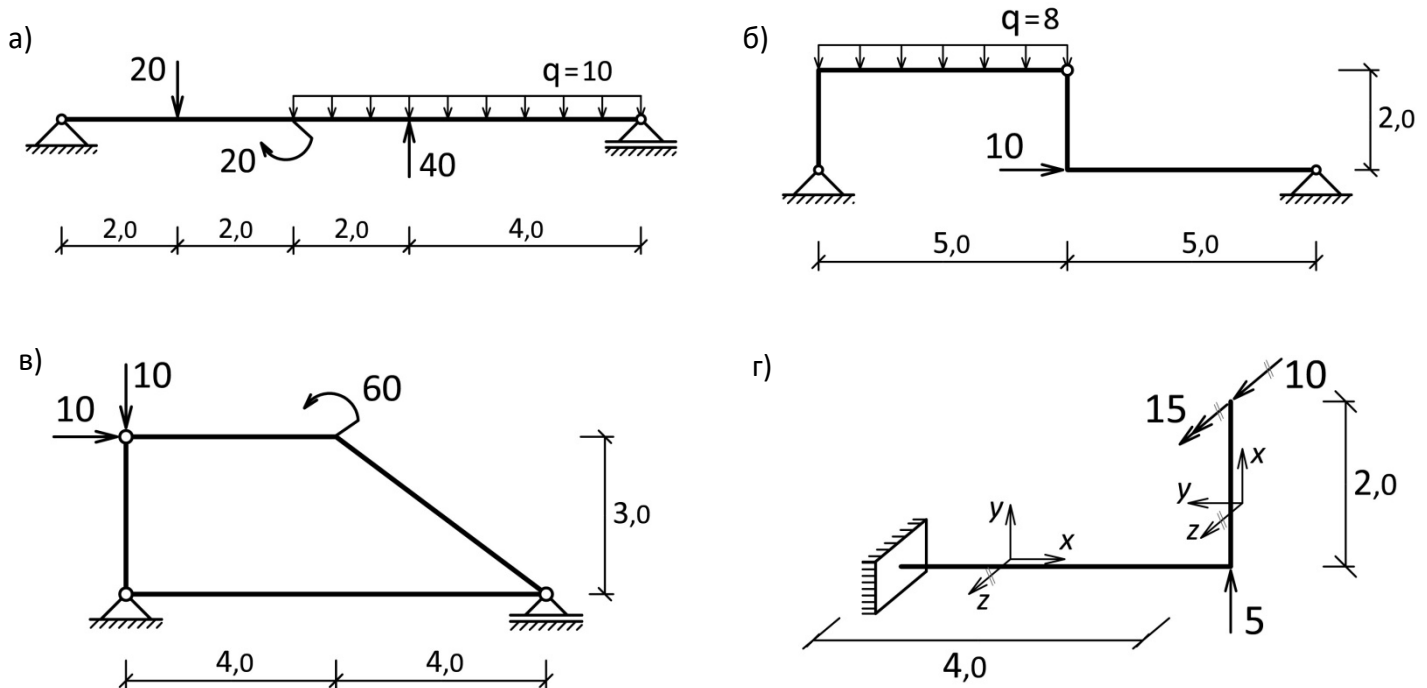


**ГРАЂЕВИНСКИ ФАКУЛТЕТ УНИВЕРЗИТЕТА У БЕОГРАДУ**  
 Усмени (теоријски) део испита из **ТЕХНИЧКЕ МЕХАНИКЕ 1**  
 (писмени део одржан 03.06.2020.)

**1. ЗАДАТАК** (условни 50 %)

Нацртати дијаграме сила у пресеку за приказане носаче.



**2. ЗАДАТАК** (30 %)

а) Шта се подразумева под троугаоном топологијом простих штапова код решеткастих носача у равни.

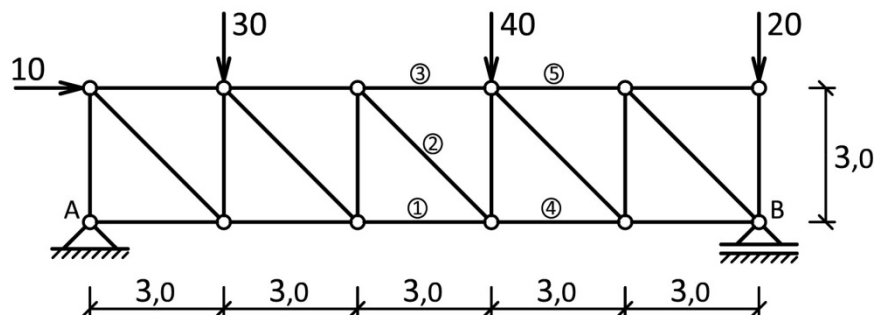
б) За приказани решеткасти носач одредити:

\* силе у штаповима 1, 2 и 3

применом Ритеровог поступка.

