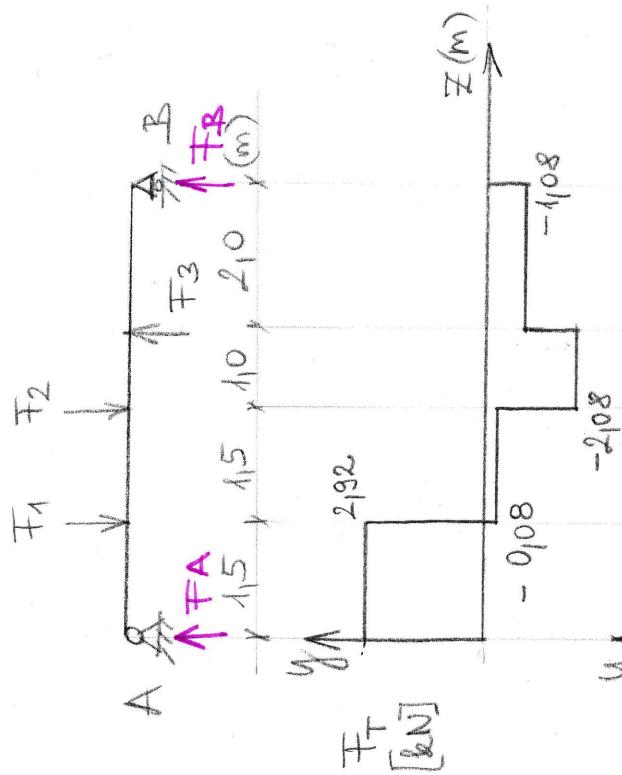


KÉTTEMASSZI TÁRTOK 1. példa megoldása

$$\begin{aligned} F_1 &= 3 \text{ kN} \\ F_2 &= 2 \text{ kN} \\ F_3 &= 1 \text{ kN} \\ \overline{F_A + F_B} &=? \\ V_{\Sigma z} &=? \text{ kg alb.} \end{aligned}$$

MEGOLDÁS



Támasztók és zámlatáisa
 $\overline{F_B} \uparrow$ feltételezve

$$\begin{aligned} \sum M(A) = \phi &= -F_1 \cdot 1,5 \text{ m} - F_2 \cdot 3 \text{ m} + F_3 \cdot 4 \text{ m} + F_B \cdot 6 \text{ m} \\ \phi &= -3 \text{ kN} \cdot 1,5 \text{ m} - 2 \text{ kN} \cdot 3 \text{ m} + 1 \text{ kN} \cdot 4 \text{ m} + F_B \cdot 6 \text{ m} \end{aligned}$$

$$F_B = 1,08 \text{ kN} \uparrow$$

$\overline{F_A} \uparrow$ feltételezve

$$\begin{aligned} \sum M(B) = \phi &= -F_A \cdot 6 \text{ m} + F_1 \cdot 4,5 \text{ m} + F_2 \cdot 3 \text{ m} - F_3 \cdot 2 \text{ m} \\ \phi &= -F_A \cdot 6 \text{ m} + 3 \text{ kN} \cdot 4,5 \text{ m} + 2 \text{ kN} \cdot 3 \text{ m} - 1 \text{ kN} \cdot 2 \text{ m} \end{aligned}$$

$$F_A = 2,92 \text{ kN} \uparrow$$

$$\begin{aligned} \text{Oc: } \sum F_y = \phi &= F_A - F_1 - F_2 + F_3 + F_B \\ \phi &= 2,92 \text{ kN} - 3 \text{ kN} - 2 \text{ kN} + 1 \text{ kN} + 1,08 \text{ kN} \\ \phi &= \emptyset \quad \checkmark \end{aligned}$$

