

TEHNIČKA MEHANIKA

Inženjerstvo zaštite životne sredine

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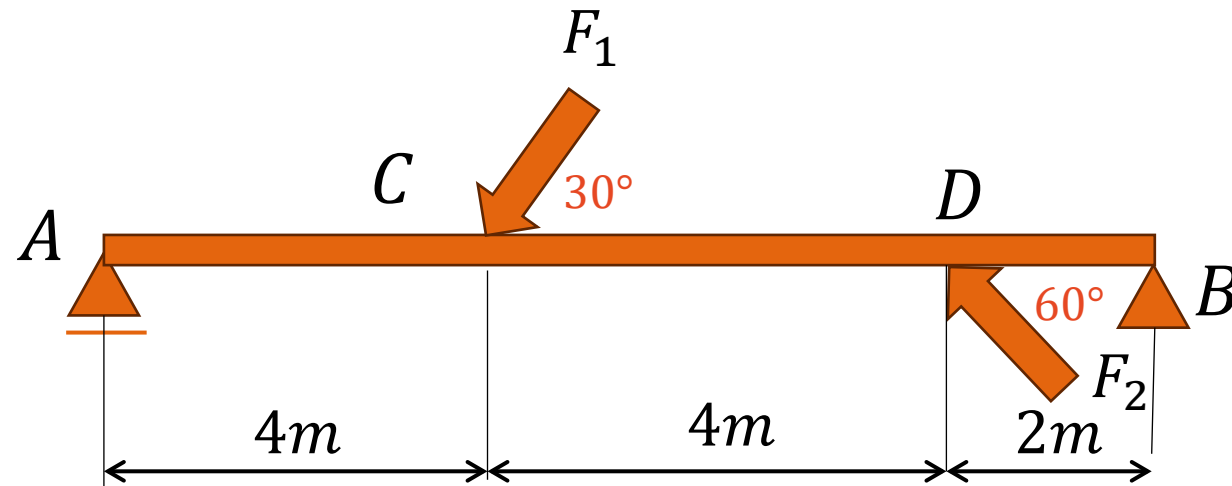
Gordana Jović

Profesor:

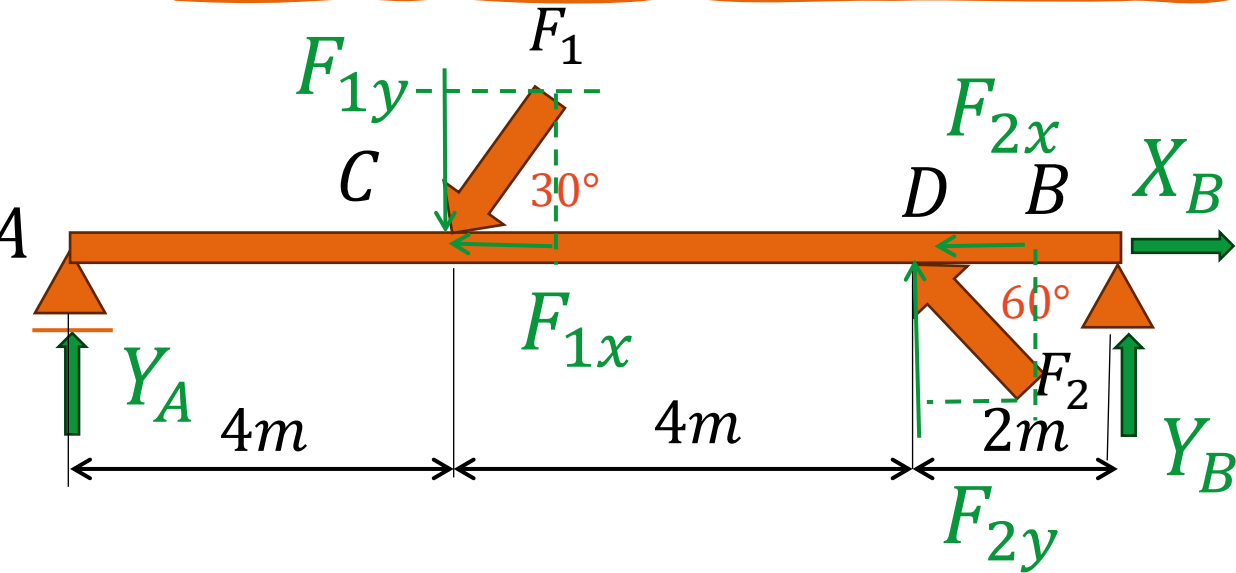
Boban Cvetanović

ZADATAK 1.

