ГРАЂЕВИНСКИ ФАКУЛТЕТ УНИВЕРЗИТЕТА У БЕОГРАДУ

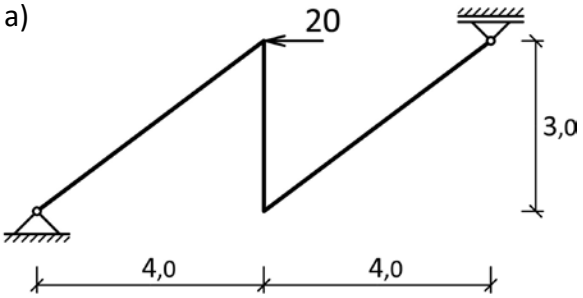
Усмени (теоријски) део испита из **ТЕХНИЧКЕ МЕХАНИКЕ 1**

(писмени део одржан 07.06.2018.)

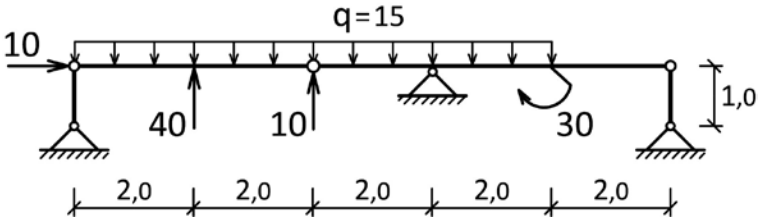
1. ЗАДАТАК (условни 50 %)

Нацртати дијаграме сила у пресеку за приказане носаче.

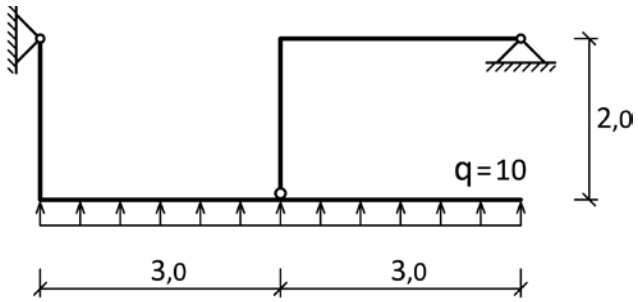
а)



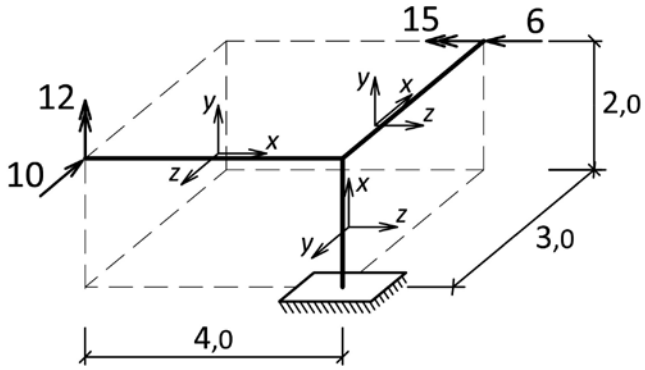
б)



в)



г)

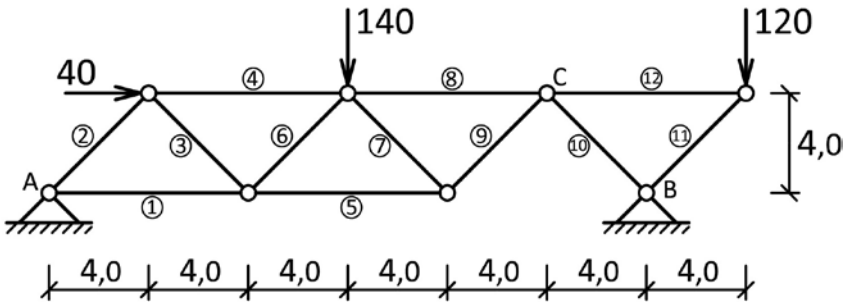


2. ЗАДАТАК (20 %)

а) Навести поступке за одређивање сила у штаповима решеткастих носача.

б) Одредити силе у штаповима 5, 7, 8 методом Ритера.

в) Одредити силе у штаповима 1, 2, 3 методом равнотеже чворова.



3. ЗАДАТАК (30 %)

а) Приказати и укратко објаснити израз за виртуелно померање тачака слободног крутог тела.