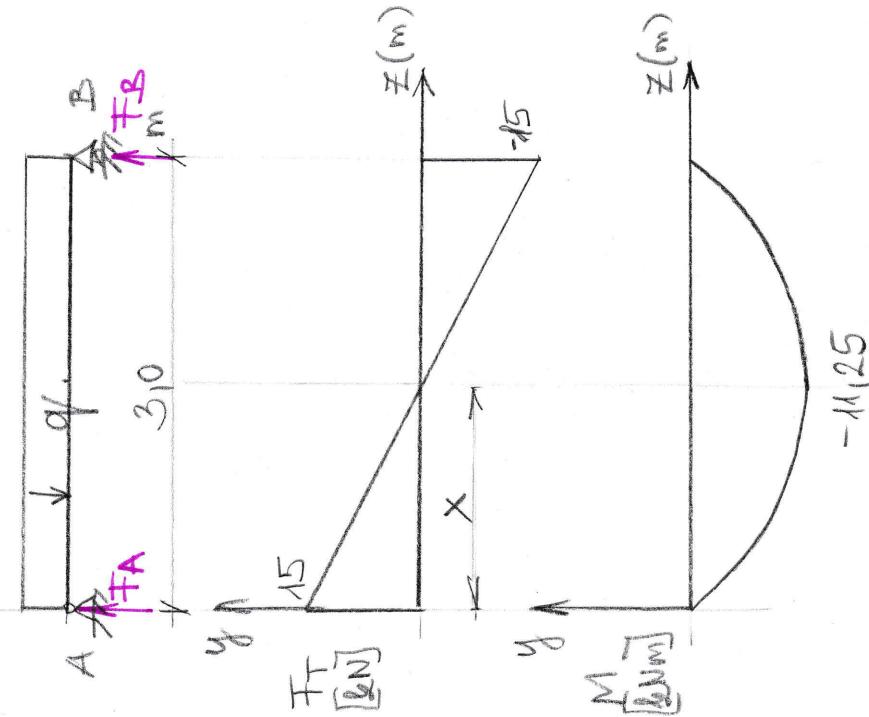
Nyomatékok, momențe:

$$\begin{aligned} M(z = 1,5 \text{ m}) &= -F_A \cdot 1,5 \text{ m} = -2,92 \text{ kN} \cdot 1,5 \text{ m} = -4,38 \text{ kNm} \\ M(z = 3 \text{ m}) &= -F_A \cdot 3 \text{ m} + F_1 \cdot 1,5 \text{ m} = -2,92 \text{ kN} \cdot 1,5 \text{ m} + 3 \text{ kN} \cdot 1,5 \text{ m} = \\ &= -4,26 \text{ kNm} \end{aligned}$$

$$\begin{aligned} M_{\max}: \quad z &= 1,5 \text{ m} \\ M_{\max} &= 4,38 \text{ kNm} \end{aligned}$$

KÉT TÁMASZÚ TARTÓK 2. példá megoldása

$$q = 10 \text{ kN/m}$$



$$F_A; F_B = ?$$

Vesz. lemn?

rögzítésekkel ábrázol

MEGOLDÁS

o Talajreakciók meghatározza

$F_B \uparrow$ félteleszerűk

$$\Sigma M(A) = \phi = -q \cdot 3m \cdot 1,5m + F_B \cdot 3m = -10 \text{ kN/m} \cdot 3m \cdot 1,5m + F_B \cdot 3m$$

$$F_B = 15 \text{ kN} \uparrow$$

$F_A \uparrow$ félteleszerűk

$$\Sigma M(B) = \phi = q \cdot 3m \cdot 1,5m - F_A \cdot 3m = 10 \text{ kN/m} \cdot 3m \cdot 1,5m - F_A \cdot 3m$$

$$F_A = 15 \text{ kN} \uparrow$$

$$\text{Ell: } \Sigma F_y = \phi = F_A - q \cdot 3m + F_B = 15 \text{ kN} - 10 \text{ kN/m} \cdot 3m + 15 \text{ kN}$$

$$\phi = \phi \checkmark$$

o X talajreakciók meghatározza

$$F_A - q \cdot X = \phi \Rightarrow X = \frac{F_A}{q} = \frac{15}{10} = 1,5 \text{ m}$$

o Díszítmények meghatározza

$$\begin{aligned} M(z=1,5 \text{ m}) &= -F_A \cdot 1,5m + q \cdot 1,5m \cdot 0,75m = \\ &= -15 \text{ kN} \cdot 1,5m + 10 \text{ kN/m} \cdot 1,5m \cdot 0,75m = \\ &= -M_{\max} = -11,25 \text{ kNm} \end{aligned}$$

