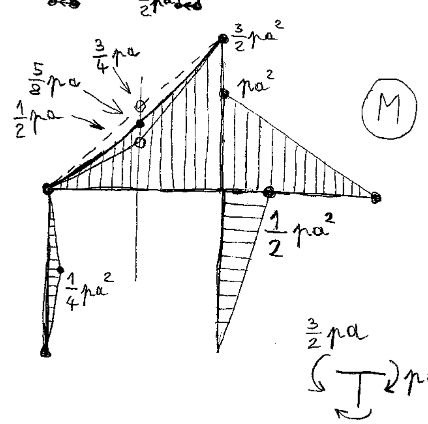
4.) $\sum F_x = 0 = -F_{Ax} + F - F_{Bx} = -\left(\frac{1}{2}pa\right) + (pa) - F_{Bx} \rightarrow \boxed{F_{Bx} = \frac{1}{2}pa\ (\leftarrow)}$

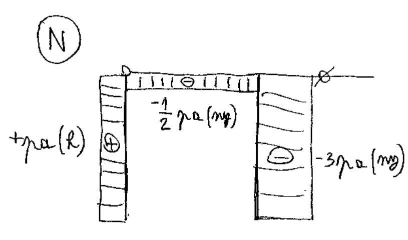
5.) $\sum F_x^{(1)} = 0 = -F_{Ax} + F - F_{Cx}^{(1)} = -\left(\frac{1}{2}pa\right) + (pa) - F_{Cx}^{(1)} \rightarrow \boxed{F_{Cx}^{(1)} = \frac{1}{2}pa\ (\leftarrow)}$

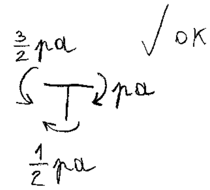
6.) $\sum F_y^{(1)} = 0 = F_{Cy}^{(1)} - F_{Ay} = F_{Cy}^{(1)} - (pa) \rightarrow \boxed{F_{Cy}^{(1)} = pa\ (\uparrow)}$







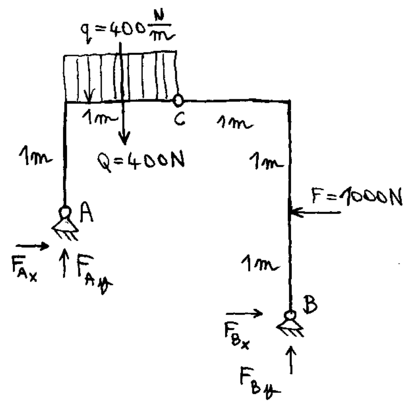


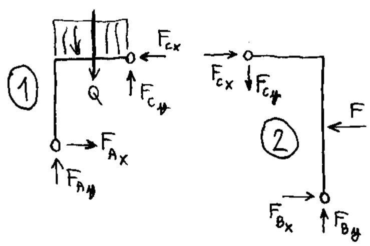


3. példa: A 2010.04.08.-ai gyakorlat 4. feladata.

Számítsuk ki a reakcióerőket és a csuklóerőt! Rajzoljuk meg a igénybevételi ábrákat!

Megjegyzés: A támaszok se vízszintesen, se függőlegesen nincsenek egy vonalban, ezért első lépésként két nyomatéki egyenletből álló egyenletrendszert kell felírnunk.





1.) $\sum M_A = 0 = -Q\cdot 0{,}5 + F_{Bx}\cdot 1 + F_{By}\cdot 2$

2.) $\sum M_C^{(2)} = 0 = -F\cdot 1 + F_{Bx}\cdot 2 + F_{By}\cdot 1 \quad /\cdot(-2)$

2'.) $0 = +2F - 4F_{Bx} - 2F_{By}$

1+2'.) $0 = 2F - 0{,}5Q - 3F_{Bx}$

$$F_{Bx} = \frac{2F - 0{,}5Q}{3} = \frac{2\cdot 1000 - 0{,}5\cdot 400}{3} = 600\,N\ (\rightarrow)$$

2.) $F_{By} = F - 2F_{Bx} = 1000 - 2\cdot 600 = -200\,N\ (\downarrow)$

$\sum F_x = 0 = F_{Ax} - F + F_{Bx}$

$$F_{Ax} = F - F_{Bx} = 1000 - 600 = 400\,N\ (\rightarrow)$$

$\sum F_y = 0 = F_{Ay} - Q + F_{By}$

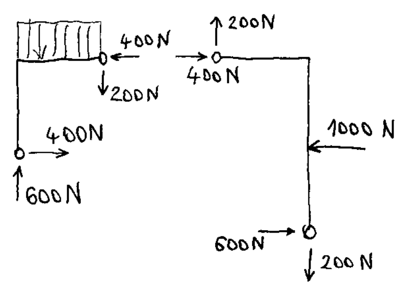
$$F_{Ay} = Q - F_{By} = 400 - (-200) = 600\,N\ (\uparrow)$$

$\sum F_x^{(1)} = 0 = F_{Ax} - F_{Cx}$

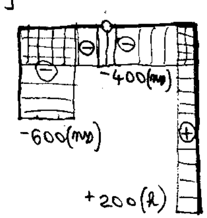
$$F_{Cx} = F_{Ax} = 400\,N$$

$\sum F_y^{(2)} = 0 = F_{By} - F_{Cy}$

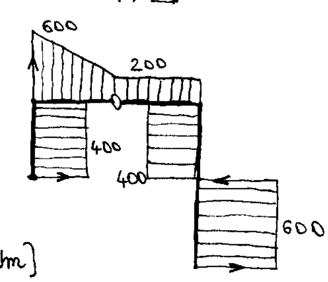
$F_{Cy} = F_{By} = -200\,N$ (ellentétes)



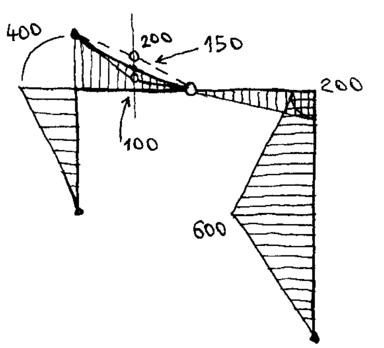
N[N]



V[N]



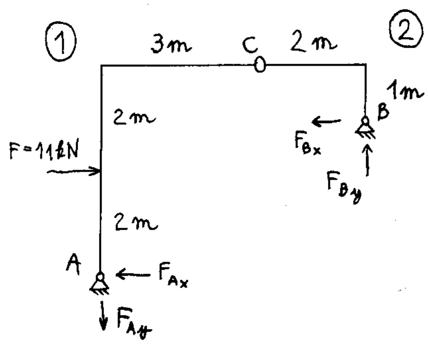
M[Nm]



4. példa:

Számítsuk ki a reakcióerőket! Rajzoljuk meg a igénybevételi ábrákat!

Megjegyzés: A támaszok se vízszintesen, se függőlegesen nincsenek egy vonalban, ezért első lépésként két nyomatéki egyenletből álló egyenletrendszert kell felírnunk.



1.) $\sum M_A = 0 = -F\cdot 2 + F_{Bx}\cdot 3 + F_{By}\cdot 5$

2.) $\sum M_c^{(2)} = 0 = -F_{Bx}\cdot 1 + F_{By}\cdot 2$

2.) $F_{Bx} = 2F_{By}$

2→1.) $0 = -F\cdot 2 + (2F_{By})\cdot 3 + F_{By}\cdot 5$

$$\boxed{F_{By} = \frac{2}{11}F = \frac{2}{11}\cdot 11 = 2\ kN\ (\uparrow)}$$

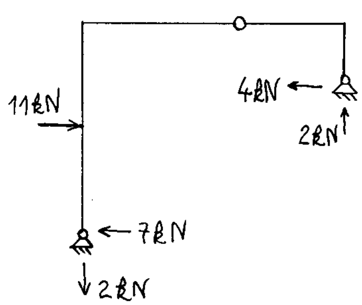
2.) $\boxed{F_{Bx} = 2\cdot 2 = 4\ kN\ (\leftarrow)}$

$\sum F_x = 0 = -F_{Ax} + F - F_{Bx}$

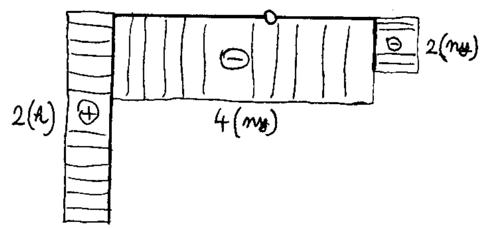
$$\boxed{F_{Ax} = F - F_{Bx} = 11 - 4 = 7\ kN\ (\leftarrow)}$$