\* силе у штаповима 4 и 5 применом опште једначине статике.

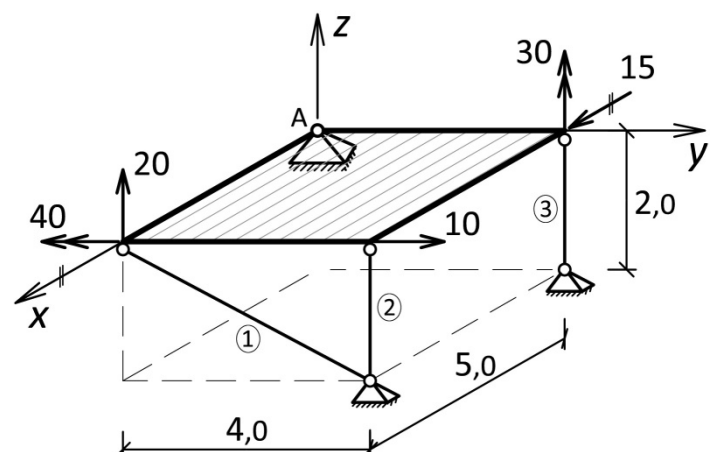
(при томе за сваки штап назначити да ли је притиснут или затегнут)



**3. ЗАДАТАК** (20 %)

а) Навести Варињонову теорему.

б) Одредити реакције веза и вредности сила у штаповима код плоче приказане на скици.

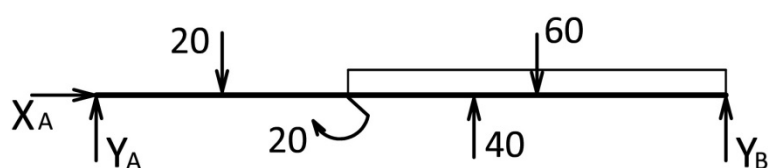
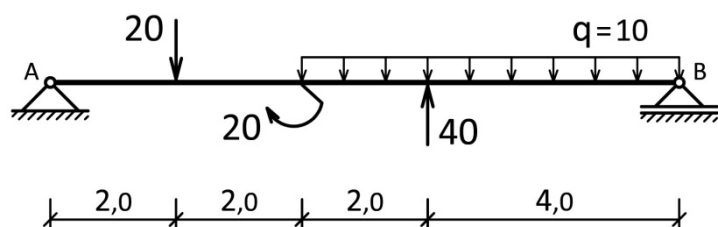


Напомена: У свим задацима димензије за дужине и силе су: m, kN

**- Р Е Ш Е Њ А -**

**1. ЗАДАТАК** (условни 50 %)

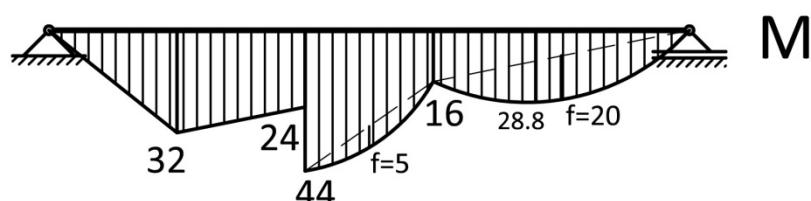
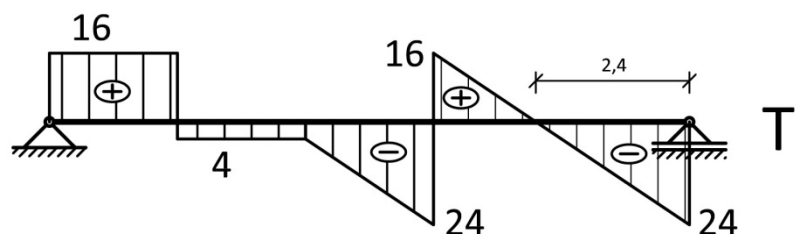
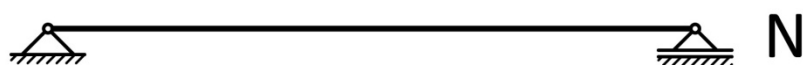
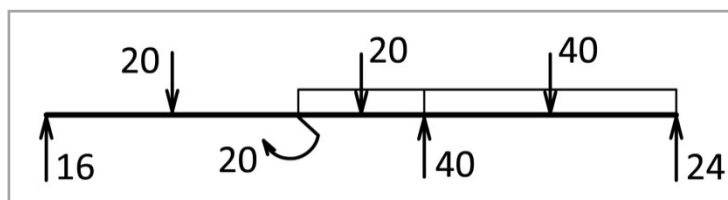
a)