Nr. k:

$$z = 1,5 \text{ m}$$

$$M_{\max} = -M_{\max}$$

KÉT TÁMASZÚ TARTÓK 3. példa megoldás

$$\begin{aligned} q &= 10 \text{ kN/m} \\ F &= 40 \text{ kN} \end{aligned}$$

$$\begin{aligned} F_A + F_B &=? \\ V_{\text{erk}} \cdot 2m &=? \\ \text{igénybevettel ábrák} \end{aligned}$$

MEGOLDÁS:

- Támasztók számlálása
- $F_B \uparrow$ feltelelésre vár

$$\sum M(A) = \phi = -q \cdot 2m \cdot 1m - F \cdot 4m + F_B \cdot 5m = -10 \frac{\text{kN}}{\text{m}} \cdot 2m \cdot 1m - 40 \text{kN} \cdot 4m + F_B \cdot 5m$$

$$F_B = \underline{\underline{36 \text{ kN}}} \uparrow$$

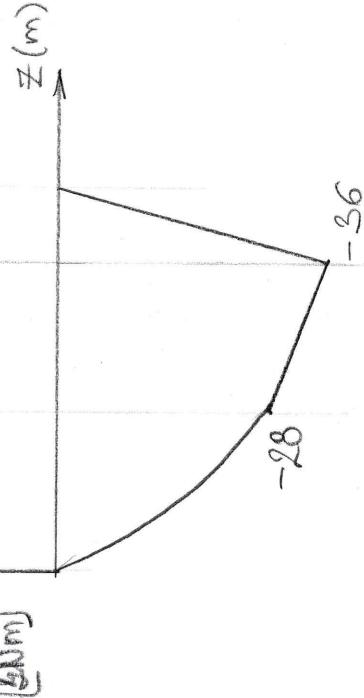
$F_A \uparrow$ feltelelésre vár

$$\sum M(B) = \phi = -F_A \cdot 5m + q \cdot 2m \cdot 4m = -F_A \cdot 5m + 10 \frac{\text{kN}}{\text{m}} \cdot 2m \cdot 4m + 40 \text{kN} \cdot 1m$$

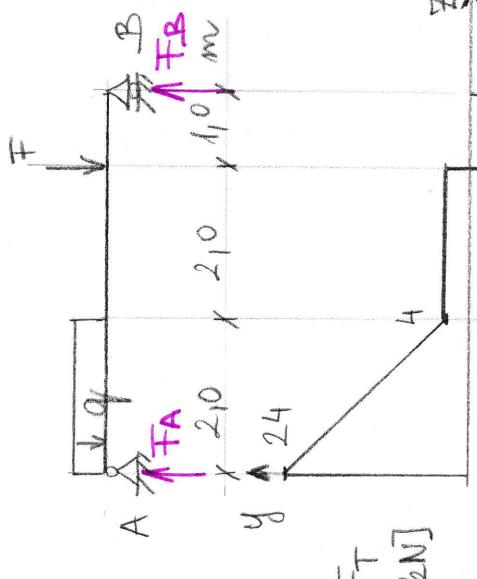
$$F_A = \underline{\underline{24 \text{ kN}}} \uparrow$$

$$\text{Ell: } \sum F_y = \phi = F_A - q \cdot 2m - F + F_B = 24 \text{ kN} - 10 \frac{\text{kN}}{\text{m}} \cdot 2m - 40 \text{kN} + 36 \text{ kN}$$

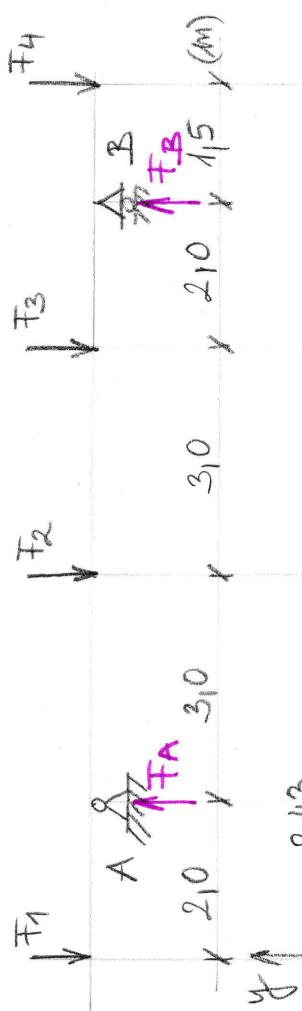
- Néhány számítás:



$$\text{M}_0: \underline{\underline{z = 4 \text{ m}}} \\ M_{\text{max}} = -36 \text{ kNm}$$