б) Применом опште једначине статике одредити:

* реакције веза у „десном“ непокретном ослонцу (задатак 1в),
* хоризонталну реакцију везе у ослонцу B (задатак 2),
* силу у штапу 12 (задатак 2).

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

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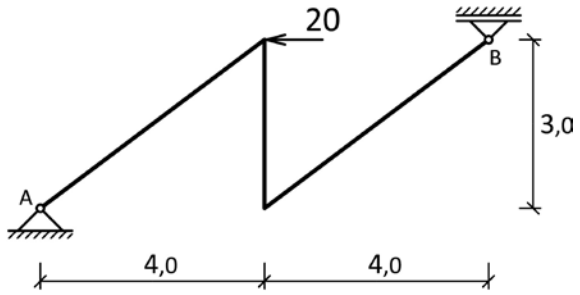
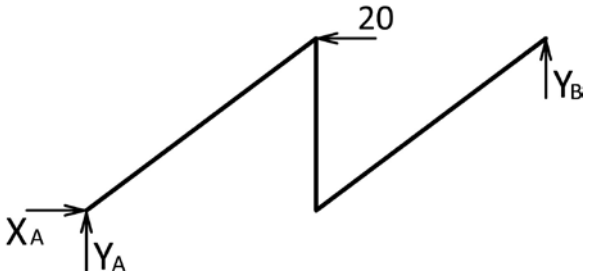
(писмени део одржан 07.06.2018.)

- Р Е Ш Е Њ А -

1. ЗАДАТАК (условни 50 %)

а)

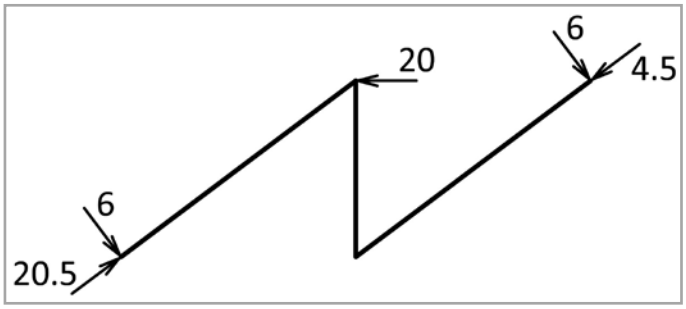


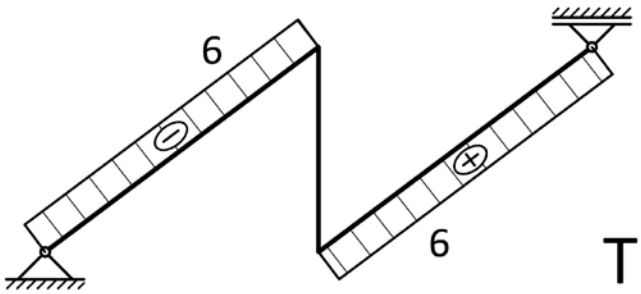


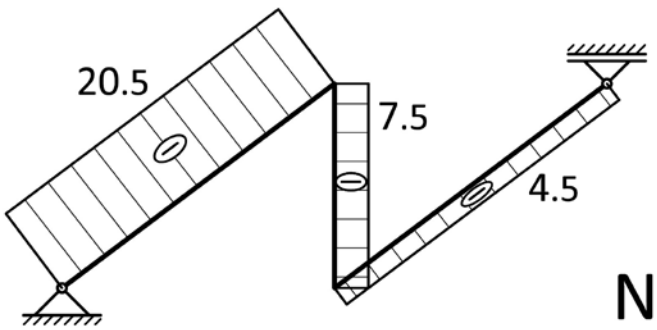
$\sum F_X = 0: \; X_A - 20 = 0 \;\rightarrow\; \underline{X_A = 20}$

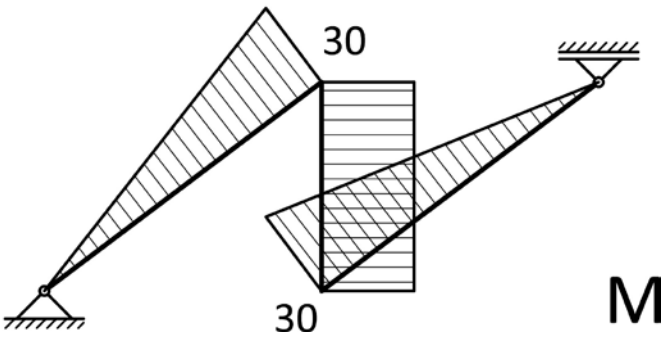
$\sum M_A = 0: \; Y_B \cdot 8 + 20 \cdot 3 = 0 \;\rightarrow\; \underline{Y_B = -7.5}$

