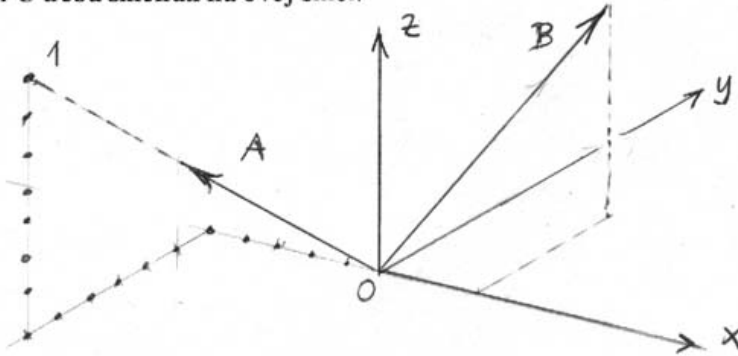
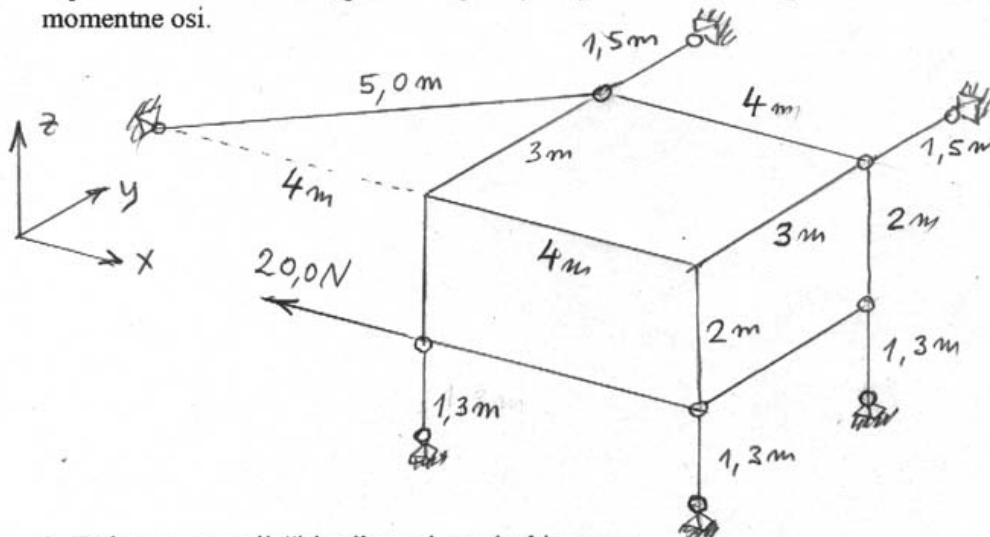


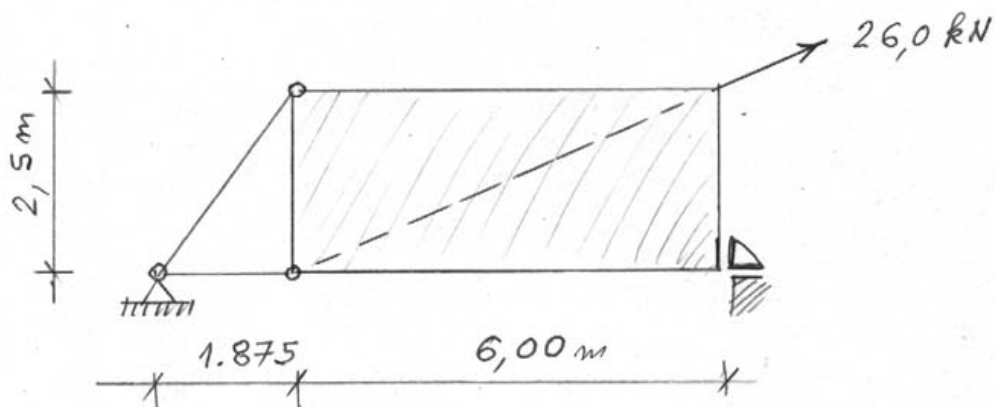
1. Zadani su vektori veličine A i B. Zadano je $A = 30.$, a vektor leži na spojnici (0,1), koja je zadana koordinatama točke 1: (-5.; -6.; +7.). Vektor A usmjeren je od ishodišta prema točki 1. Vektor B zadan je veličinom $B = 40.$, te kutovima $\alpha = 70^\circ$, $\beta = 56^\circ$, $\gamma < 90^\circ$. Treba odrediti vektor C koji je zbroj vektora A i B. Treba odrediti podatke: C_x , C_y , C_z , C (veličina), φ , ψ . Vektor C treba skicirati na ovoj skici.



