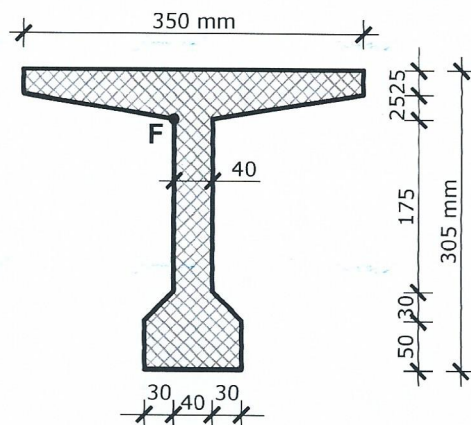




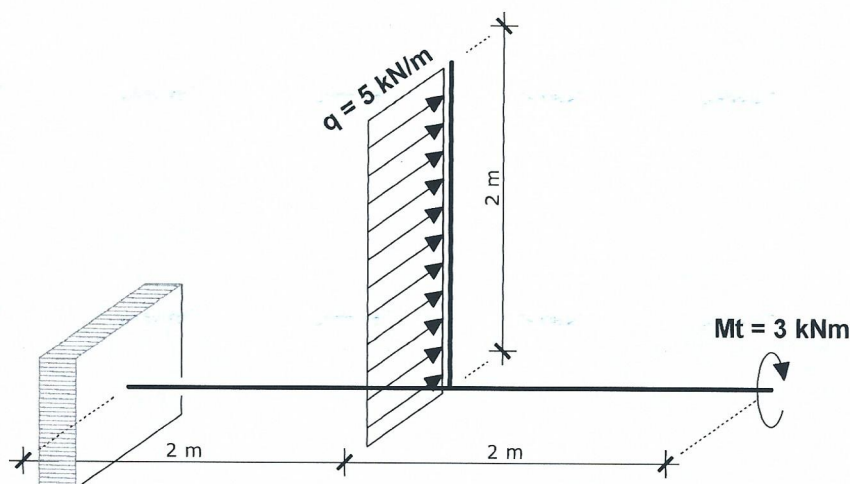
Ime i prezime:

Janko Kozjak

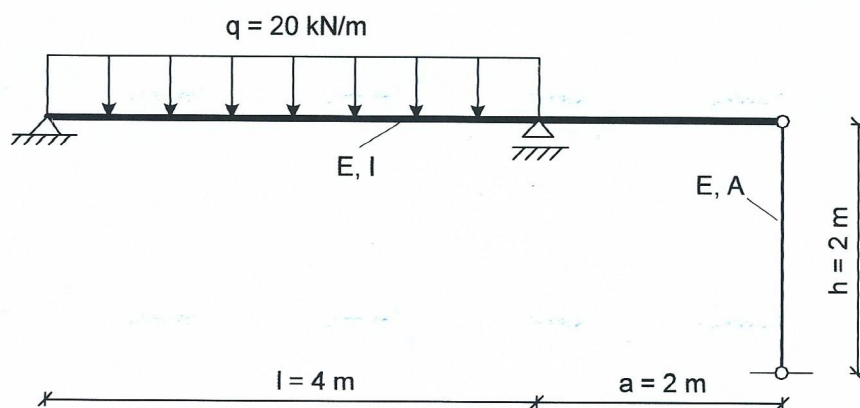
1.] Za zadani poprečni presjek opterećen vlačnom silom $F = 725$ kN treba nacrtati jezgru presjeka te primjenom jezgre odrediti i nacrtati dijagram normalnih naprezanja.