$\sum F_y = 0 = -F_{Ay} + F_{By}$

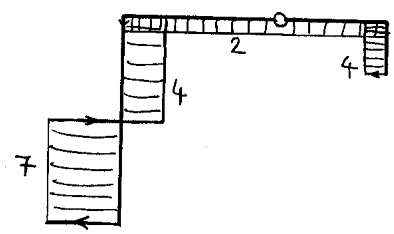
$$\boxed{F_{Ay} = F_{By} = 2\ kN\ (\downarrow)}$$



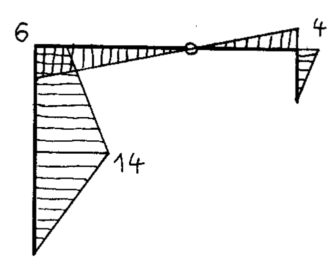
N[kN]



V[kN]



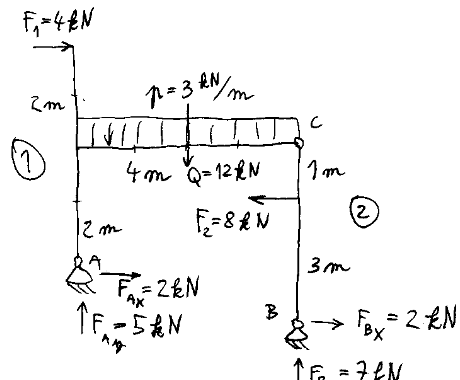
M[kNm]



5. példa:

Számítsuk ki a reakcióerőket és a csuklóerőt! Rajzoljuk meg az igénybevételi ábrákat!

Megjegyzés: A támaszok se vízszintesen, se függőlegesen nincsenek egy vonalban. A B támasz és a C csukló viszont függőlegesen egy vonalban van, ezért nincs szükség két ismeretlenes egyenletrendszerre. A $\sum M_C^{(1)} = 0$ helyett $\sum M_A = 0$ egyenletet is fel lehetne írni, de így kevesebb erő szerepel a képletben.



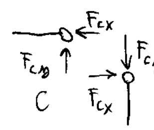
$$\sum M_C^{(2)} = 0 = -F_2 \cdot 1 + F_{Bx} \cdot 4 \rightarrow F_{Bx} = 2\,kN\,(\rightarrow)$$

$$\sum F_x = 0 = F_1 + F_{Ax} - F_2 + F_{Bx} \rightarrow F_{Ax} = 2\,kN\,(\rightarrow)$$

$$\sum M_C^{(1)} = 0 = -F_1 \cdot 2 + Q \cdot 2 + F_{Ax} \cdot 2 - F_{Ay} \cdot 4$$

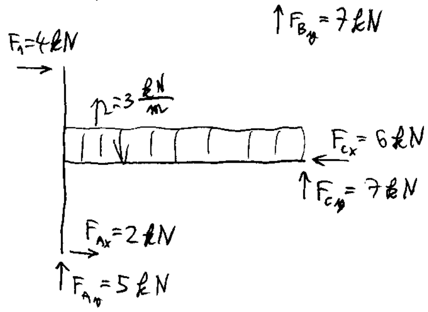
$$F_{Ay} = \frac{Q + F_{Ax} - F_1}{2} = 5\,kN\,(\uparrow)$$

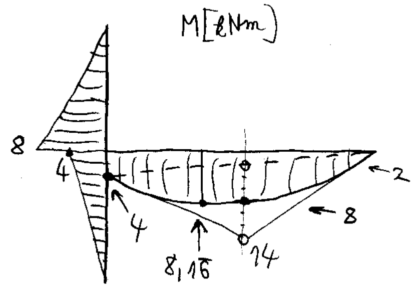
$$\sum F_y = 0 = F_{Ay} - Q + F_{By} \rightarrow F_{By} = 7\,kN\,(\uparrow)$$

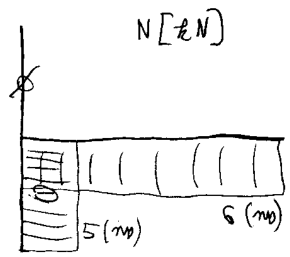


$$\sum F_x^{(2)} = 0 \rightarrow F_{Cx} = 6\,kN$$

$$\sum F_y^{(2)} = 0 \rightarrow F_{Cy} = 7\,kN$$





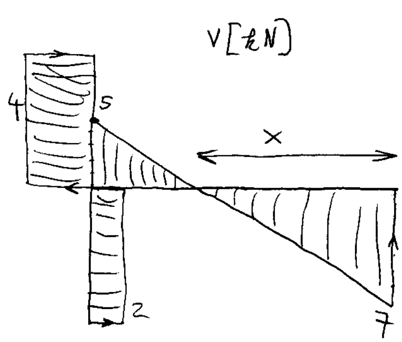


$$T(x) = 7 - q x = 0$$

$$q = \frac{7}{3} = 2{,}\overline{3}\ m$$

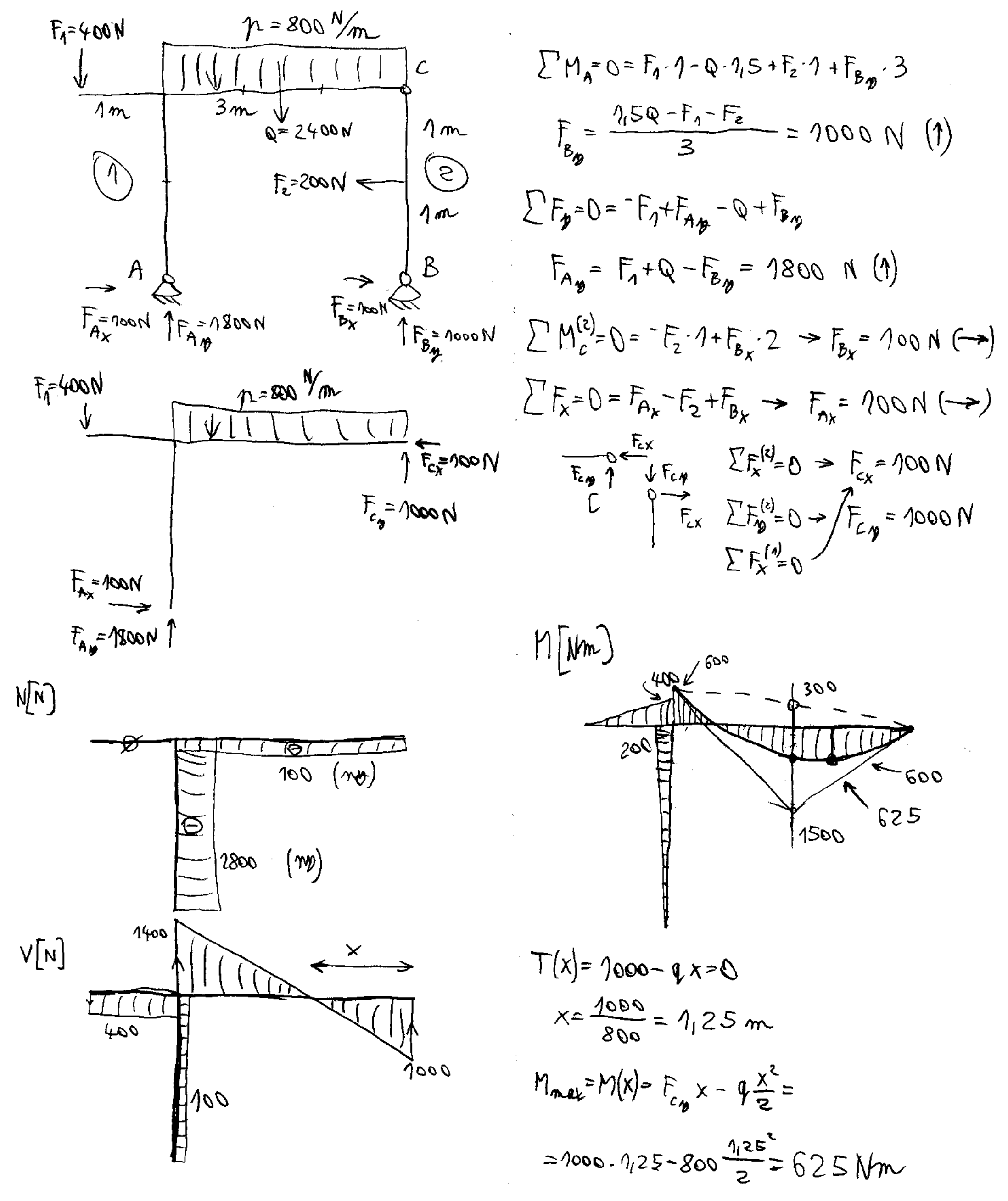
$$M_{max} = M(x) = F_{Cy} x - q \frac{x^2}{2} =$$

$$= 7 \cdot 2{,}\overline{3} - 3\,\frac{2{,}\overline{3}^2}{2} = 8{,}1\overline{6}\ kNm$$



6. példa:

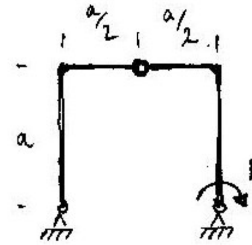
Számítsuk ki a reakcióerőket és a csuklóerőt! Rajzoljuk meg az igénybevételi ábrákat!