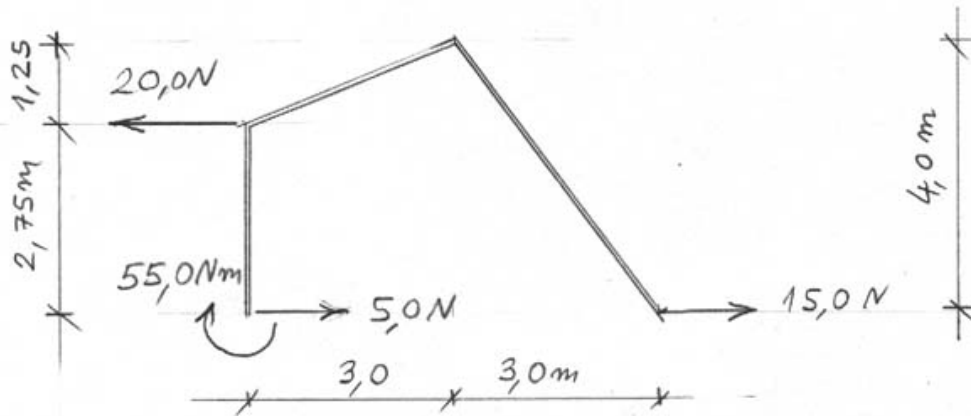
2. Treba na propisani način odrediti sile u zglobnim štapovima prikazanog prostornog sustava koji se nalazi u ravnoteži, prikazati rješenje te provesti kontrolu pomoću tri odgovarajuće momentne osi.



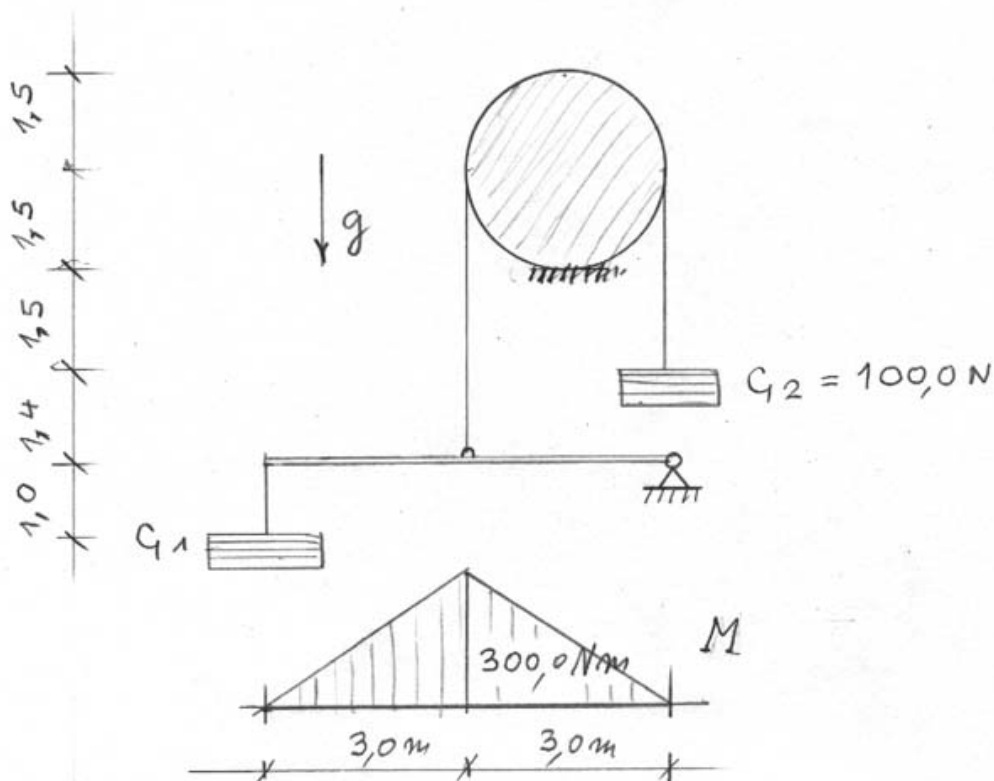
3. Treba potpuno riješiti prikazani ravninski sustav.