KÉTÍMÁSZÚ TARTÓK 4. példa megoldása



$$F_1 = 1 \text{ kN}$$

$$F_2 = 3 \text{ kN}$$

$$F_3 = 2 \text{ kN}$$

$$F_4 = 1 \text{ kN}$$

igénybevételi általá

verés 2m?

igénybevételi általá

MEGOLDÁS:

• Támaszték számítása:
 $F_B \uparrow$ feltételezve

$$\sum M(A) = \phi = F_1 \cdot 2m - F_2 \cdot 3m - F_3 \cdot 6m + F_B \cdot 8m - F_4 \cdot 9,5m$$

$$\phi = 1 \text{ kN} \cdot 2m - 3 \text{ kN} \cdot 3m - 2 \text{ kN} \cdot 6m + F_B \cdot 8m - 1 \text{ kN} \cdot 9,5m$$

$$F_B = 3,56 \text{ kN} \uparrow$$

$F_A \uparrow$ feltételezve

$$\sum M(B) = \phi = F_1 \cdot 10m - F_A \cdot 8m + F_2 \cdot 5m + F_3 \cdot 2m - F_4 \cdot 1,5m$$

$$\phi = 1 \text{ kN} \cdot 10m - F_A \cdot 8m + 3 \text{ kN} \cdot 5m + 2 \text{ kN} \cdot 2m - 1 \text{ kN} \cdot 1,5m$$

$$F_A = 3,43 \text{ kN} \uparrow$$

$$\text{Ell: } \sum F_y = \phi = -F_1 + F_A - F_2 - F_3 + F_B - F_4$$

$$\phi = -1 \text{ kN} + 3,43 \text{ kN} - 3 \text{ kN} - 2 \text{ kN} + 3,56 \text{ kN} - 1 \text{ kN}$$

\checkmark

• Nyomatékok számítása:

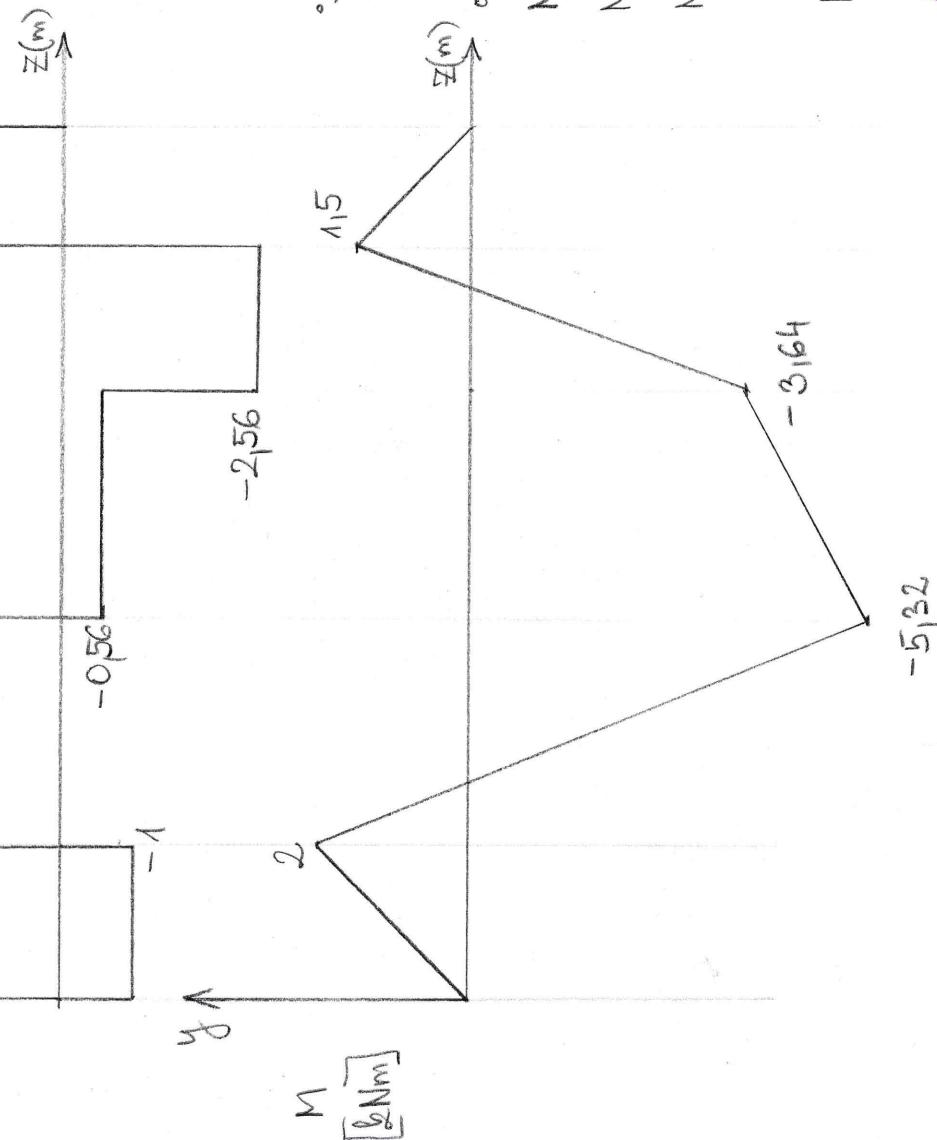
$$M(z=2m) = F_1 \cdot 2m = 1 \text{ kN} \cdot 2m = 2 \text{ kNm}$$