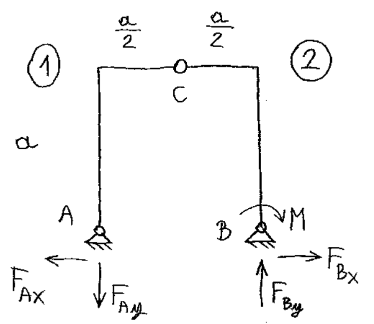


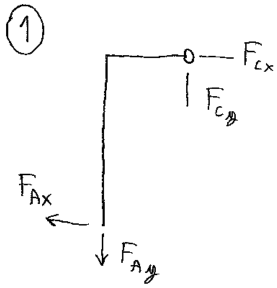
Megjegyzés: A támaszok vízszintesen egy vonalban vannak.

7. példa:

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!





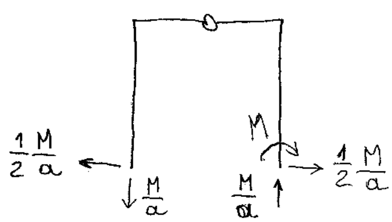


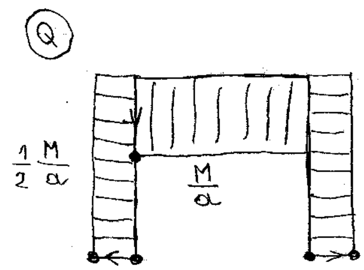
1.) $\sum M_B = 0 = F_{Ay}\cdot a - M \longrightarrow \boxed{F_{Ay} = \frac{M}{a}\ (\downarrow)}$

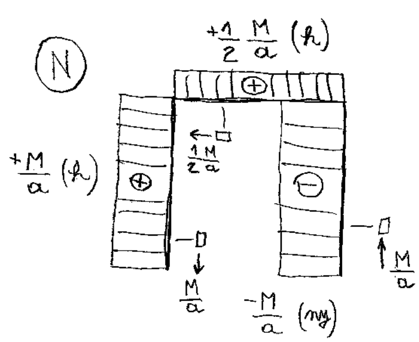
2.) $\sum F_y = 0 = -F_{Ay} + F_{By} \longrightarrow \boxed{F_{By} = F_{Ay} = \frac{M}{A}\ (\uparrow)}$

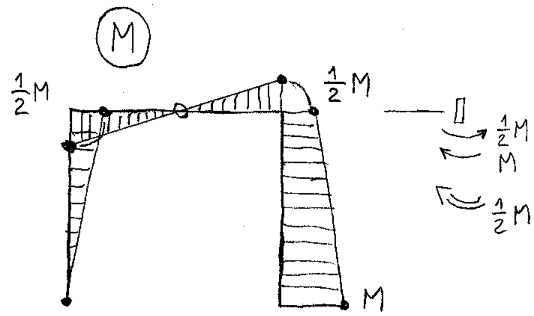
3.) $\sum M_C^{(1)} = 0 = -F_{Ax}\cdot a + F_{Ay}\cdot\frac{a}{2} \longrightarrow \boxed{F_{Ax} = \frac{1}{2}F_{Ay} = \frac{1}{2}\frac{M}{a}\ (\leftarrow)}$

4.) $\sum F_x = 0 = -F_{Ax} + F_{Bx} \longrightarrow \boxed{F_{Bx} = F_{Ax} = \frac{1}{2}\frac{M}{a}\ (\rightarrow)}$



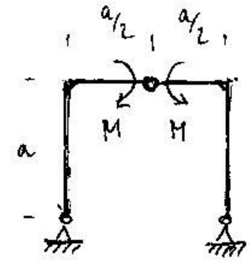


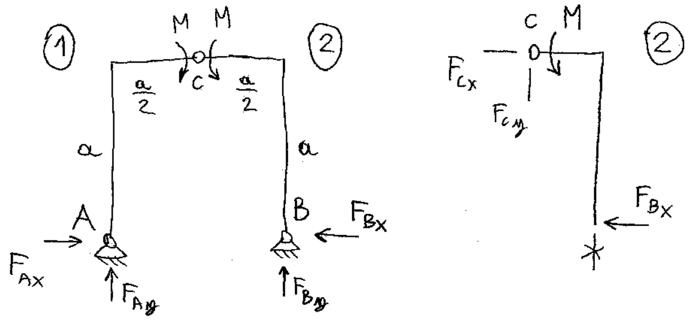




8. példa:

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!



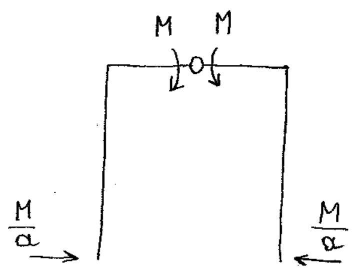


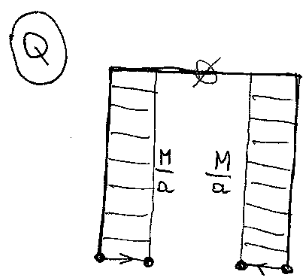
1.) $\sum M_A = 0 = -M + M + F_{By} \cdot a \rightarrow \boxed{F_{By} = 0}$

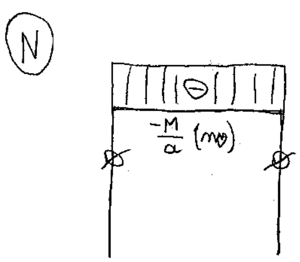
2.) $\sum F_y = 0 = F_{Ay} + F_{By} \rightarrow \boxed{F_{Ay} = 0}$

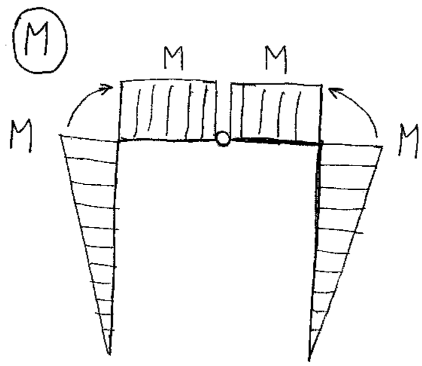
3.) $\sum M_C^{(2)} = 0 = +M - F_{Bx} \cdot a \rightarrow \boxed{F_{Bx} = \frac{M}{a} \ (\leftarrow)}$

4.) $\sum F_x = 0 = F_{Ax} - F_{Bx} \rightarrow \boxed{F_{Ax} = F_{Bx} = \frac{M}{a} \ (\rightarrow)}$



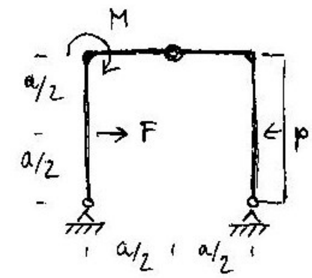


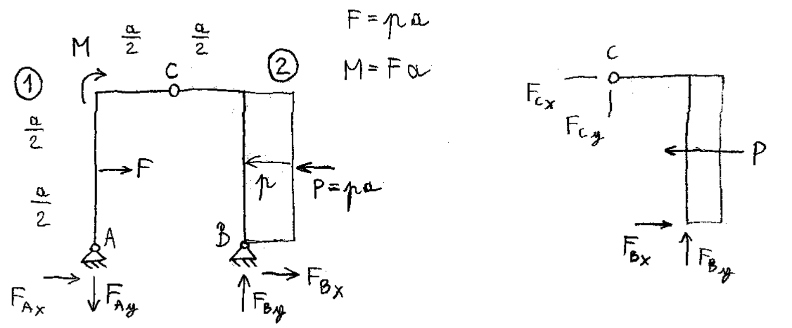




9. példa:

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!