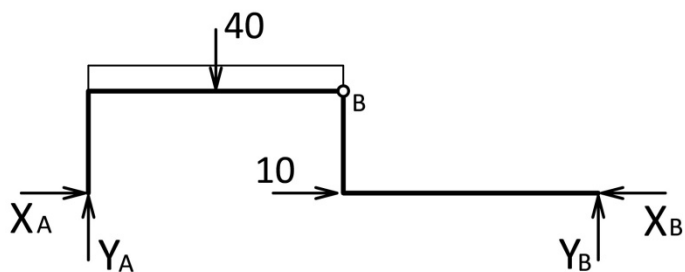
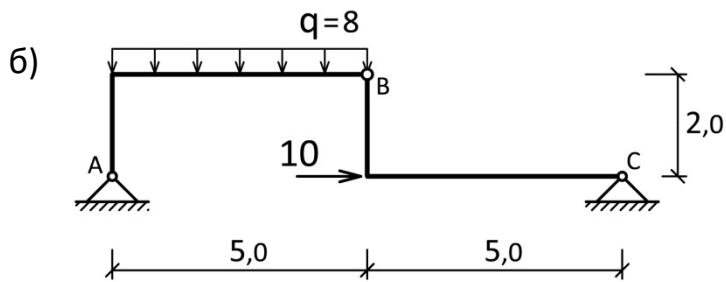


$$\sum F_x = 0 : \underline{X_A = 0}$$

$$\sum M_A = 0 : Y_B \cdot 10 - 60 \cdot 7 + 40 \cdot 6 - 20 - 20 \cdot 2 = 0 \rightarrow \underline{Y_B = 24}$$

$$\sum F_y = 0 : Y_A + Y_B - 20 + 40 - 60 = 0 \rightarrow \underline{Y_A = 16}$$



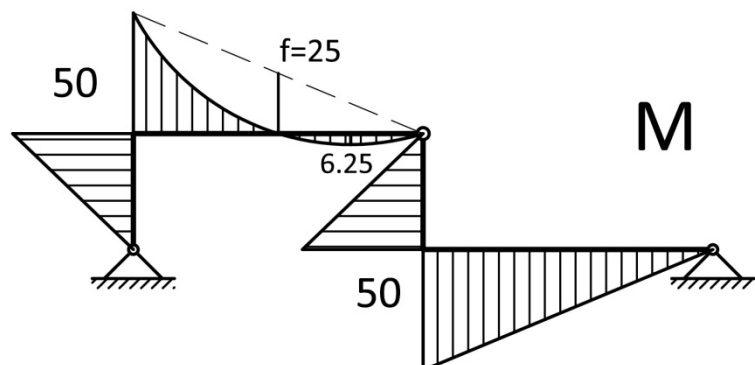
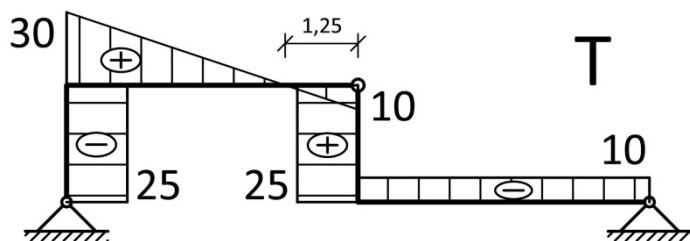
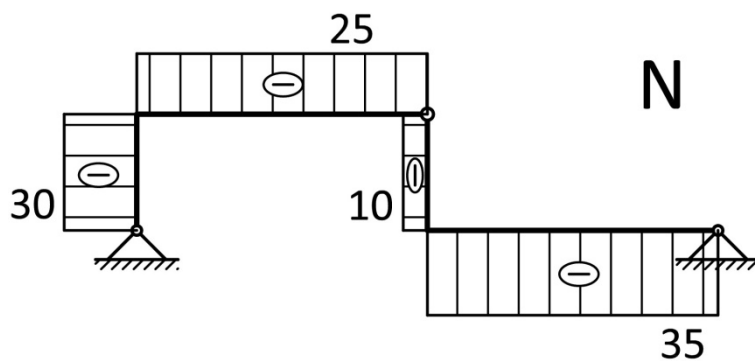
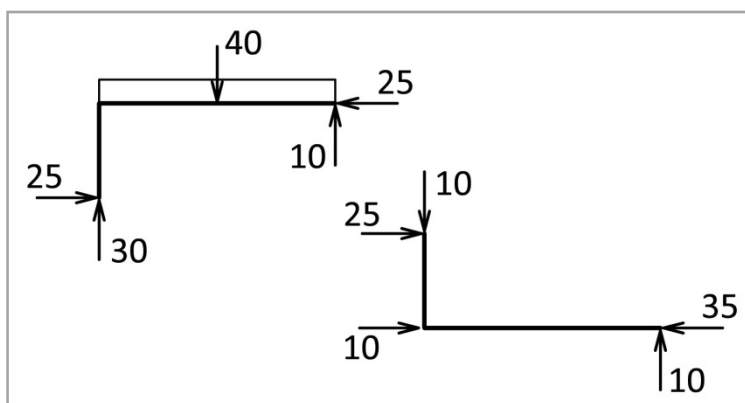