4. Za prikazani štapni element treba odrediti podatke za dijagrame M,T,N. Za svaku granu detaljno prikazati postupak za jedan presjek. Priznat će se samo podaci uneseni na pripadni dijagram (dovoljna je uredna skica slobodnom rukom). Za kose grane treba kontrolirati diferencijalnu vezu M i T, te veličinu rezultante T i N.



5. Prikazani sustav nalazi se u stanju ravnoteže. Treba odrediti minimalni koeficijent trenja između valjka i idealne niti koja je bez težine. Nit jednim krajem djeluje na štapni element bez težine. Za taj element poznat je dijagram momenata savijanja. U sustavu se nalaze i dva utega na koje djeluje konstantna gravitacija.



1) POMOĆNI VEKTOR $p_x = -5$, $p_y = -6$; $p_z = +7$

$$p = \sqrt{25 + 36 + 49} = 10,4881$$

$$A_x = \frac{p_x}{p} A = -14,3019$$

$$A_y = \frac{p_y}{p} A = -17,1623$$

$$A_z = \frac{p_z}{p} A = +20,0227$$

$$\text{KONTROLA: } \sqrt{A_x^2 + A_y^2 + A_z^2} = 29,9999$$

$$B_x = 40 \cdot \cos 70^\circ = 13,6808$$

$$B_y = 40 \cdot \cos 56^\circ = 22,3677$$

$$B_z = +\sqrt{40^2 - B_x^2 - B_y^2} = 30,2079$$

$$\gamma = \arccos\left(\frac{B_z}{B}\right) = 40,9572$$

$$\text{KONTROLA: } \cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1,00000 \checkmark$$

$$C_x = A_x + B_x = -0,6211 \quad \boxed{3}$$

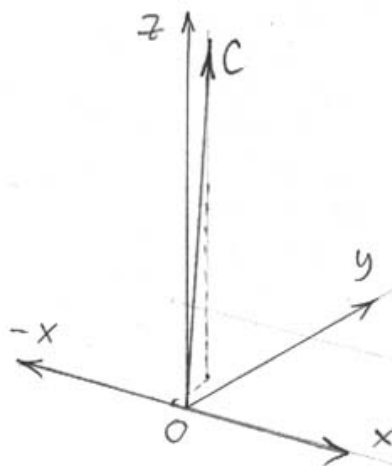
$$C_y = A_y + B_y = +5,2054 \quad \boxed{3}$$

$$C_z = A_z + B_z = 50,2306 \quad \boxed{3}$$

$$C = \sqrt{C_x^2 + C_y^2 + C_z^2} = 50,4996 \quad \boxed{2}$$

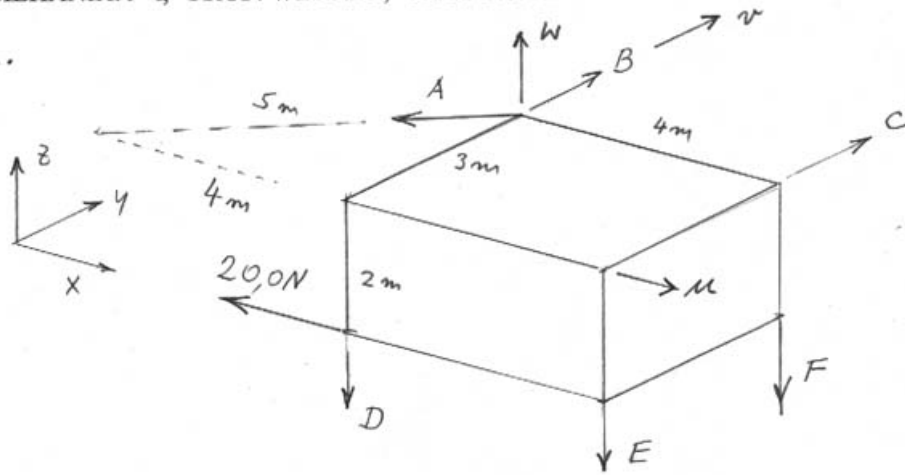
$$\psi = \arcsin\left(\frac{C_z}{C}\right) = 84,0835^\circ \quad \boxed{3}$$

$$\varphi = \arccos\left(\frac{C_x}{C \cdot \cos \psi}\right) = 96,8527 \quad \boxed{3}$$



AKSONOMETRIJSKA
SKICA 3

2.