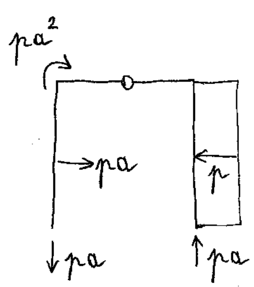
1.) $\sum M_A = 0 = -F\cdot\frac{a}{2} - M + P\cdot\frac{a}{2} + F_{By}\cdot a = -(pa)\frac{a}{2} - (pa^2) + (pa)\frac{a}{2} + F_{By}\cdot a$

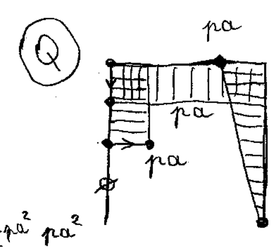
$F_{By} = pa\ (\uparrow)$

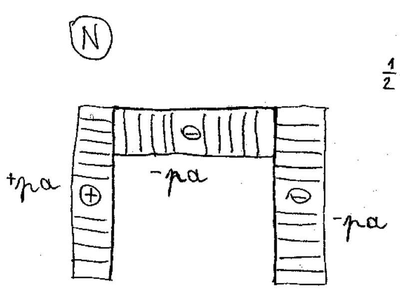
2.) $\sum F_y = 0 \rightarrow F_{Ay} = F_{By} = pa\ (\downarrow)$

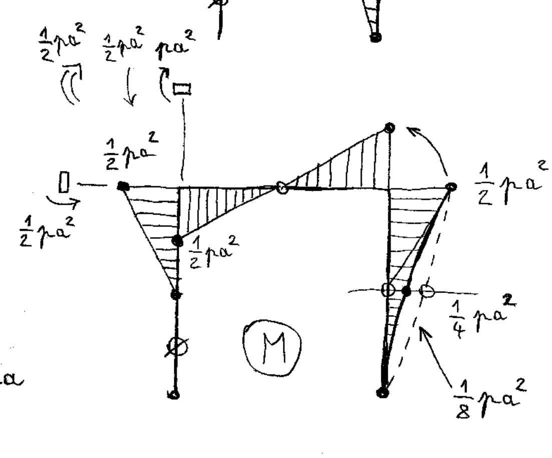
3.) $\sum M_C^{(2)} = 0 = -P\cdot\frac{a}{2} + F_{Bx}\cdot a + F_{By}\cdot\frac{a}{2} = -(pa)\frac{a}{2} + F_{Bx}a + (pa)\frac{a}{2} \rightarrow F_{Bx} = 0$

4.) $\sum F_x = F_{Ax} + F - P + F_{Bx} = F_{Ax} + (pa) - (pa) + 0 \rightarrow F_{Ax} = 0$



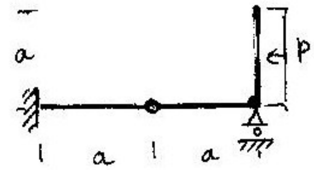


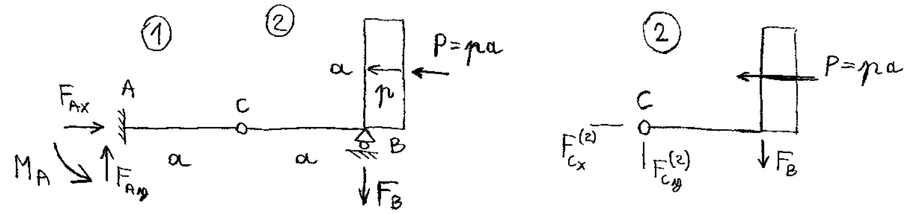




10. példa: A 2010.04.08.-ai gyakorlat 5. feladata.

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!



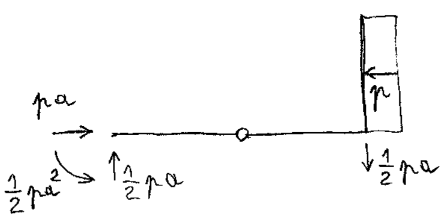


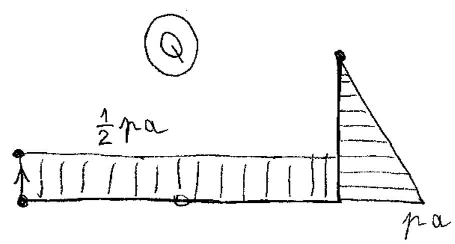
1.) $\sum F_x = 0 = F_{Ax} - P \rightarrow$ $\boxed{F_{Ax} = pa\ (\rightarrow)}$

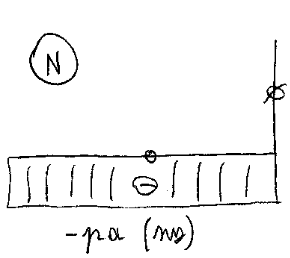
2.) $\sum M_C^{(2)} = P\cdot\frac{a}{2} - F_B\cdot a = (pa)\frac{a}{2} - F_B\cdot a \rightarrow$ $\boxed{F_B = \frac{1}{2}pa\ (\downarrow)}$

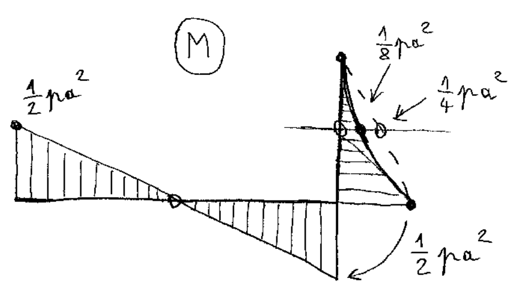
3.) $\sum F_y = 0 = F_{Ay} - F_B \rightarrow$ $\boxed{F_{Ay} = \frac{1}{2}pa\ (\uparrow)}$

4.) $\sum M_A = 0 = M_A - F_B\cdot 2a + P\cdot\frac{a}{2} = M_A - \left(\frac{1}{2}pa\right)\cdot 2a + (pa)\frac{a}{2} \rightarrow$ $\boxed{M_A = \frac{1}{2}pa^2\ \circlearrowleft}$



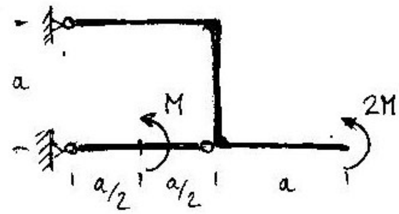


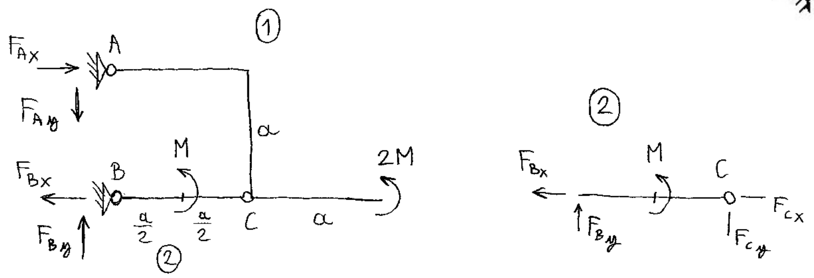




11. példa: A 2010.04.08.-ai gyakorlat 6. feladata.

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!



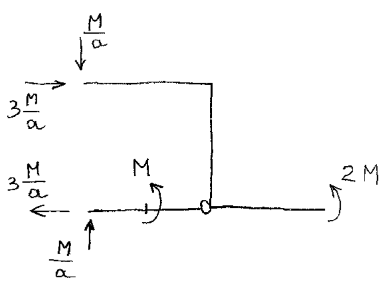


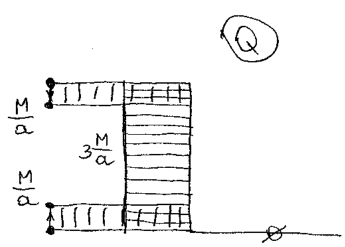
1.) $\sum M_B = 0 = M + 2M - F_{Ax} \cdot a \rightarrow \boxed{F_{Ax} = 3\frac{M}{a}\ (\rightarrow)}$

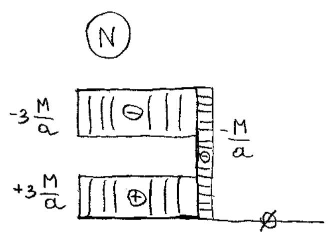
2.) $\sum F_x = 0 \rightarrow \boxed{F_{Bx} = F_{Ax} = 3\frac{M}{a}\ (\leftarrow)}$