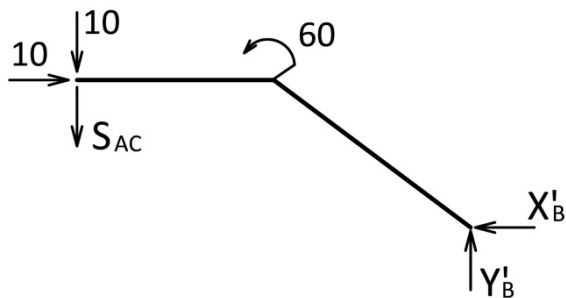
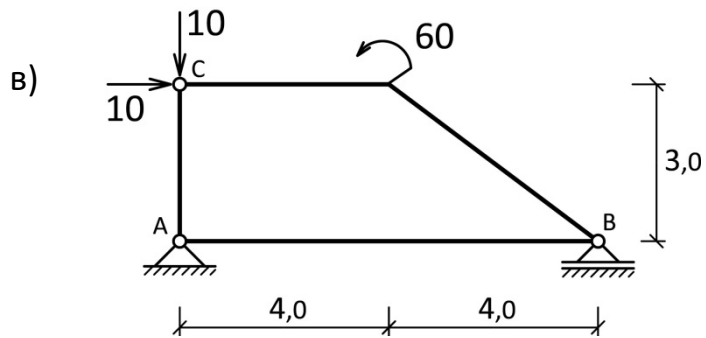
$$\sum M_A = 0 : Y_B \cdot 10 - 40 \cdot 2.5 = 0 \rightarrow \underline{Y_B = 10}$$

$$\sum F_Y = 0 : Y_A + Y_B - 40 = 0 \rightarrow \underline{Y_A = 30}$$

$$\sum M_{B, \text{лев}} = 0 : X_A \cdot 2 - Y_A \cdot 5 + 40 \cdot 2.5 = 0 \rightarrow \underline{X_A = 25}$$

$$\sum F_X = 0 : X_A - X_B + 10 = 0 \rightarrow \underline{X_B = 35}$$

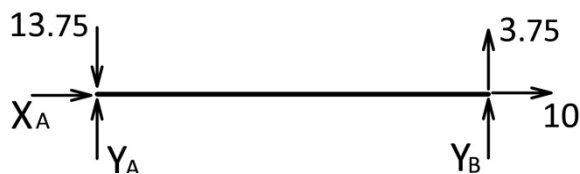




$$\sum F_X = 0 : -X'_B + 10 = 0 \rightarrow \underline{X'_B = 10}$$

$$\sum M_B = 0 : S_{AC} \cdot 8 + 10 \cdot 8 - 10 \cdot 3 + 60 = 0 \rightarrow \underline{S_{AC} = -13.75}$$