$\sum F_Y = 0: \; Y_A + Y_B = 0 \;\rightarrow\; \underline{Y_A = 7.5}$









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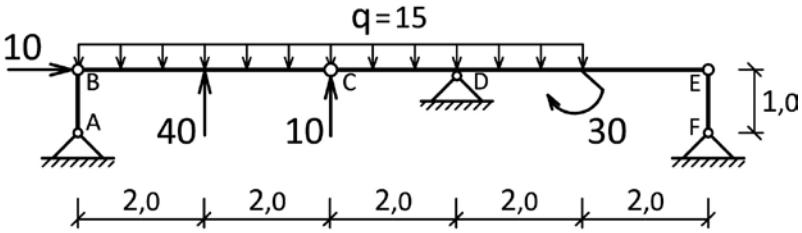
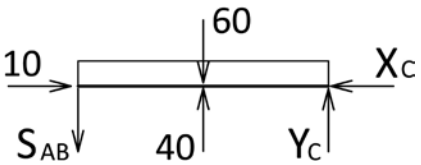
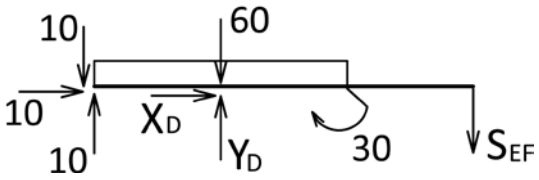




$\sum F_X = 0 : \; -X_C + 10 = 0 \rightarrow \underline{X_C = 10}$

$\sum M_C = 0 : \; S_{AB}\cdot 4 + 60\cdot 2 - 40\cdot 2 = 0 \rightarrow \underline{S_{AB} = -10}$

$\sum F_Y = 0 : \; Y_C - S_{AB} + 40 - 60 = 0 \rightarrow \underline{Y_C = 10}$

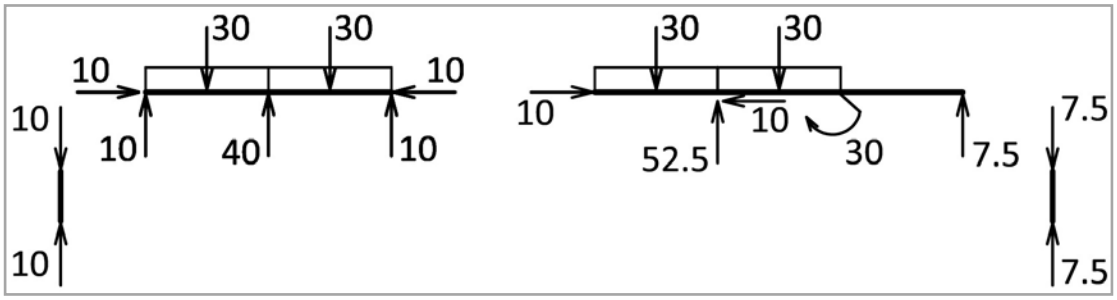


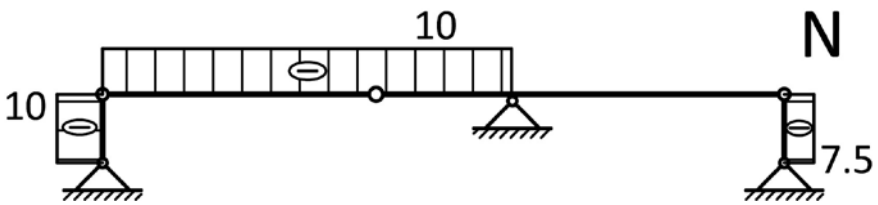
$\sum F_X = 0 : \; X_D + 10 = 0 \rightarrow \underline{X_D = -10}$

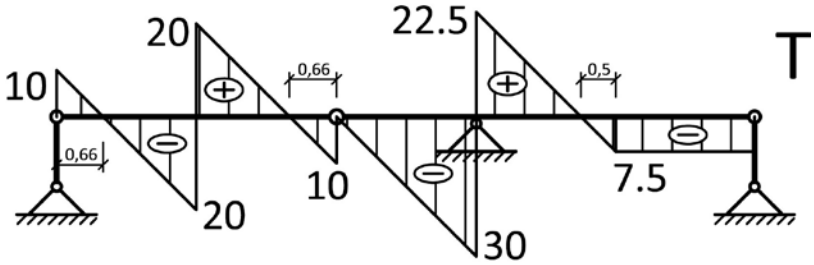
$\sum M_E = 0 : Y_D\cdot 4 - 60\cdot 4 + (10-10)\cdot 6 + 30 = 0$