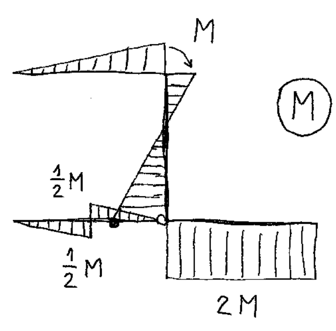
3.) $\sum M_C^{(2)} = 0 = M - F_{By} \cdot a \rightarrow \boxed{F_{By} = \frac{M}{a}\ (\uparrow)}$

4.) $\sum F_y = 0 \rightarrow \boxed{F_{Ay} = F_{By} = \frac{M}{a}\ (\downarrow)}$





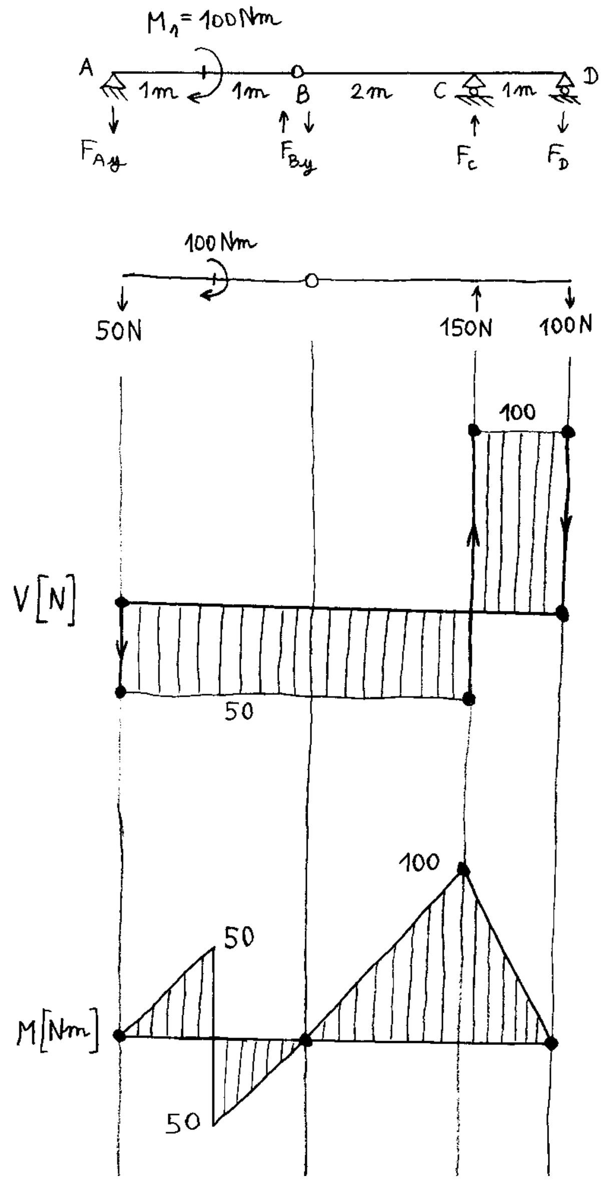




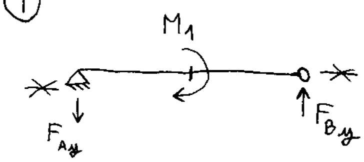
Gerber-tartók

12. példa: A 2010.04.16.-ai gyakorlat 1. feladata.

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!



①



$$\sum M_B^{(1)} = 0 = F_{Ay}\cdot 2 - M_1$$

$$\boxed{F_{Ay} = \frac{1}{2}M_1 = \frac{1}{2}\cdot 100 = 50\,N\ (\downarrow)}$$

A teljes tartóra:

$$\sum M_D = 0 = F_{Ay}\cdot 5 - M_1 - F_c\cdot 1$$

$$\boxed{F_c = 5F_{Ay} - M_1 = 5\cdot 50 - 100 = 150\,N\ (\uparrow)}$$

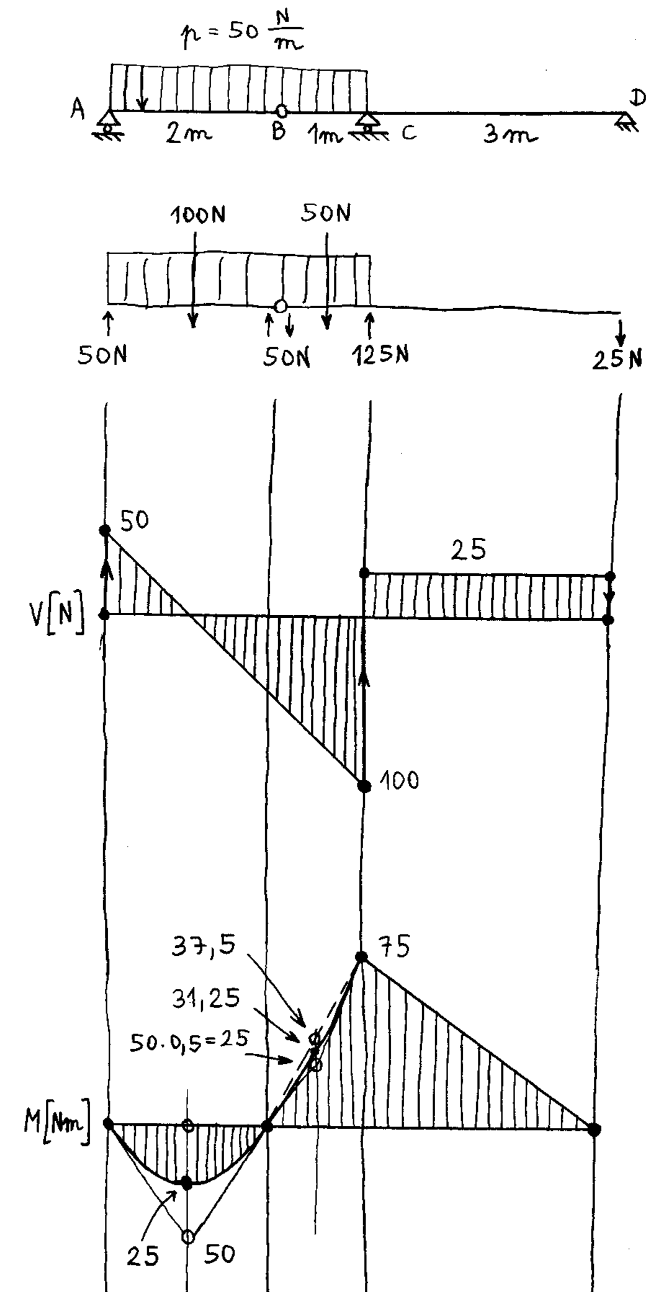
$$\sum F_y = 0 = -F_{Ay} + F_c - F_D$$

$$\boxed{F_D = F_c - F_{Ay} = 150 - 50 = 100\,N\ (\downarrow)}$$

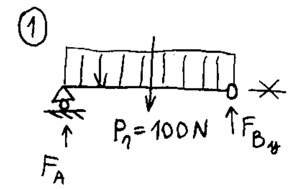
Megjegyzés:
Nem számoltuk ki a csuklóerőt.

13. példa: A 2010.04.16.-ai gyakorlat 2. feladata.

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!



①



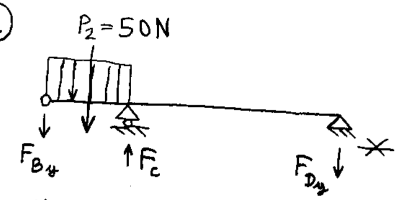
$$\sum M_B^{(1)} = 0 = +P_1 \cdot 1 - F_A \cdot 2$$

$$F_A = \frac{1}{2} P_1 = \frac{1}{2} \cdot 100 = 50\ N\ (\uparrow)$$

$$\sum F_y^{(1)} = 0 = F_A - P_1 + F_{By}$$

$$F_{By} = P_1 - F_A = 100 - 50 = 50 N$$

②



$$\sum M_C^{(2)} = 0 = F_{By} \cdot 1 + P_2 \cdot 0{,}5 - F_{Dy} \cdot 3$$

$$F_{Dy} = \frac{F_{By} + 0{,}5 P_2}{3} = \frac{50 + 0{,}5 \cdot 50}{3} = 25 N\ (\downarrow)$$

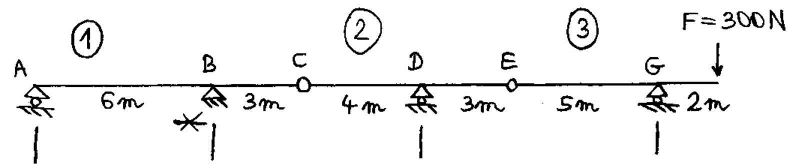
$$\sum F_y^{(2)} = 0 = -F_{By} - P_2 + F_c - F_{Dy}$$

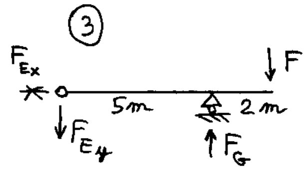
$$F_c = F_{By} + P_2 + F_{Dy} = 50 + 50 + 25 = 125\ N\ (\uparrow)$$

Megjegyzés:
A csuklóerőt is kiszámoltuk, mert így könnyebb volt megrajzolni a rövidebb megoszló szakasz nyomatéki ábráját.