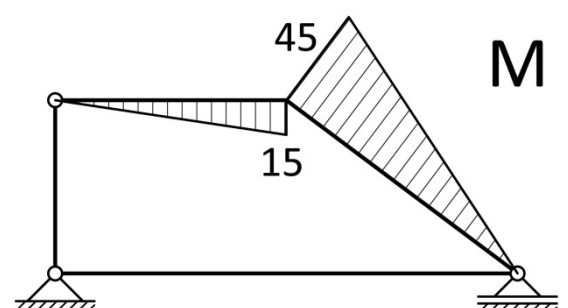
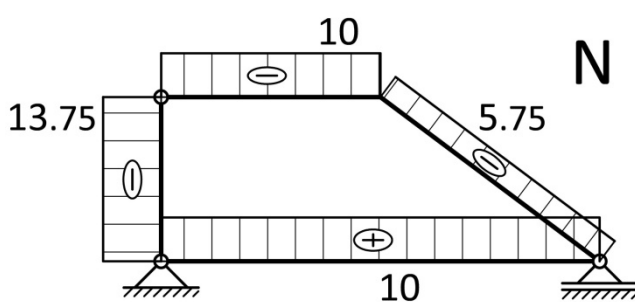
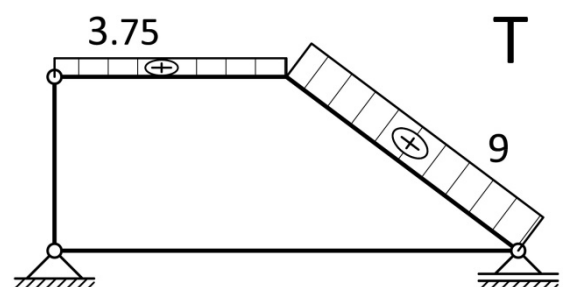
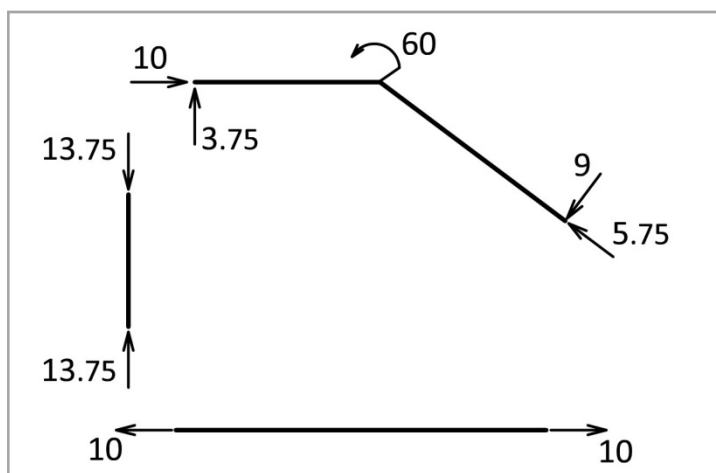
$$\sum F_Y = 0 : Y'_B - S_{AC} - 10 = 0 \rightarrow \underline{Y'_B = -3.75}$$



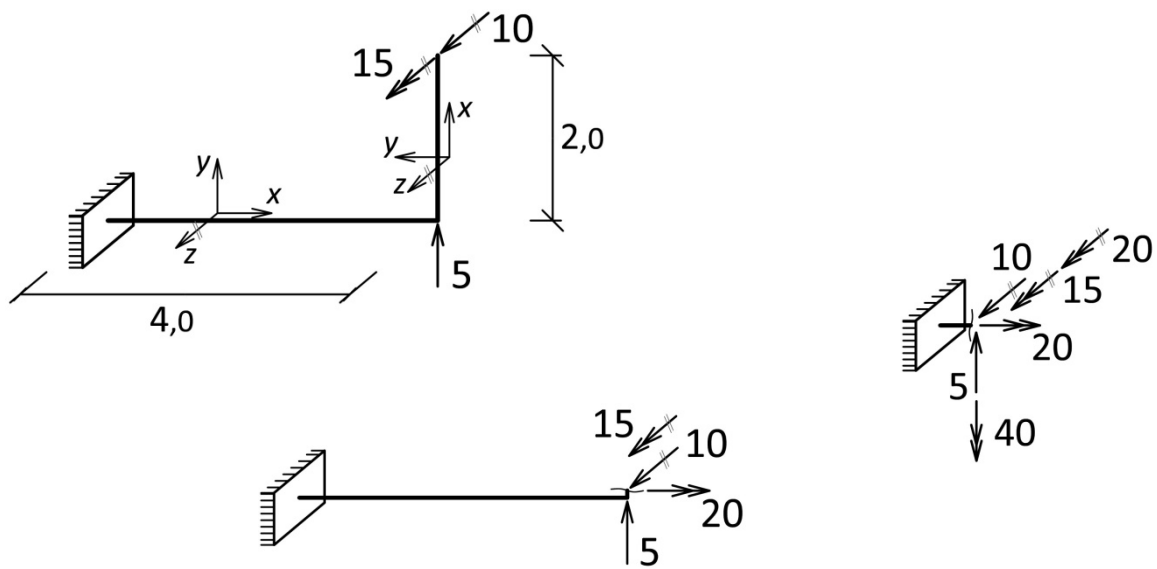
$$\sum F_X = 0 : X_A + 10 = 0 \rightarrow \underline{X_A = -10}$$