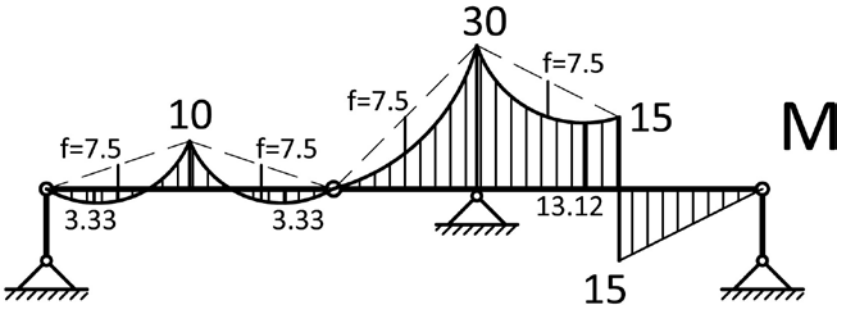
$\rightarrow \underline{Y_D = 52.5}$

$\sum F_Y = 0 : \; -S_{EF} + Y_D - 60 + 10 - 10 = 0 \rightarrow \underline{Y_A = -7.5}$









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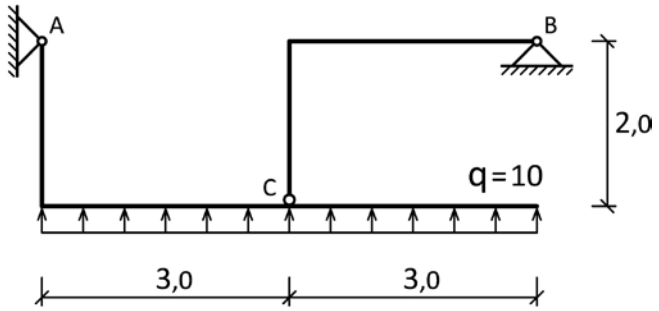
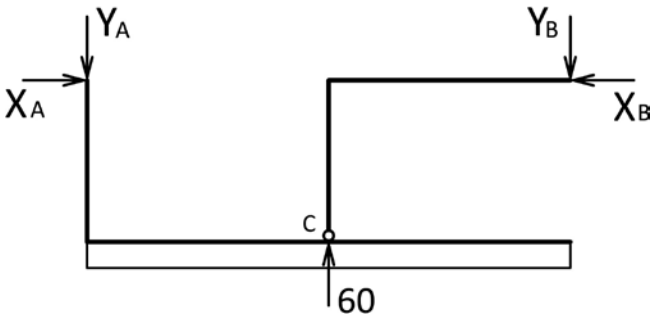


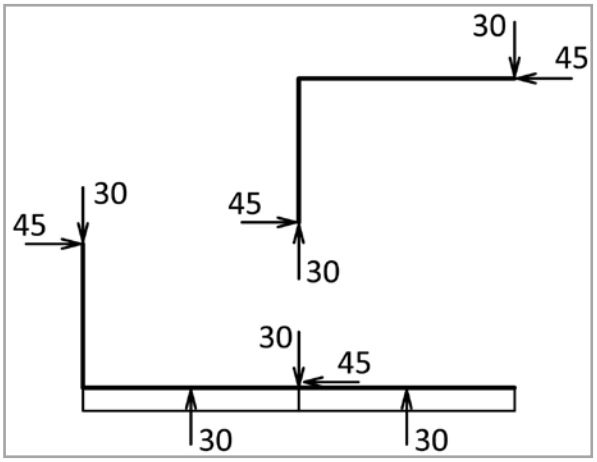


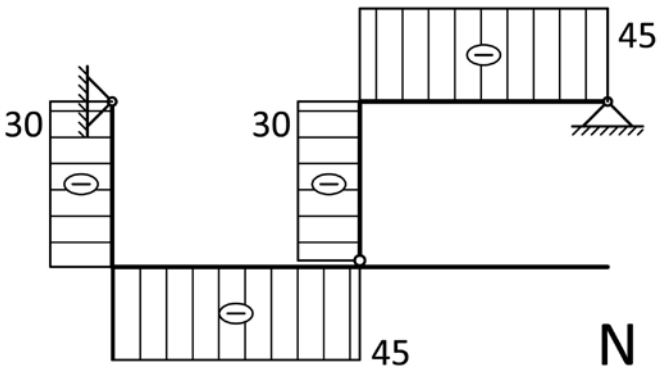
$\sum M_A = 0 : Y_B \cdot 6 - 60 \cdot 3 = 0 \rightarrow \underline{Y_B = 30}$