2

$$\sum F_{xi} = \phi; \quad A = -\frac{1}{0,8} 20 = -25,0 \text{ N} \quad \boxed{1}$$

$$\sum M_w = \phi; \quad C = \frac{1}{4} (3 \cdot 20) = +15,0 \text{ N} \quad \boxed{2}$$

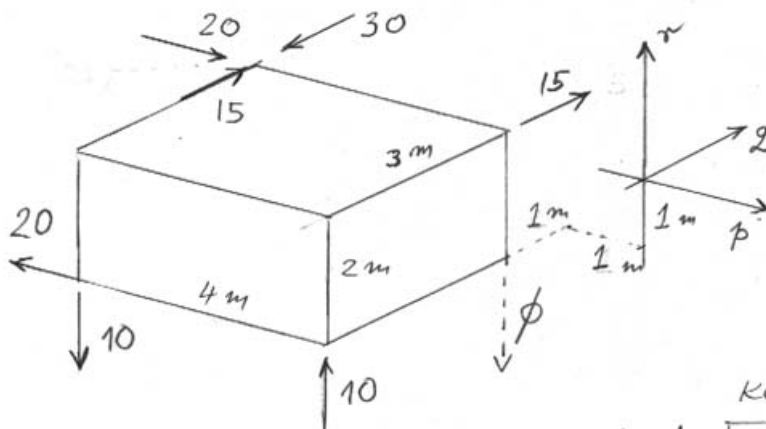
$$\sum F_{yi} = \phi; \quad B = 0,8 \cdot A - C = -30,0 \text{ N} \quad \boxed{2}$$

$$\sum M_u = \phi; \quad F = \phi \quad \boxed{1}$$

$$\sum M_v = \phi; \quad E = -\frac{1}{4} (2 \cdot 20) = -10,0 \text{ N} \quad \boxed{2}$$

$$\sum F_{zi} = \phi; \quad D = -E - F = +10,0 \text{ N} \quad \boxed{2}$$

SKICA STVARNIH DJELOVANJA



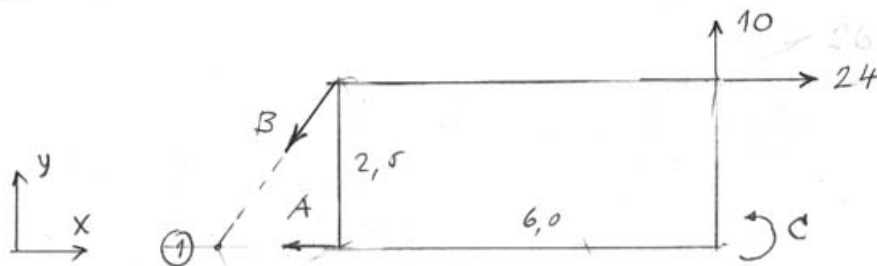
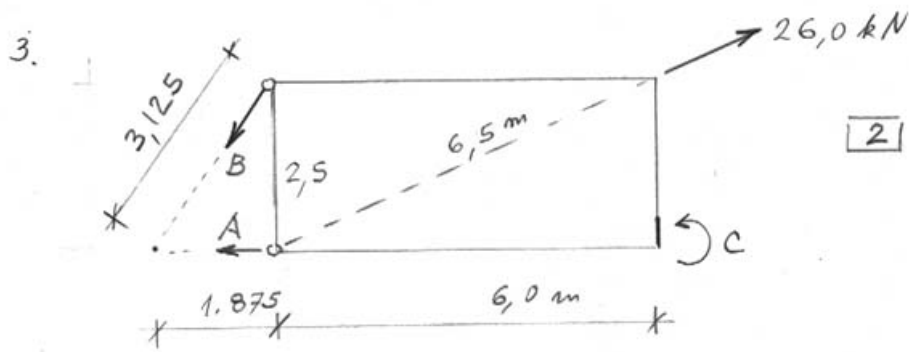
2

KONTROLA:

$$\sum M_p = +1 \cdot (30 - 15 - 15) = \phi. \checkmark \quad \boxed{2}$$

$$\sum M_q = +1 \cdot 20 + 1 \cdot 20 - 5 \cdot 10 + 1 \cdot 10 = \phi. \checkmark \quad \boxed{2}$$