14. példa: Két csuklós (3 részes) Gerber-tartó:

Számítsuk ki a reakcióerőket és a csuklóerőket! Rajzoljuk meg az igénybevételi ábrákat!



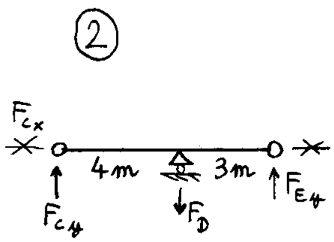


$$\sum M_E^{(3)} = 0 = F_G \cdot 5 - F \cdot 7$$

$$\boxed{F_G = \frac{7}{5} F = \frac{7}{5} \cdot 300 = 420\ \text{N}\ (\uparrow)}$$

$$\sum F_y^{(3)} = 0 = -F_{Ey} + F_G - F$$

$$\boxed{F_{Ey} = F_G - F = 420 - 300 = 120\ \text{N}}$$

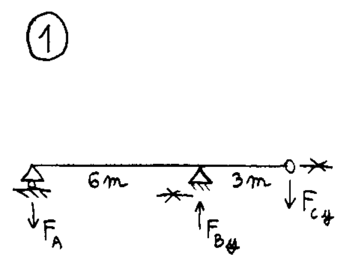


$$\sum M_C^{(2)} = 0 = -F_D \cdot 4 + F_{Ey} \cdot 7$$

$$\boxed{F_D = \frac{7}{4} F_{Ey} = \frac{7}{4} \cdot 120 = 210\ \text{N}\ (\downarrow)}$$

$$\sum F_y^{(2)} = 0 = F_{Cy} - F_D + F_{Ey}$$

$$\boxed{F_{Cy} = F_D - F_{Ey} = 210 - 120 = 90\ \text{N}}$$



$$\sum M_B^{(1)} = 0 = F_A \cdot 6 - F_{Cy} \cdot 3$$

$$\boxed{F_A = \frac{3}{6} F_{Cy} = \frac{1}{2} \cdot 90 = 45\ \text{N}\ (\downarrow)}$$

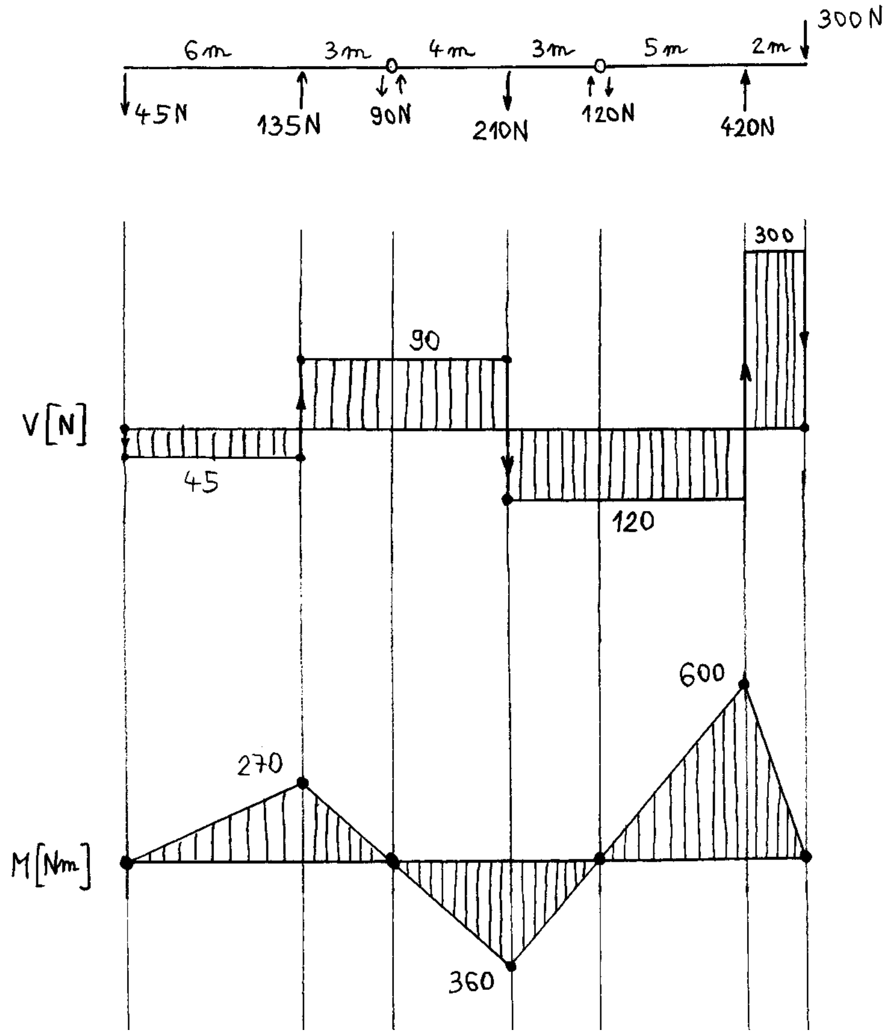
$$\sum F_y^{(1)} = 0 = -F_A + F_{By} - F_{Cy}$$

$$\boxed{F_{By} = F_A + F_{Cy} = 45 + 90 = 135\ \text{N}\ (\uparrow)}$$

Ellenőrzés:

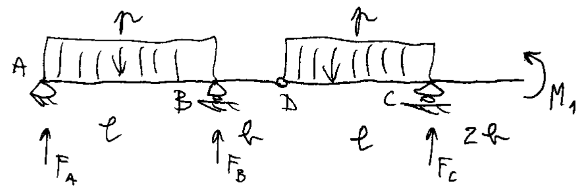
$$\sum F_y = -F_A + F_{By} - F_D + F_G - F = -45 + 135 - 210 + 420 - 300 = 0 \qquad \checkmark \text{OK}$$

Megjegyzés:
Az eredményeket a teljes tartóra felírt függőleges erőegyensúly kiszámításával ellenőriztük.


300 N
6 m
3 m
4 m
3 m
5 m
2 m
45N
135N
90N
210N
120N
420N
V[N]
300
90
45
120
M[Nm]
600
270
360

15. példa: Egy régi vizsga példa.

Számítsuk ki a reakcióerőket és a csuklóerőt! Rajzoljuk meg az igénybevételi ábrákat!

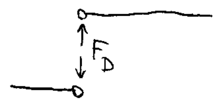


$p = 1800\ \frac{N}{m}$ $M_1 = 2\ kNm$

$l = 1{,}8\ m$ $b = 0{,}4\ m$

$Q = 3240\ N$

$$\sum M_D^{(2)} = 0 = -p l \frac{l}{2} + F_C l + M_1$$



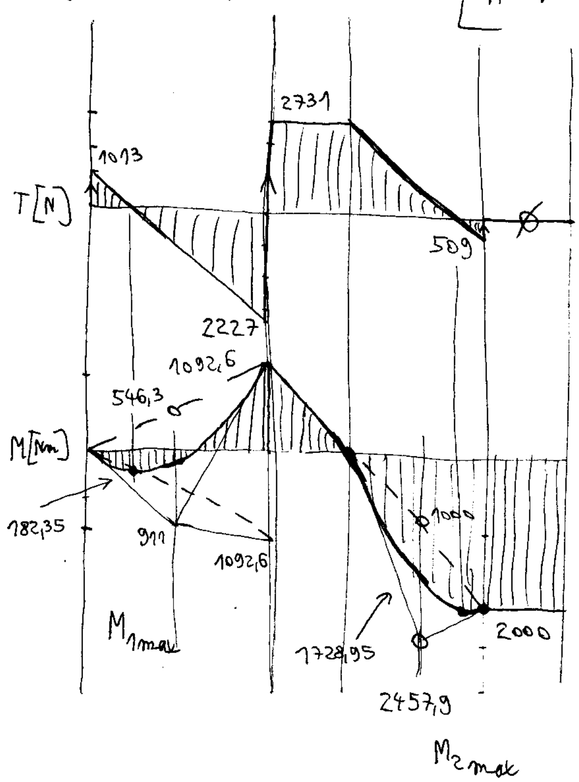
$$F_C = \frac{pl}{2} - \frac{M_1}{l} = 508{,}9\ N\ (\uparrow)$$

$$\sum F_y^{(2)} = 0 = F_D - pl + F_C \rightarrow F_D = pl - F_C = 2731\ N$$

$$\sum M_A^{(1)} = 0 = -pl \frac{l}{2} + F_B l - F_D (l + b)$$

$$F_B = \frac{pl}{2} + F_D\left(1 + \frac{b}{l}\right) = 4958\ N\ (\uparrow)$$

$$\sum F_y^{(1)} = 0 = F_A - pl + F_B - F_D \rightarrow F_A = pl - F_B + F_D = 1013\ N\ (\uparrow)$$