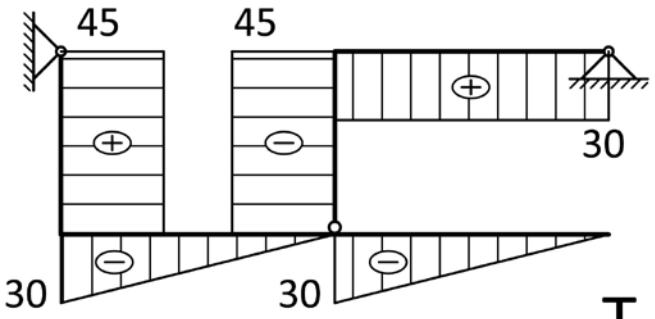
$\sum F_Y = 0 : -Y_A - Y_B + 60 = 0 \rightarrow \underline{Y_A = 30}$

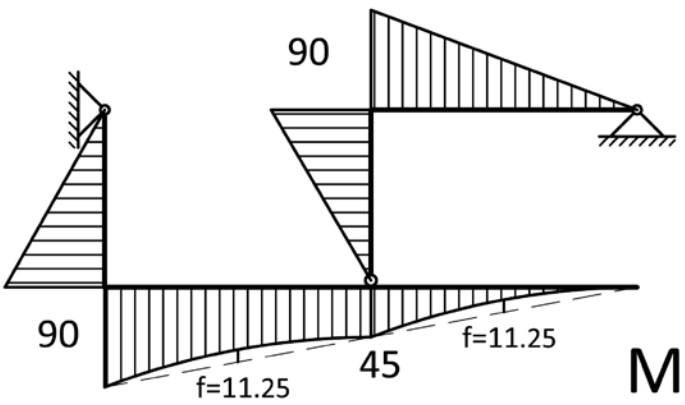
$\sum M_{C,лев} = 0 : X_B \cdot 2 - Y_B \cdot 3 = 0 \rightarrow \underline{X_B = 45}$