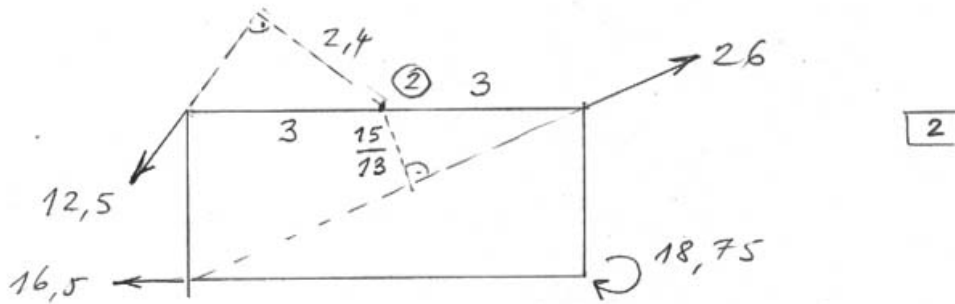
$$\sum M_r = +1 \cdot 20 + 5 \cdot (30 - 15) - 1 \cdot 15 - 4 \cdot 20 = \phi. \checkmark \quad \boxed{2}$$



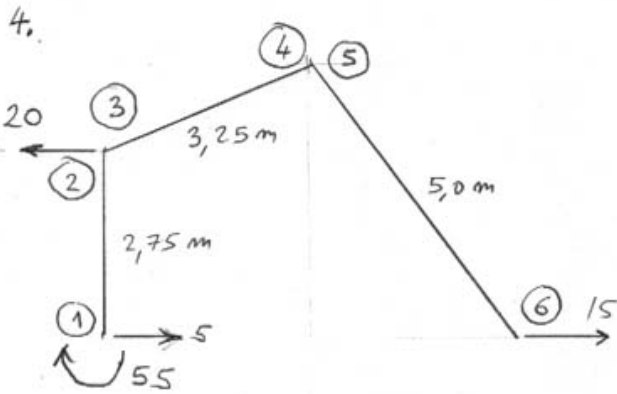
$$\sum F_{yi} = 0; \quad B = \frac{1}{0,8} \cdot 10 = +12,5 \text{ kN} \quad [4]$$

$$\sum F_{xi} = 0; \quad A = -0,6 \cdot B + 24 = 16,5 \text{ kN} \quad [4]$$

$$\sum M_{(1)} = 0; \quad C = 2,5 \cdot 24 - 7,875 \cdot 10 = -18,75 \text{ kNm} \quad [4]$$



$$\text{KONTROLA: } \sum M_{(2)} = 2,4 \cdot 12,5 + \frac{15}{13} \cdot 26 - 2,5 \cdot 16,5 - 18,75 = 0,00 \checkmark \quad [4]$$

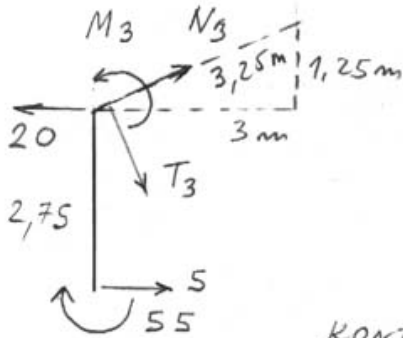


DIREKTNO VIDLJIVO:
 $|M_1| = 55$ (VLAK DESNO).