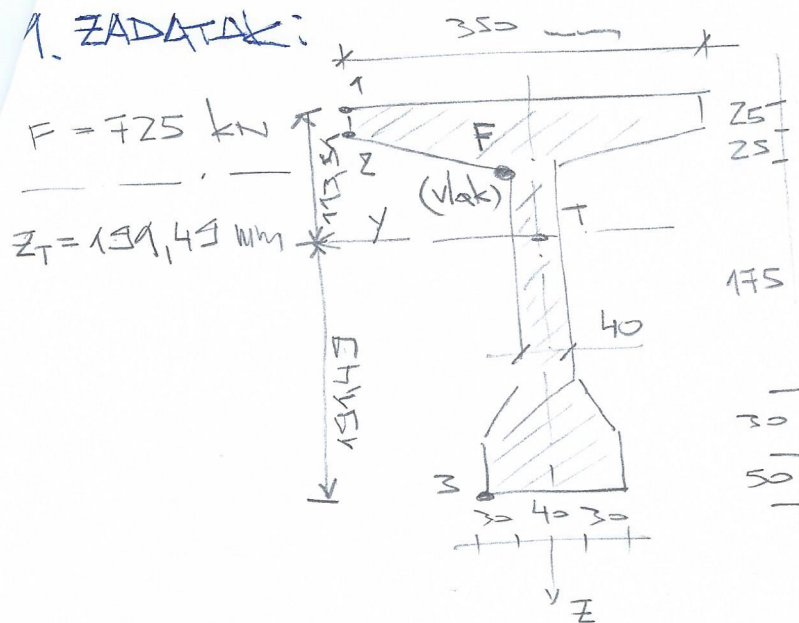
2.] Štap prikazan na slici okruglog je poprečnog presjeka i promjera $d = 120$ mm. Odredite koeficijente sigurnosti u kritičnom presjeku štapa po 3. i 5. teoriji čvrstoće. Zadano je: $\sigma_T = 235$ MPa. **Označite točku u kritičnom presjeku za koju ste odredili koeficijent sigurnosti!**



3.] Za sistem prikazan na slici treba odrediti i nacrtati dijagrame unutarnjih sila (M , T , N) ako je zadano: $E = 2 \cdot 10^5$ MPa, $I = 1,5 \cdot 10^6$ mm⁴, $A = 30$ mm².



1. ZADATAK:



$$I_y = 317,03 \cdot 10^6 \text{ mm}^4$$

$$I_z = 120,65 \cdot 10^6 \text{ mm}^4$$

$$A = 27725 \text{ mm}^2$$

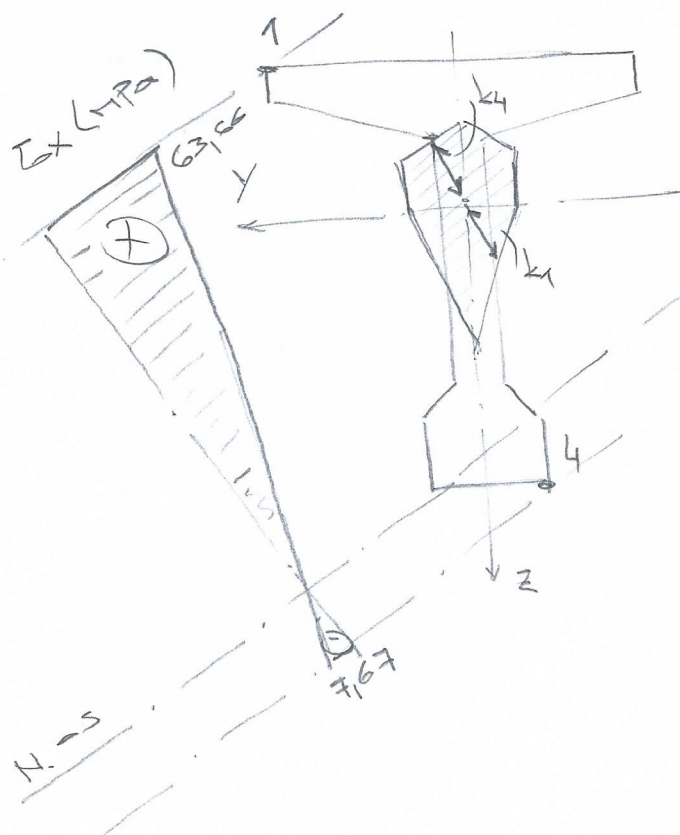
$$i_y^2 = 11434,81 \text{ mm}^2$$

$$i_z^2 = 4351,67 \text{ mm}^2$$

$$\alpha_y = -\frac{i_z^2}{e_y}$$

$$\alpha_z = -\frac{i_y^2}{e_z}$$

Tabela:	e_y	e_z	α_y	α_z
1	175	-113,51	-24,87	100,74
2	175	-88,51	-24,87	129,19
3	50	131,49	-87,03	-59,71
F	20	-63,51	-217,58	180,05