$\sum F_X = 0 : X_A - X_B = 0 \rightarrow \underline{X_A = 45}$









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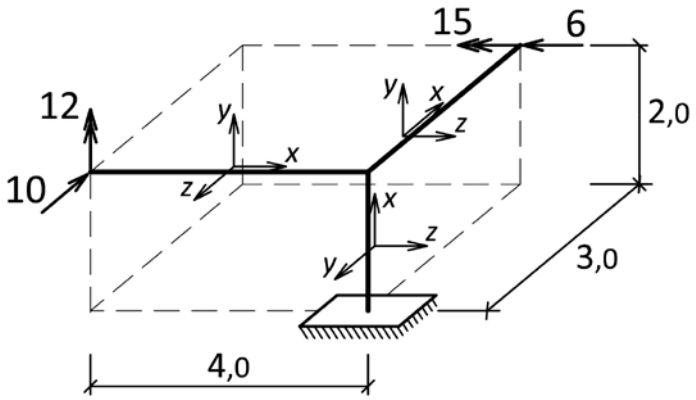
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12
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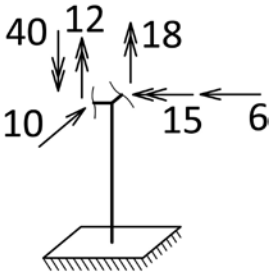
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12
18
10
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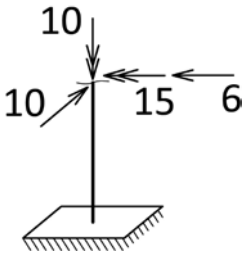
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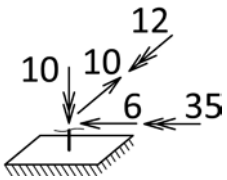
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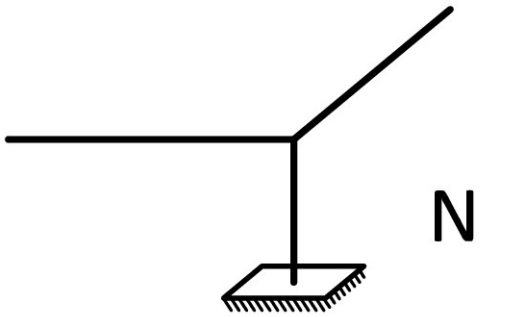
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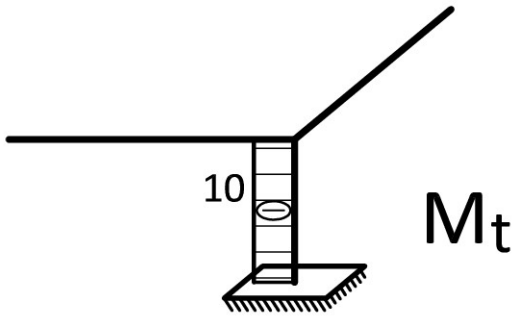
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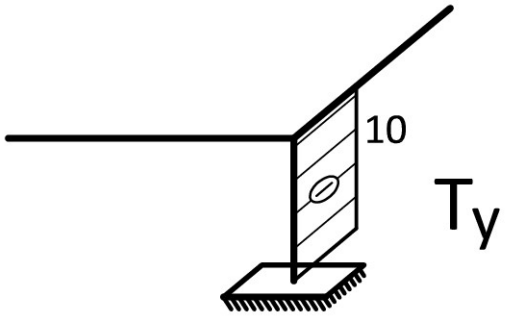
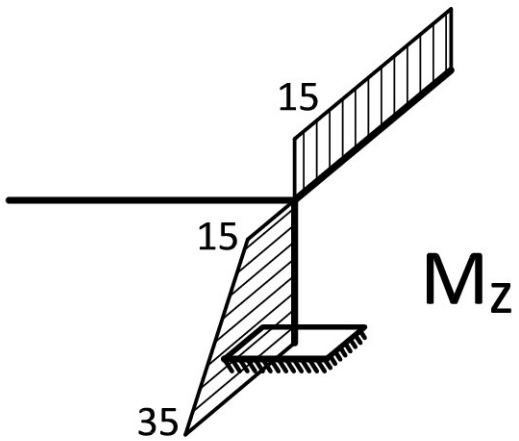

10
Ty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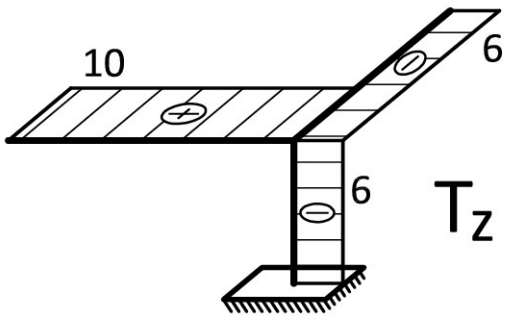
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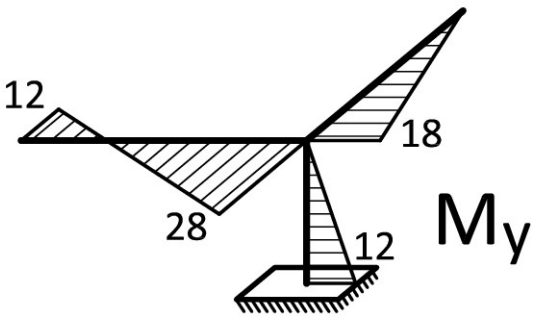
Tz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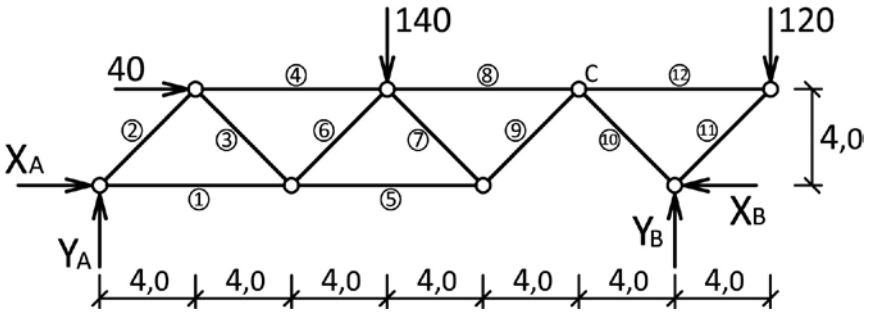
My

2. ЗАДАТАК (20 %)