$$N_1 = \phi.$$

$$M_6 = \phi$$

$$N_6 > \phi.$$

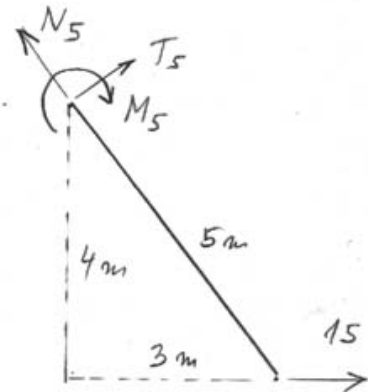


$$M_3 = 55 - 2,75 \cdot 5 = 41,25 \text{ Nm} \quad (\text{VLAK DOLJE})$$

$$T_3 = (20 - 5) \frac{1,25}{3,25} = +5,7692 \text{ N}$$

$$N_3 = (20 - 5) \frac{3,0}{3,25} = +13,8462 \text{ N}$$

$$\text{KONTROLA } \sqrt{T_3^2 + N_3^2} = 15,0000 \quad \boxed{1}$$

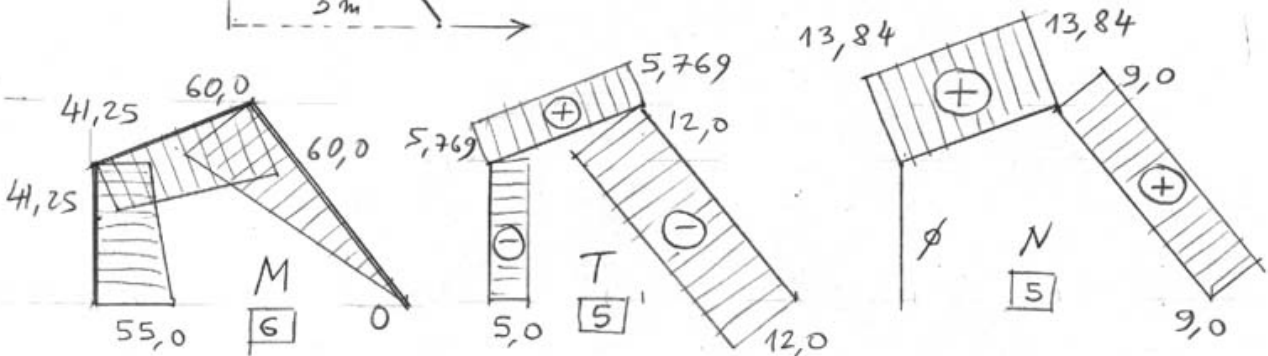


$$M_5 = 4 \cdot 15 = 60,0 \text{ Nm} \quad (\text{VLAK LIJEVO})$$

$$T_5 = -\frac{4}{5} \cdot 15 = -12,0 \text{ N}$$

$$N_5 = +\frac{3}{5} \cdot 15 = +9,0 \text{ N}$$

$$\text{KONTROLA } \sqrt{T_5^2 + N_5^2} = 15 \sqrt{\quad} \boxed{1}$$

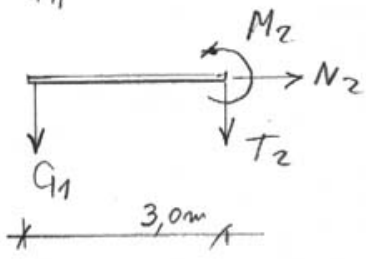
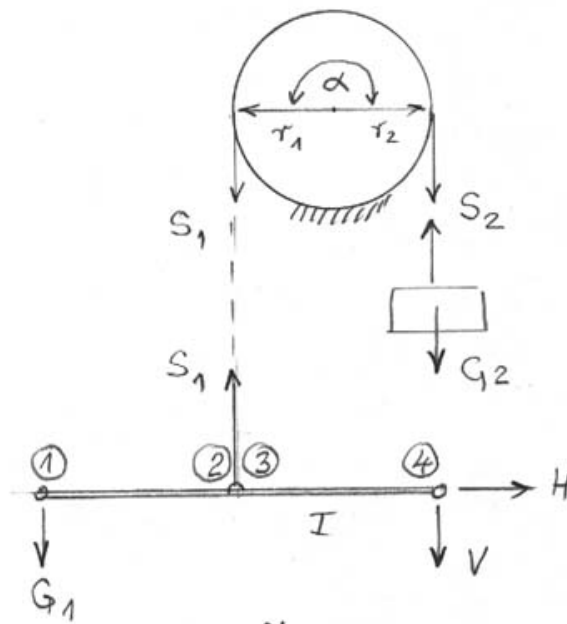


KONTROLA DIFERENCIJALNIH ODNOSA

$$\text{ŠTAP (3,4)} \quad \frac{dM}{ds} = \frac{60 - 41,25}{3,25} = +5,769 \quad \checkmark \quad \boxed{1}$$

$$\text{ŠTAP (5,6)} \quad \frac{dM}{ds} = \frac{0 - 60}{5} = -12,0 \quad \checkmark \quad \boxed{1}$$

5.



$$M_2 = -300. Nm$$

$$M_2 = -3 \cdot G_1$$

$$-300. = -3 \cdot G_1$$

$$G_1 = 100. N \quad [4]$$

$$T_1 = -100. N \quad [1]$$

$$N_1 = \phi \quad [1]$$

$$\sum_I M(4) = 0; \quad S_1 = \frac{1}{3}(6 \cdot G_1) = 200. N \quad [4]$$

$$\sum_I F_{yi} = \phi \quad V = S - G_1 = 100. N \quad [1]$$

$$\sum F_{xi} = \phi. \quad H = \phi \quad [1]$$

$$\ln \frac{S_1}{S_2} = \mu_0 \alpha$$

$$\ln \frac{200}{100} = \mu_0 \cdot \pi$$

$$\mu_0 = \frac{1}{\pi} \ln 2 = 0,220636 \quad [8]$$