$$M(z=5m) = F_1 \cdot 5m - F_A \cdot 3m = 1 \text{ kN} \cdot 5m - 3,43 \text{ kN} \cdot 3m = -5,32 \text{ kNm}$$

$$M(z=8m) = F_1 \cdot 8m - F_A \cdot 6m + F_2 \cdot 3m = 1 \text{ kN} \cdot 8m - 3,43 \text{ kN} \cdot 6m + 3 \text{ kN} \cdot 3m = -3,64 \text{ kNm}$$

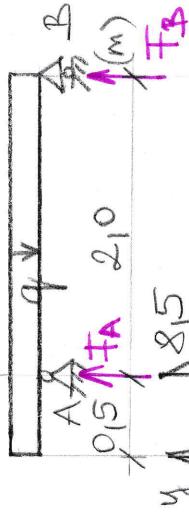
$$M(z=10m) \text{ jobboldal} = F_4 \cdot 1,5m = 1 \text{ kN} \cdot 1,5m = 1,5 \text{ kNm}$$

$$15. \text{ Sz: } \underline{\underline{z = 5m}} \quad \text{ i } M_{\max} = \underline{\underline{-5,32 \text{ kNm}}}$$



KÉTTRÁMASZÚ TÁRTÓK 5. Példa megoldás

$$q = 8 \text{ kN/m}$$



MEGOLDÁS:

- Támvázeggy számlálása
 $F_B \uparrow$ feltekerük

$$\sum M(A) = \phi = -q \cdot 2,15m \cdot 0,75m + F_B \cdot 2m = -8 \frac{\text{kN}}{\text{m}} \cdot 2,15m \cdot 0,75m + F_B \cdot 2m$$

$$F_B = 4,5 \text{ kN} \uparrow$$

- $F_A \uparrow$ feltekerük

$$\sum M(B) = \phi = q \cdot 2,15m \cdot 1,25m - F_A \cdot 2m = 8 \frac{\text{kN}}{\text{m}} \cdot 2,15m \cdot 1,25m - F_A \cdot 2m$$

$$F_A = 12,15 \text{ kN} \uparrow$$

$$\text{Ell: } \sum F_y = \phi = F_A - q \cdot 2,5m + F_B = 12,15 \text{ kN} - 8 \frac{\text{kN}}{\text{m}} \cdot 2,5m + 4,5 \text{ kN}$$