$$e = 66,58 \text{ mm}$$

$$\left. \begin{aligned} k_4 &= 51,48 \text{ mm} \\ k_1 &= 46,41 \text{ mm} \end{aligned} \right\} \text{OŠITANO!}$$

$$\sigma_i = \pm \frac{F}{A} \pm \frac{F \cdot e}{k_i \cdot A}$$

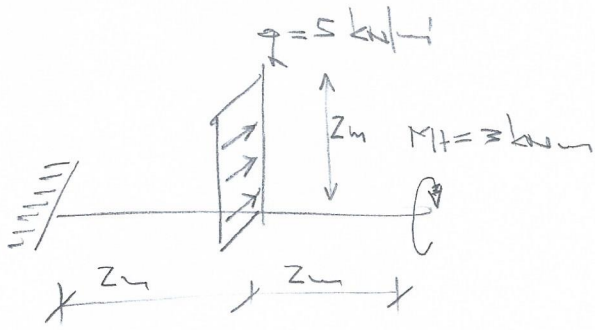
$$\sigma_1 = \frac{F}{A} + \frac{F \cdot e}{k_1 \cdot A} = 26,15 + 37,51$$

$$\sigma_1 = 63,66 \text{ MPa (vlak)}$$

$$\sigma_4 = +\frac{F}{A} - \frac{F \cdot e}{k_4 \cdot A} = 26,15 - 33,82$$

$$\sigma_4 = -7,67 \text{ MPa (vlak)}$$

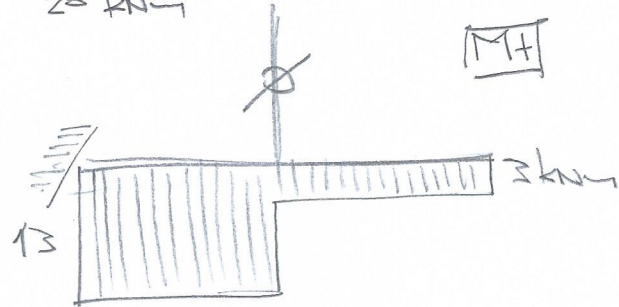
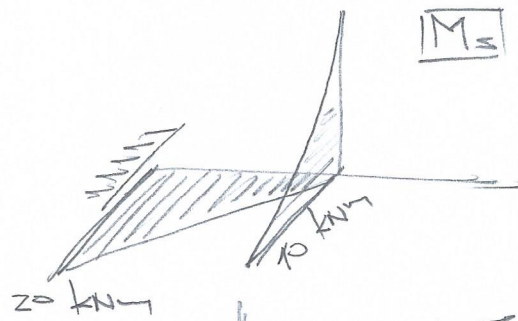
2. ZADATAK: $d = 120 \text{ mm}$
 $\sigma_T = 235 \text{ MPa}$



$$W_y = \frac{d^3 \pi}{32} = 169646,00 \text{ mm}^3$$

$$\sigma_x = \frac{M_s}{W_y} = 117,89 \text{ MPa}$$

$$\tau = \frac{Mt}{2W_y} = 38,32 \text{ MPa}$$



$$\sigma_{1,2} = \frac{\sigma}{2} \pm \frac{1}{2} \sqrt{\sigma^2 + 4\tau^2} = 58,95 \pm 70,31$$

$$\sigma_1 = 129,25 \text{ MPa}$$

$$\sigma_2 = -11,36 \text{ MPa}$$

$$\boxed{3.T.E} \quad \sigma_{ck}^{(3)} = |\sigma_1 - \sigma_2| = 140,61 \text{ MPa}$$

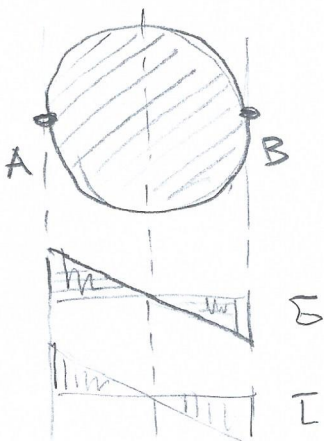
$$k_3 = \frac{\sigma_T}{\sigma_{ck}^{(3)}} = 1,67$$

$$\boxed{5.T.E} \quad \sigma_{ck}^{(5)} = \sqrt{\sigma_1^2 + \sigma_2^2 - \sigma_1 \sigma_2}$$