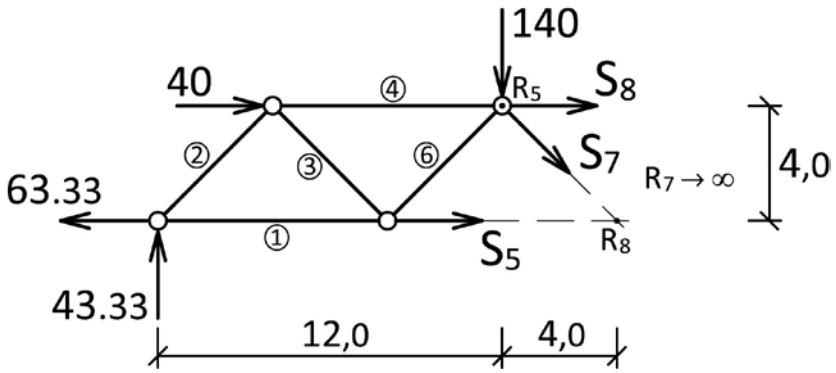
$\sum M_A = 0: \; Y_B \cdot 24 - 120 \cdot 28 - 140 \cdot 12 - 40 \cdot 4 = 0 \rightarrow \underline{Y_B = 216.67}$

$\sum F_Y = 0: \; Y_A + Y_B - 140 - 120 = 0 \rightarrow \underline{Y_A = 43.33}$

$\sum M_{C,дес} = 0: X_B \cdot 4 - Y_B \cdot 4 + 120 \cdot 8 = 0 \rightarrow \underline{X_B = -23.33}$

$\sum F_X = 0: \; X_A - X_B + 40 = 0 \rightarrow \underline{X_A = -63.33}$

б) Ритеров поступак:



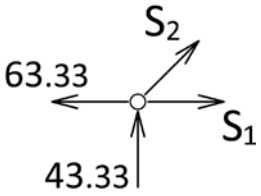
$\sum M_{R5} = 0: \; S_5 \cdot 4 - 43.33 \cdot 12 - 63.33 \cdot 4 = 0 \rightarrow \underline{S_5 = 193.33}$

$\sum F_Y = 0: \; -0.707 \cdot S_7 - 140 + 43.33 = 0 \rightarrow \underline{S_7 = -136.71}$

$\sum M_{R8} = 0: \; S_8 \cdot 4 - 140 \cdot 4 + 43.33 \cdot 16 + 40 \cdot 4 = 0 \rightarrow \underline{S_8 = -73.33}$

в) Метода равнотеже чворова:

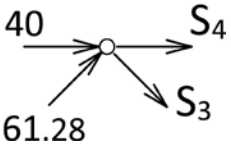
Чвор A:



$\sum F_Y = 0: \; 0.707 \cdot S_2 + 43.33 = 0 \rightarrow \underline{S_2 = -61.28}$

$\sum F_X = 0: \; S_1 + 0.707 \cdot (-61.28) - 63.33 = 0 \rightarrow \underline{S_1 = 106.67}$

Чвор D:



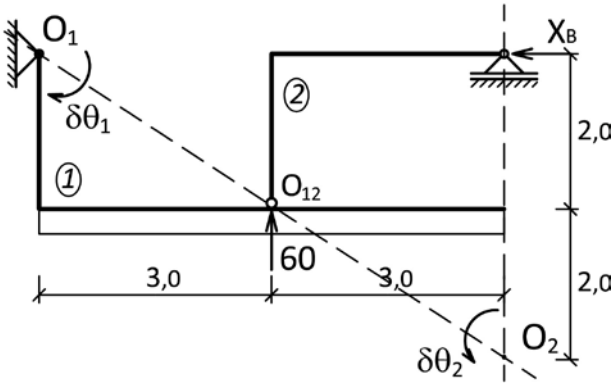
$\sum F_Y = 0: \; -0.707 \cdot S_3 + 0.707 \cdot 61.28 = 0 \rightarrow \underline{S_3 = 61.28}$

$\sum F_X = 0: \; S_4 + 0.707 \cdot (61.28) + 0.707 \cdot (61.28) + 40 = 0$

$\rightarrow S_4 = -126.67$

3. ZADATAK (30 %)

б) X_B =? (zad. 1v)