- X távolság számlálása:
 $8,5 \text{ m} - q \cdot x = \phi \Rightarrow x = \frac{8,5 \text{ m}}{8 \frac{\text{kN}}{\text{m}}} = 1,06 \text{ m}$

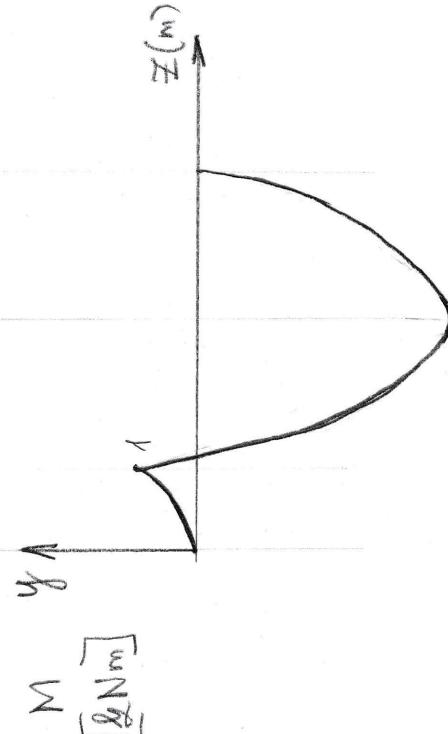
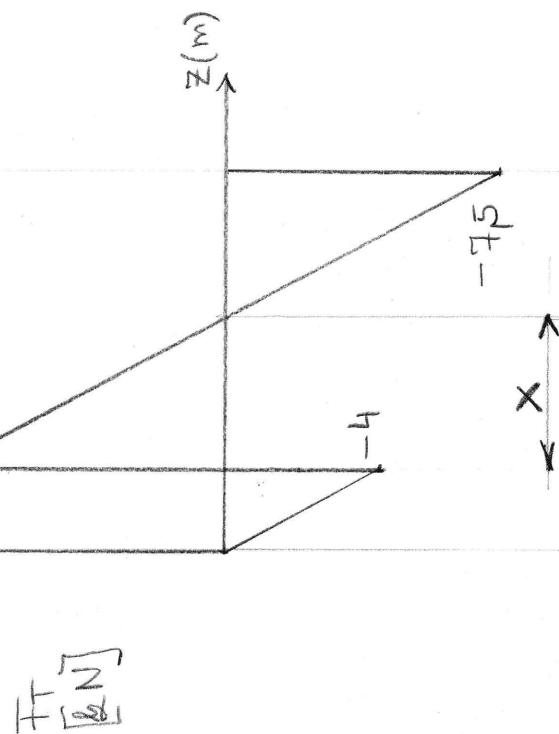
- X távolság számlálása:
 $8,5 \text{ m} - q \cdot x = \phi \Rightarrow x = \frac{8,5 \text{ m}}{8 \frac{\text{kN}}{\text{m}}} = 1,06 \text{ m}$

- Nyomatékos számlálás:

$$M(z=0,5 \text{ m}) = q \cdot 0,5m \cdot 0,25m = 1 \text{ kNm}$$

$$M(z=1,56 \text{ m}) = q \cdot 1,56m \cdot \frac{1,56}{2} \text{ m} - F_A \cdot 1,06 \text{ m} = -3,52 \text{ kNm}$$

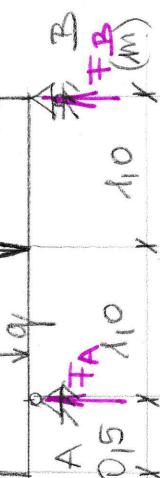
$$-3,52$$



Utolsó: $\underline{z = 1,56 \text{ m}}$ $\underline{M_{\max} = -3,52 \text{ kNm}}$

KÜTTAMASZÚ TÁRÓK 6. példa megoldás

$$\frac{q = 8 \text{ kN/m}}{F = 9 \text{ kN}}$$



$\sigma_{\text{cr}} \cdot l \text{ m?}$
igénybevételi által?