$T_1(x) = 1013 - 1800x = 0$

$x_0 = 0{,}5628\ m$

$M_1(x) = 1013x - 1800\frac{x^2}{2}$

$M_{1max} = 285{,}0\ Nm$

$T_2(x) = 509 - 1800x = 0$

$x_0 = 0{,}2828\ m$

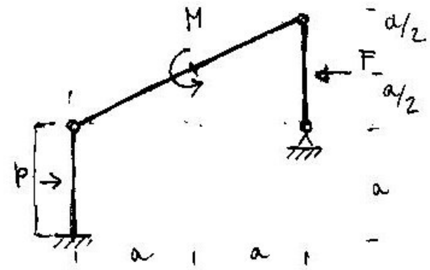
$M_2(x) = 2000 + 508{,}9x - 1800\frac{x^2}{2}$

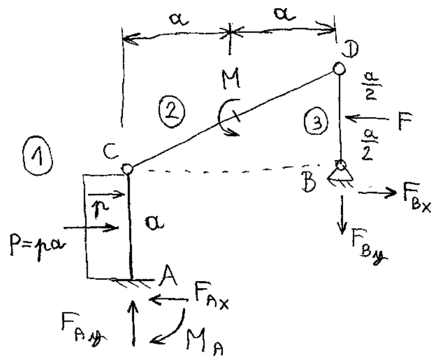
$M_{2max} = 2072\ Nm$

$M_{max} = 2072\ Nm$

16. példa: Egy nehezebb példa ferde szakasszal.

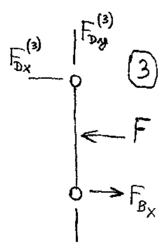
Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg a hajlító-nyomatéki ábrát!





$F = pa$

$M = Fa$

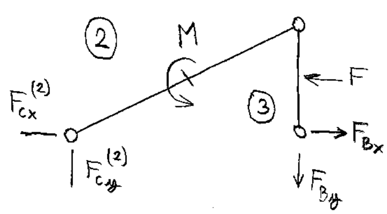


1.) $\sum M_D^{(3)} = 0 = -F\cdot\frac{a}{2} + F_{Bx}\cdot a = -(pa)\frac{a}{2} + F_{Bx}\, a$

$\boxed{F_{Bx} = \frac{1}{2}pa\ (\rightarrow)}$

2.) $\sum F_x = 0 = -F_{Ax} + P - F + F_{Bx} = -F_{Ax} + (pa) - (pa) + \left(\frac{1}{2}pa\right)$

$\boxed{F_{Ax} = \frac{1}{2}pa\ (\leftarrow)}$



3.) $\sum M_C^{(2+3)} = 0 = +M + F\cdot\frac{a}{2} + F_{Bx}\cdot 0 - F_{By}\cdot 2a =$

$= (pa^2) + (pa)\frac{a}{2} - F_{By}\cdot 2a$

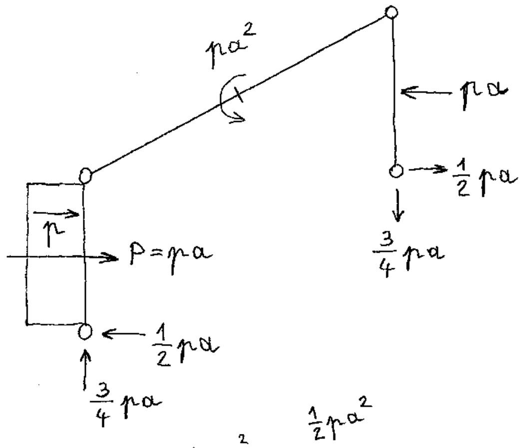
$\boxed{F_{By} = \frac{3}{4}pa\ (\downarrow)}$

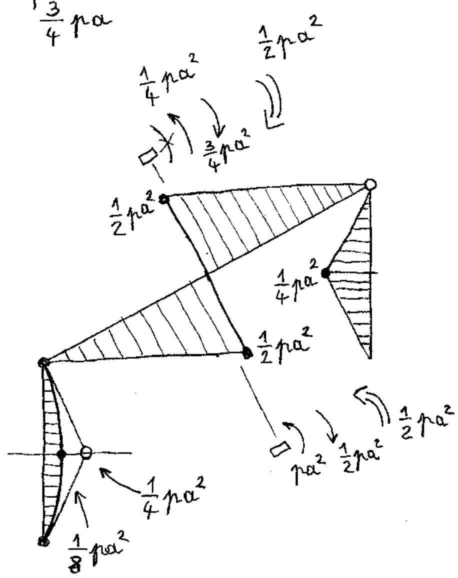
4.) $\sum F_y = 0 = F_{Ay} - F_{By} = F_{Ay} - \left(\frac{3}{4}pa\right) \longrightarrow \boxed{F_{Ay} = \frac{3}{4}pa\ (\uparrow)}$

5.) $\sum M_A = 0 = -P\cdot\frac{a}{2} + M + F\cdot\frac{3}{2}a - F_{Bx}\cdot a - F_{By}\cdot 2a - M_A =$

$= -(pa)\frac{a}{2} + (pa^2) + (pa)\cdot\frac{3}{2}a - \left(\frac{1}{2}pa\right)\cdot a - \left(\frac{3}{4}pa\right)\cdot 2a - M_A$

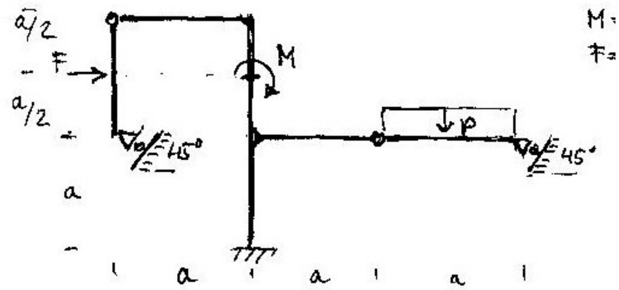
$\boxed{M_A = 0}$

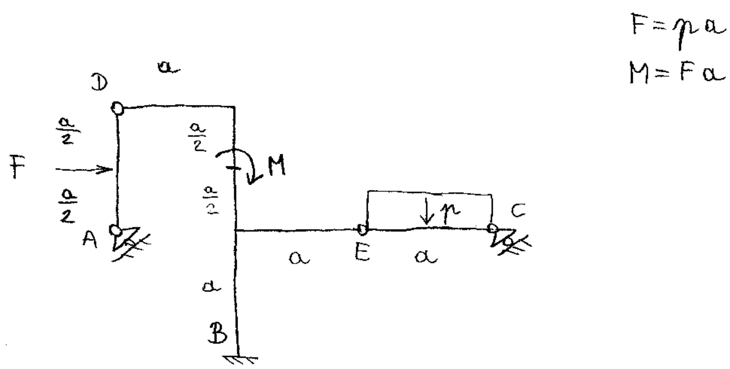

pa^2
pa
$\frac{1}{2}pa$
$\frac{3}{4}pa$
p
$P=pa$
$\frac{1}{2}pa$
$\frac{3}{4}pa$

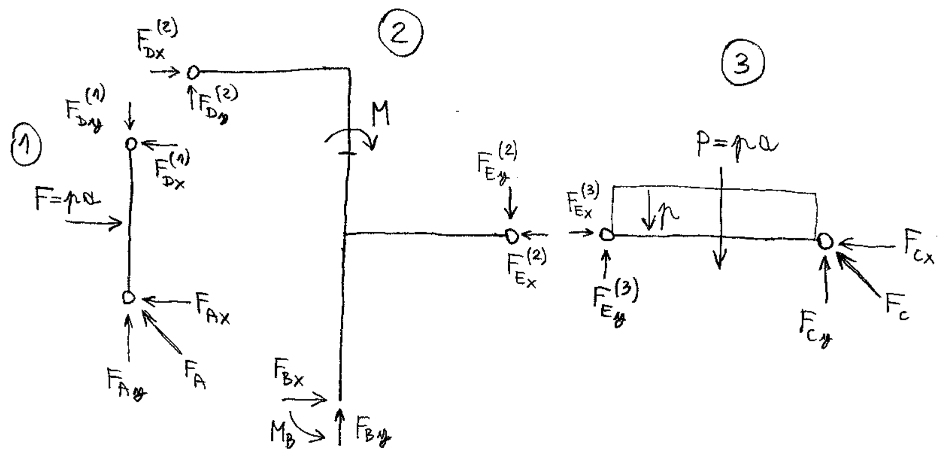

$\frac{1}{2}pa^2$
$\frac{1}{4}pa^2$
$\frac{3}{4}pa^2$
$\frac{1}{2}pa^2$
$\frac{1}{4}pa^2$
$\frac{1}{2}pa^2$
$\frac{1}{2}pa^2$
pa^2
$\frac{1}{2}pa^2$
$\frac{1}{4}pa^2$
$\frac{1}{8}pa^2$

17. példa: Egy nehezebb példa két belső csuklóval.