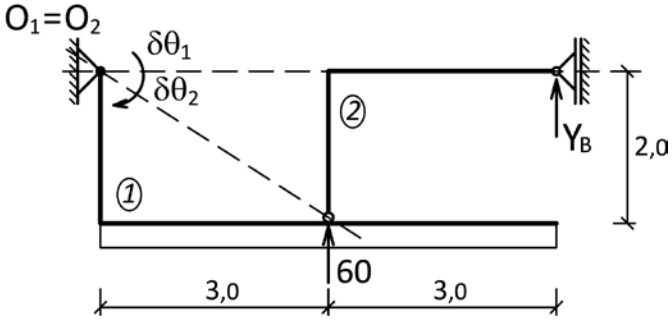


$\delta r_{O12,y} = \delta\theta_1 \cdot 3 = \delta\theta_2 \cdot 3 \rightarrow \delta\theta_1 = \delta\theta_2$

$\delta A = X_B \cdot (4 \cdot \delta\theta_2) - 60 \cdot (3 \cdot \delta\theta_1) = 0$

$\rightarrow$ $X_B = 45.0$

Y_B =? (zad. 1v)

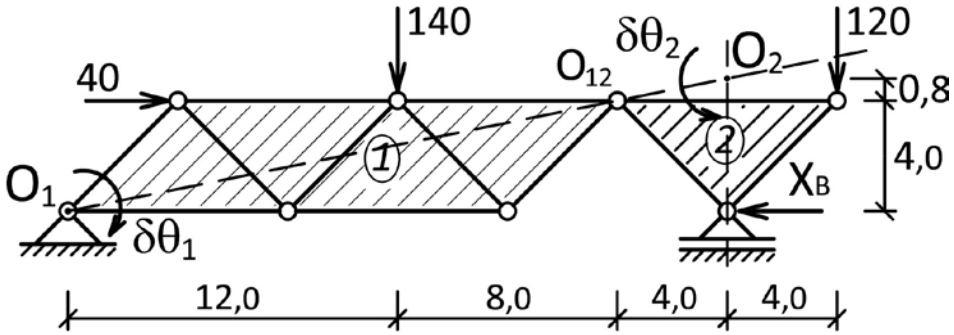


$\delta r_{O12,y} = \delta\theta_1 \cdot 3 = \delta\theta_2 \cdot 3 \rightarrow \delta\theta_1 = \delta\theta_2$

$\delta A = -Y_B \cdot (6 \cdot \delta\theta_2) - 60 \cdot (3 \cdot \delta\theta_1) = 0$

$\rightarrow$ $Y_B = -30.0$

X_B =? (zad. 2)



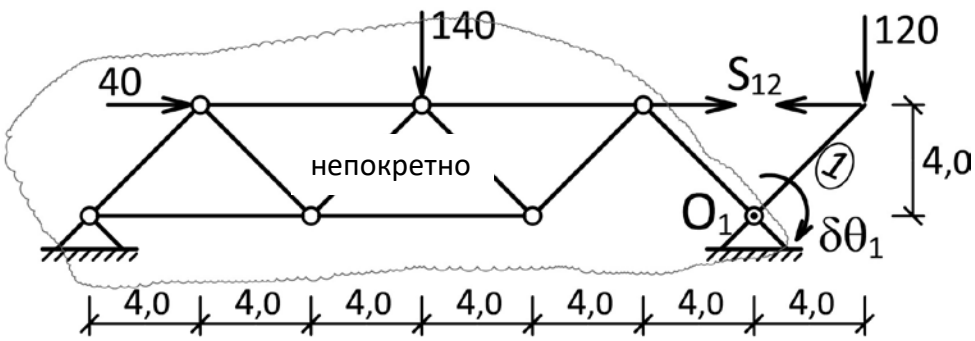
$\delta r_{O12,y} = \delta\theta_1 \cdot 20 = \delta\theta_2 \cdot 4$

$\rightarrow$ $\delta\theta_1 = 0.2 \cdot \delta\theta_2$

$\delta A = 40 \cdot (4 \cdot \delta\theta_1) + 140 \cdot (12 \cdot \delta\theta_1) - 120 \cdot (4 \cdot \delta\theta_2) - X_B \cdot (4.8 \cdot \delta\theta_2) = 0$

$-4.8 \cdot X_B \cdot \delta\theta_2 - 112 \cdot \delta\theta_2 = 0$ $\rightarrow$ $X_B = -23.33$

S_{12} =? (zad. 2)



$\delta A = -S_{12} \cdot (4 \cdot \delta\theta_1) + 120 \cdot (4 \cdot \delta\theta_1) = 0$

$\rightarrow$ $S_{12} = 120.0$