• Támasztószabvánnyal:

$F_B \uparrow$

Feltételezve:

$$\sum M(A) = \phi = -q \cdot 2,5 \text{ m} \cdot 0,75 \text{ m} - F \cdot 1 \text{ m} + F_B \cdot 2 \text{ m}$$

$$F_B = \underline{\underline{12 \text{ kN} \uparrow}}$$

$F_A \uparrow$ feltételezve:

$$\begin{aligned} \sum M(B) = \phi &= F \cdot 1 \text{ m} + q \cdot 2,5 \text{ m} \cdot 1,25 \text{ m} - F_A \cdot 2 \text{ m} \\ &= q \cdot 2 \text{ N} \cdot 1 \text{ m} + 8 \frac{\text{kN}}{\text{m}} \cdot 2,5 \text{ m} \cdot 1,25 \text{ m} - F_A \cdot 2 \text{ m} \end{aligned}$$

$$F_A = \underline{\underline{17 \text{ kN} \uparrow}}$$

$$\bullet \text{SOL: } \sum F_y = \phi = F_A - q \cdot 2,5 \text{ m} - F + F_B = 17 \text{ kN} - 8 \frac{\text{kN}}{\text{m}} \cdot 2,5 \text{ m} - q \cdot 2,5 \text{ m} + 12 \text{ kN}$$

$$\phi = \underline{\underline{\phi}}$$

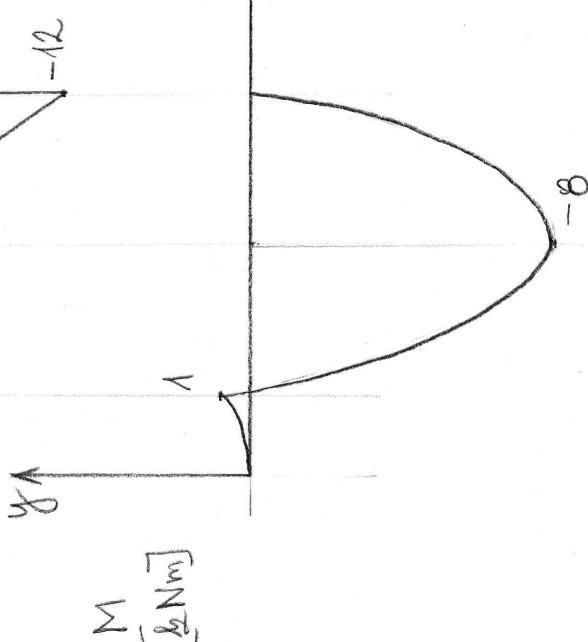
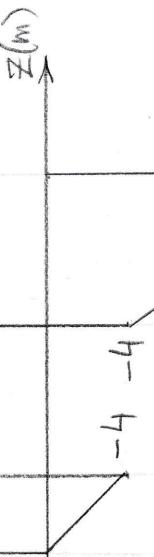
• Nyíróerőkkel szabvánnyal:

$$\begin{aligned} \sum F(z=0,5 \text{ m}) &= -q \cdot 0,5 \text{ m} = -8 \frac{\text{kN}}{\text{m}} \cdot 0,5 \text{ m} = -4 \text{ kN} \\ \sum F(z=1,5 \text{ m}) &= -q \cdot 1,5 \text{ m} + F_A = -8 \frac{\text{kN}}{\text{m}} \cdot 1,5 \text{ m} + 17 \text{ kN} = 5 \text{ kN} \end{aligned}$$

• Nyomatékkel szabvánnyal:

$$\begin{aligned} M(z=0,5 \text{ m}) &= q \cdot 0,5 \text{ m} \cdot 0,125 \text{ m} = 8 \frac{\text{kN}}{\text{m}} \cdot 0,5 \text{ m} \cdot 0,125 \text{ m} = 1 \text{ kNm} \\ M(z=1,5 \text{ m}) &= q \cdot 1,5 \text{ m} \cdot 0,175 \text{ m} - F_A \cdot 1 \text{ m} = 8 \frac{\text{kN}}{\text{m}} \cdot 1,5 \text{ m} \cdot 0,175 \text{ m} - 17 \text{ kN} \cdot 1 \text{ m} = -8 \text{ kNm} \end{aligned}$$

$$\sum F \quad [\text{kN}]$$



$$M \quad [\text{kNm}]$$