$$\sigma_{ck}^{(5)} = 135,29 \text{ MPa}$$

$$k_5 = 1,74$$

* TOČKA: A i B



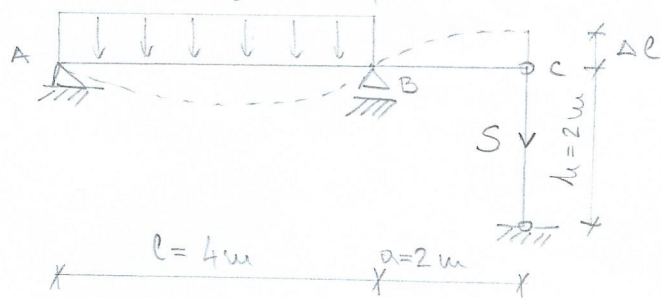
ZADATAK:

$$E = 2 \cdot 10^5 \text{ MPa}$$

$$I = 1,5 \cdot 10^6 \text{ mm}^4$$

$$A = 30 \text{ mm}^2$$

$$q = 20 \text{ kN/m}$$



$$|W_c| = |W_c^2| - |W_c^S| = |\Delta l| = \frac{S \cdot h}{EA}$$

$$\phi_1 = \frac{ql^2}{8} \cdot l \cdot \frac{2}{3} = \frac{ql^3}{12}$$

$$\overline{R}_{B1} = \frac{\phi_1}{2} = \frac{ql^3}{24}$$

$$\overline{M}_c^2 = -\overline{R}_{B1} \cdot a = -\frac{ql^3 \cdot a}{24}$$

$$|W_c^2| = \frac{\overline{M}_c^2}{EI} = \frac{ql^3 a}{24EI}$$

$$\phi_2 = \frac{a \cdot S \cdot l}{2}$$

$$\phi_3 = \frac{a \cdot S \cdot a}{2} = \frac{a^2 S}{2}$$

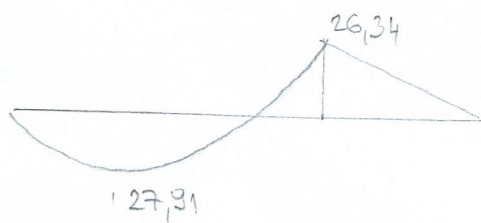
$$\overline{R}_{B2} = \frac{2}{3} \phi_2 = \frac{a S l}{3}$$

$$\overline{M}_c^S = \overline{R}_{B2} \cdot a + \phi_3 \cdot \frac{2}{3} a = \frac{a^2 S l}{3} + \frac{a^3 S}{3}$$

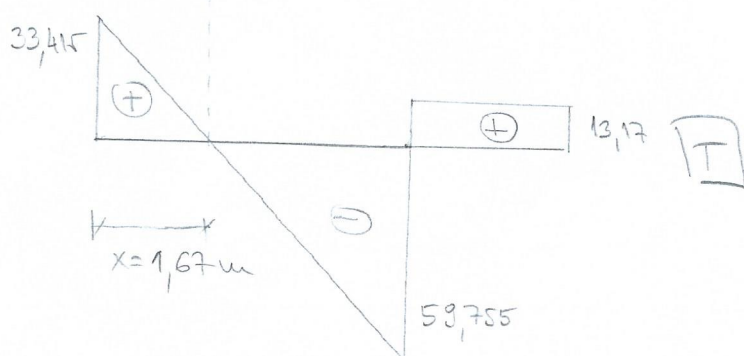
$$W_c^S = \frac{\overline{M}_c^S}{EI}$$

$$\frac{ql^3 a}{24EI} - \frac{S a^2}{3EI} (l+a) = \frac{S \cdot h}{EA} / \cdot 24EI$$

$$S = \frac{ql^3 a}{8a^2(l+a) + 24h \frac{1}{A}} = \frac{20 \cdot 4000^3 \cdot 2000}{8 \cdot 2000^2 \cdot 6000 + 24 \cdot 2000 \cdot \frac{1,5 \cdot 10^6}{30}} = \frac{13168 \text{ N}}{10} = \underline{\underline{13,17 \text{ kN}}}$$



[M]



$$R_A = 33,415$$

$$R_B = 59,755$$

$$33,415 - 20 \cdot x = 0$$

$$x = 1,67 \text{ m}$$