$$\sum M_A = 0 : Y_B \cdot 8 + 3.75 \cdot 8 = 0 \rightarrow \underline{Y_B = -3.75}$$

$$\sum F_Y = 0 : Y_A + Y_B - 13.75 + 3.75 = 0 \rightarrow \underline{Y_A = 13.75}$$



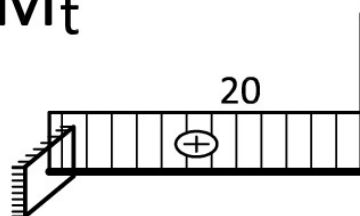
r)



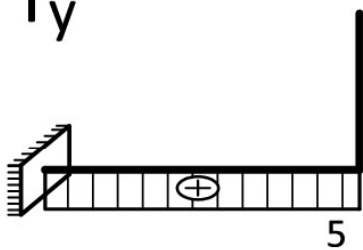
N



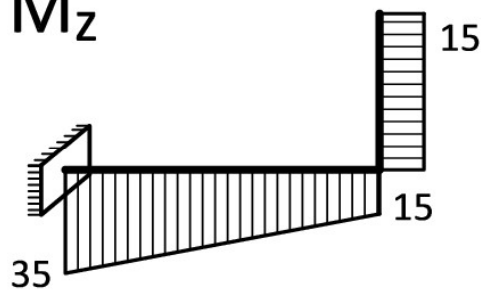
$M_t$



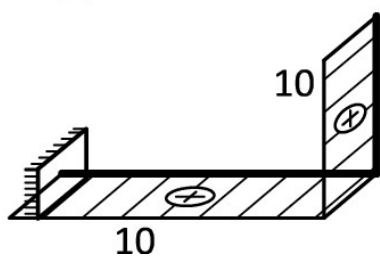
$T_y$



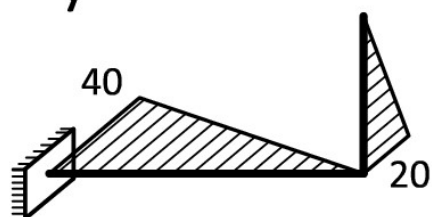
$M_z$



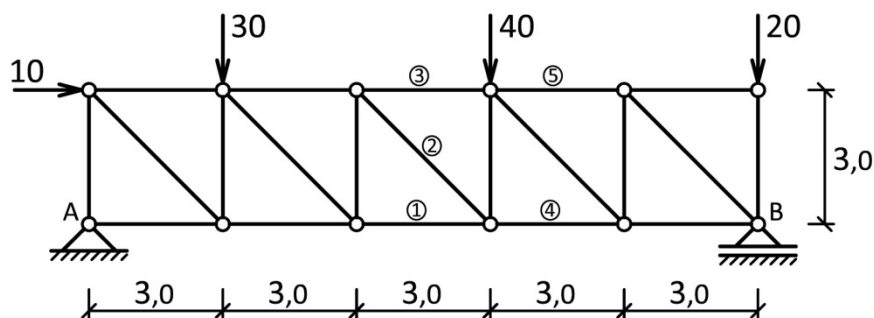
$T_z$



$M_y$

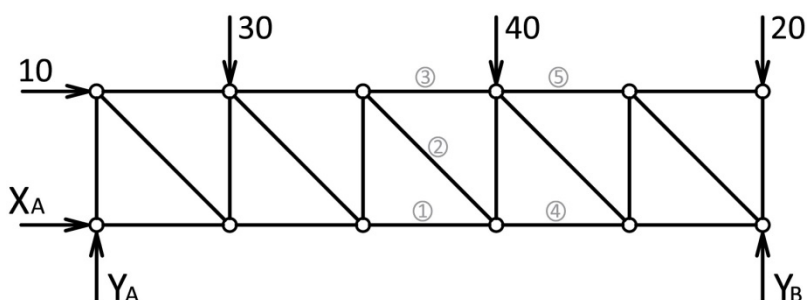


## 2. ЗАДАТАК (30 %)



б) Ритеров поступак:

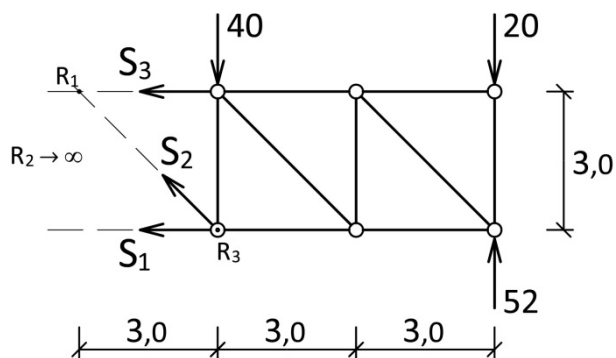
Одређивање реакција веза:



$$\sum F_X = 0 : X_A + 10 = 0 \rightarrow \underline{X_A = -10}$$

$$\sum M_A = 0 : Y_B \cdot 15 - 20 \cdot 15 - 40 \cdot 9 - 30 \cdot 3 - 10 \cdot 3 = 0 \rightarrow \underline{Y_B = 52}$$

$$\sum F_Y = 0 : Y_A + Y_B - 30 - 40 - 20 = 0 \rightarrow \underline{Y_A = 38}$$



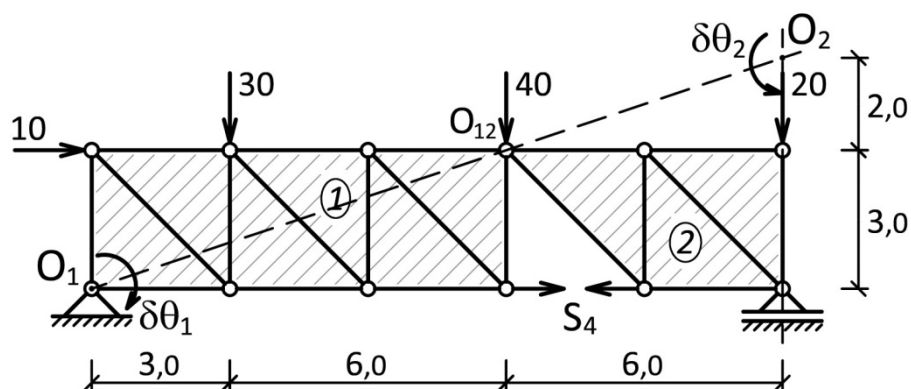
$$\sum M_{R1} = 0 : S_1 \cdot 3 + 40 \cdot 3 + 20 \cdot 9 - 52 \cdot 9 = 0 \rightarrow \underline{S_1 = 56} \text{ (затегнут штап)}$$

$$\sum F_Y = 0 : 0.707 \cdot S_2 - 40 - 20 + 52 = 0 \rightarrow \underline{S_2 = 13.314} \text{ (затегнут штап)}$$

$$\sum M_{R3} = 0 : S_3 \cdot 3 - 20 \cdot 6 + 52 \cdot 6 = 0 \rightarrow \underline{S_3 = -64} \text{ (притиснут штап)}$$

Примена опште једначине статике:

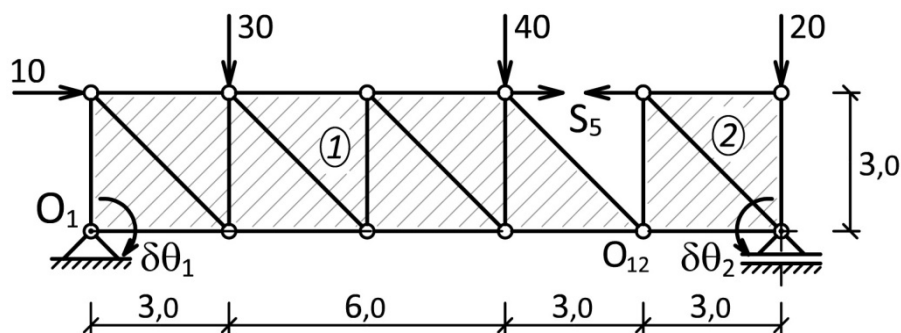
$S_4 = ?$



$$\delta r_{O_{12},y} = \delta \theta_1 \cdot 9 = \delta \theta_2 \cdot 6 \rightarrow \delta \theta_2 = 1.5 \cdot \delta \theta_1$$

$$\delta A = 10 \cdot (3 \cdot \delta \theta_1) + 30 \cdot (3 \cdot \delta \theta_1) + 40 \cdot (9 \cdot \delta \theta_1) - S_4 \cdot (5 \cdot \delta \theta_2) = 0$$

$$-7.5 \cdot S_4 \cdot \delta \theta_1 + 480 \cdot \delta \theta_1 = 0 \rightarrow \underline{S_4 = 64} \text{ (затегнут штап)}$$