Számítsuk ki a reakciókat, és a jellemző értékek feltüntetésével rajzoljuk meg az igénybevételi ábrákat!







1.) $\sum M_D^{(1)} = 0 = {}^{+}F\cdot\frac{a}{2} - F_{Ax}\cdot a = (pa)\frac{a}{2} - F_{Ax}a \rightarrow \boxed{F_{Ax} = \frac{1}{2}pa\ (\leftarrow)}$

2.) $45^0 \rightarrow \boxed{F_{Ay} = F_{Ax} = \frac{1}{2}pa\ (\uparrow)}$

3.) $\sum F_x^{(1)} = 0 = F - F_{Ax} - F_{Dx}^{(1)} \rightarrow \boxed{F_{Dx}^{(1)} = F - F_{Ax} = (pa) - \left(\frac{1}{2}pa\right) = \frac{1}{2}pa\ (\leftarrow)}$

4.) $\sum F_y^{(1)} = 0 = F_{Ay} - F_{Dy}^{(1)} \rightarrow \boxed{F_{Dy}^{(1)} = F_{Ay} = \frac{1}{2}pa\ (\downarrow)}$

5.) $\sum M_E^{(3)} = 0 = {}^{-}P\cdot\frac{a}{2} + F_{Cy}\cdot a = {}^{-}(pa)\frac{a}{2} + F_{Cy}\,a \rightarrow \boxed{F_{Cy} = \frac{1}{2}pa\ (\uparrow)}$

6.) $45^0 \rightarrow F_{Cx} = F_{Cy} = \frac{1}{2}pa\ (\leftarrow)$

7.) $\sum F_x^{(3)} = 0 = F_{Ex}^{(3)} - F_{Cx} = F_{Ex}^{(3)} - \left(\frac{1}{2}pa\right) \rightarrow \boxed{F_{Ex}^{(3)} = \frac{1}{2}pa\ (\rightarrow)}$

8.) $\sum F_y^{(3)} = 0 = F_{Ey}^{(3)} - P + F_{Cy} = F_{Ey}^{(3)} - (pa) + \left(\frac{1}{2}pa\right) \rightarrow \boxed{F_{Ey}^{(3)} = \frac{1}{2}pa\ (\uparrow)}$

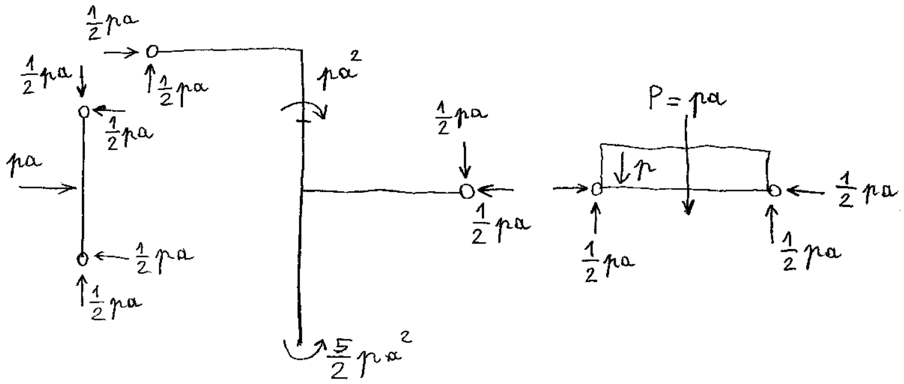
9.) $\sum F_x^{(2)} = 0 = F_{Dx}^{(2)} + F_{Bx} - F_{Ex}^{(2)} = \left(\frac{1}{2}pa\right) + F_{Bx} - \left(\frac{1}{2}pa\right) \rightarrow \boxed{F_{Bx} = 0}$

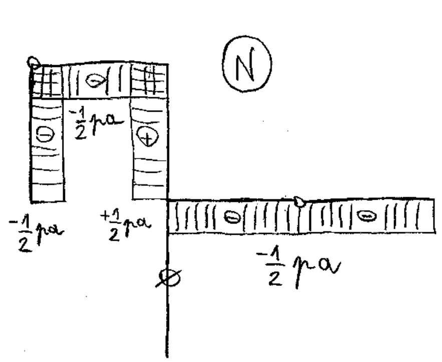
10.) $\sum F_y^{(2)} = 0 = F_{Dy}^{(2)} + F_{By} - F_{Ey}^{(2)} = \left(\frac{1}{2}pa\right) + F_{By} - \left(\frac{1}{2}pa\right) \rightarrow \boxed{F_{By} = 0}$

11.) $\sum M_B^{(2)} = 0 = {}^{-}F_{Dx}^{(2)}\cdot 2a - F_{Dy}^{(2)}\cdot a - M + F_{Ex}^{(2)}\cdot a - F_{Ey}^{(2)}\cdot a + M_B$

$= {}^{-}\left(\frac{1}{2}pa\right)\cdot 2a - \left(\frac{1}{2}pa\right)\cdot a - \left(pa^2\right) + \left(\frac{1}{2}pa\right)\cdot a - \left(\frac{1}{2}pa\right)\cdot a + M_B$

$\boxed{M_B = \frac{5}{2}pa^2\ \circlearrowleft}$


P = pa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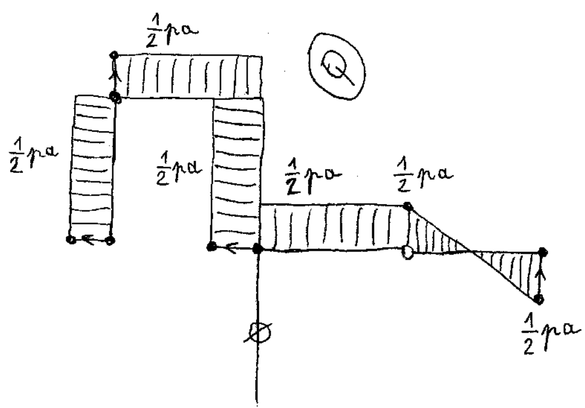
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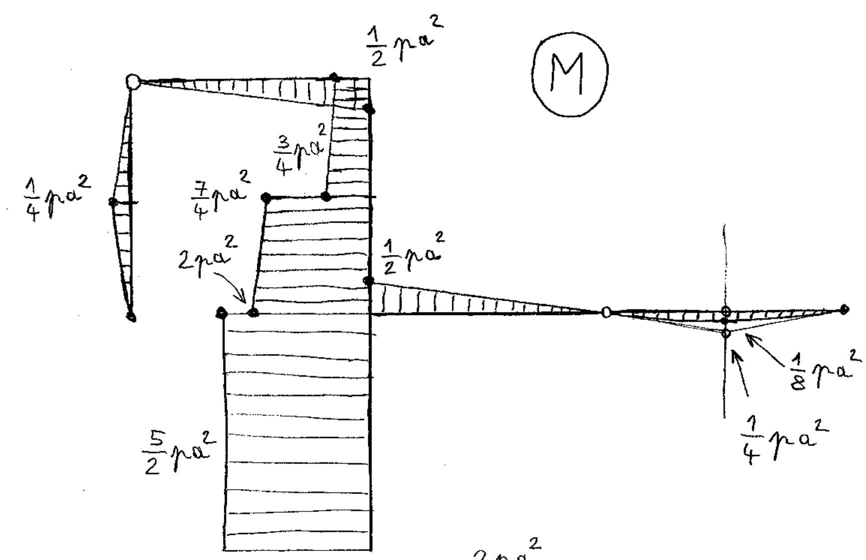
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