- Neka je prosta greda AB dužine 10m, u tačkama C i D opterećena koncentrisanim silama $F_1 = 12kN$ i $F_2 = 20 kN$, prema slici. Analitičkim putem odrediti otpore oslonaca.



ZADATAK 3.



$$F_{1x} = F_1 * \cos 30 = 6\sqrt{3} \text{ kN}$$

$$F_{1y} = F_1 * \sin 30 = 6 \text{ kN}$$

$$F_{2x} = F_2 * \cos 60 = 10 \text{ kN}$$

$$F_{2y} = F_2 * \sin 60 = 10\sqrt{3} \text{ kN}$$

ZADATAK 1.

Diagram of a beam structure with forces and dimensions. The beam has a total length of 10m. At point A (left end), there is a pin support with reaction force Y_A acting upwards. At point B (right end), there is a roller support with reaction force Y_B acting upwards. At point C, 4m from A, a force F_1 acts downwards at a 30° angle to the horizontal. Its components are F_{1x} (horizontal, to the left) and F_{1y} (vertical, down). At point D, 4m from C (8m from A), a force F_2 acts downwards at a 60° angle to the horizontal. Its components are F_{2x} (horizontal, to the left) and F_{2y} (vertical, down). At point B, there is also a horizontal reaction force X_B acting to the right. Distances are marked: 4m from A to C, 4m from C to D, and 2m from D to B.

Equations for horizontal equilibrium:

$$\sum_{i=1}^n X_i = 0$$

$$X_B - F_{1x} - F_{2x} = 0$$

$$X_B = F_{1x} + F_{2x}$$

$$X_B = 30,78 \text{ kN}$$

Equations for vertical equilibrium:

$$\sum_{i=1}^n Y_i = 0$$

$$Y_B + F_{2y} - F_{1y} + Y_A = 0$$

$$Y_B + Y_A = F_{1y} - F_{2y}$$

$$Y_B + Y_A = -11,32$$

Equation for moment equilibrium about point A:

$$\sum_{i=1}^n M_A = 0$$

$$+Y_B * 10m + F_{2y} * 8m - F_{1y} * 4m = 0$$

$$Y_B * 10 = -F_{2y} * 8 + F_{1y} * 4$$

$$Y_B = \frac{-F_{2y} * 8 + F_{1y} * 4}{10}$$

$$Y_B = -11,456 \text{ kN}$$

Final calculation for Y_A :