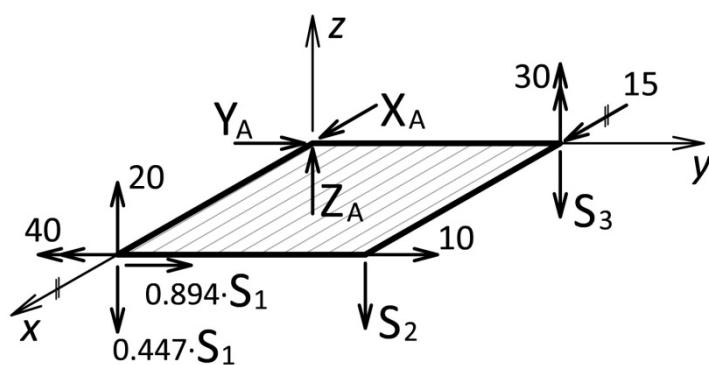
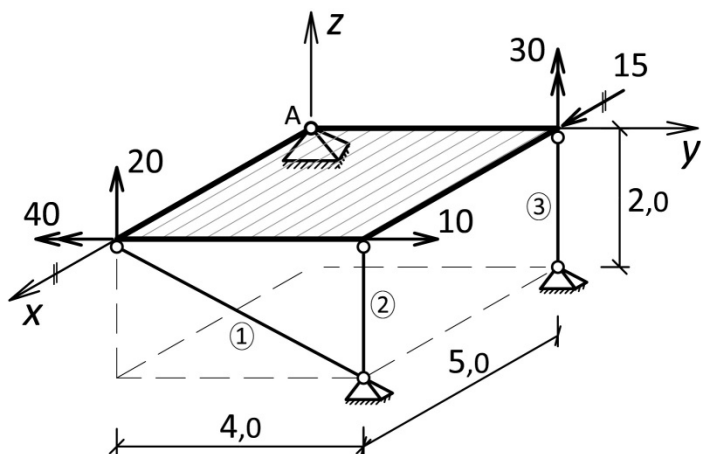
$$\delta r_{O_{12},y} = \delta \theta_1 \cdot 12 = \delta \theta_2 \cdot 3 \rightarrow \delta \theta_2 = 4 \cdot \delta \theta_1$$

$$\delta A = 10 \cdot (3 \cdot \delta \theta_1) + 30 \cdot (3 \cdot \delta \theta_1) + 40 \cdot (9 \cdot \delta \theta_1) + S_5 \cdot (3 \cdot \delta \theta_1) + S_5 \cdot (3 \cdot \delta \theta_2) = 0$$

$$15 \cdot S_5 \cdot \delta \theta_1 + 480 \cdot \delta \theta_1 = 0 \rightarrow \underline{S_5 = -32} \text{ (притиснут штап)}$$

### 3. ЗАДАТАК (20 %)

6)



$$\sum F_x = 0 : X_A + 15 = 0 \quad \rightarrow \underline{X_A = -15}$$

$$\sum F_y = 0 : Y_A + 0.894 \cdot S_1 + 10 = 0 \quad \rightarrow \underline{Y_A = -6}$$

$$\sum F_z = 0 : Z_A - 0.447 \cdot S_1 - S_2 - S_3 + 20 = 0 \quad \rightarrow \underline{Z_A = -22}$$

$$\sum M_x = 0 : -S_2 \cdot 4 - S_3 \cdot 4 = 0 \quad \rightarrow \underline{S_3 = -30}$$

$$\sum M_y = 0 : 0.447 \cdot S_1 \cdot 5 + S_2 \cdot 5 - 20 \cdot 5 - 40 = 0 \quad \rightarrow \underline{S_2 = 30}$$

$$\sum M_z = 0 : 0.894 \cdot S_1 \cdot 5 + 10 \cdot 5 - 15 \cdot 4 + 30 = 0 \quad \rightarrow \underline{S_1 = -4.472}$$