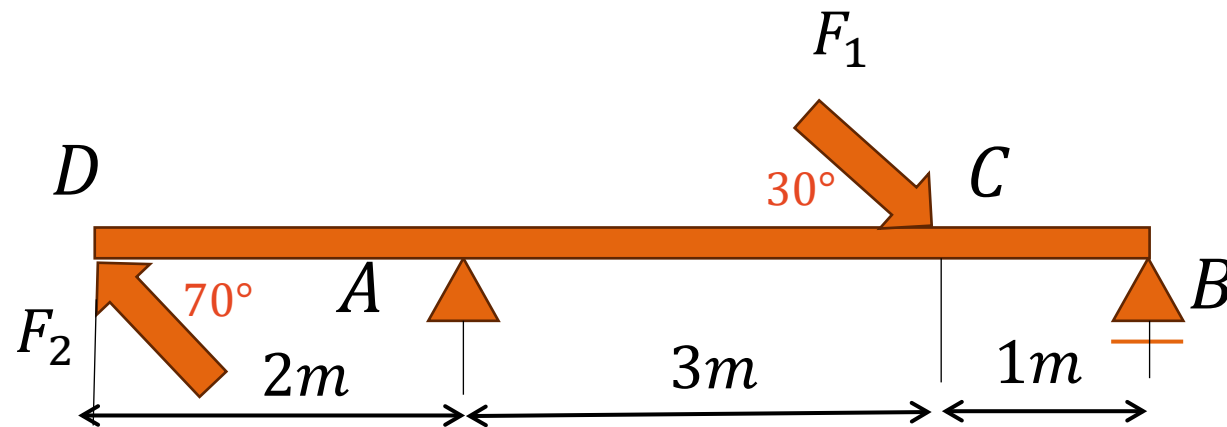
$$Y_A = -11,32 - Y_B$$

$$Y_A = -11,32 + 11,456$$

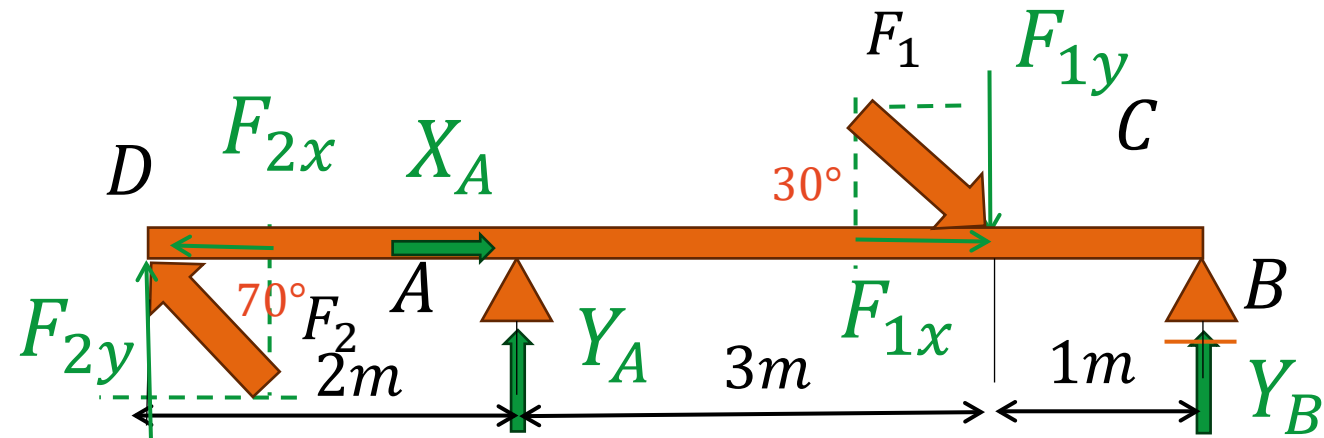
$$Y_A = 0,136 \text{ kN}$$

ZADATAK 2.

- Neka je prosta greda AB dužine 6m, u tačkama C i D opterećena kosom koncentrisanom silom $F_1 = 10kN$ i $F_2 = 40kN$, prema slici. Analitičkim putem odrediti otpore oslonaca.



ZADATAK 2.



$$F_{1x} = F_1 * \cos 30 = 5\sqrt{3} \text{ kN}$$

$$F_{1y} = F_1 * \sin 30 = 5 \text{ kN}$$

$$F_{2x} = F_2 * \cos 70 = 13,68 \text{ kN}$$

$$F_{2y} = F_2 * \sin 70 = 37,58 \text{ kN}$$

ZADATAK 2.

Diagram of a beam structure with forces and dimensions. The beam has points D, A, C, and B. At D, a force F_2 is applied at 70° . At A, a horizontal reaction force X_A and a vertical reaction force Y_A are shown. At C, a force F_1 is applied at 30° . At B, a vertical reaction force Y_B is shown. Dimensions are 2m between D and A, 3m between A and C, and 1m between C and B.

Equations for horizontal equilibrium:

$$\sum_{i=1}^n X_i = 0$$

$$X_A + F_{1x} - F_{2x} = 0$$

$$X_A = -F_{1x} + F_{2x}$$

$$X_A = 5,019 \text{ kN}$$

Equations for vertical equilibrium:

$$\sum_{i=1}^n Y_i = 0$$

$$Y_B + F_{2y} - F_{1y} + Y_A = 0$$

$$Y_B + Y_A = F_{1y} - F_{2y}$$

$$Y_B + Y_A = -32,58$$

Equation for moment equilibrium about point A:

$$\sum_{i=1}^n M_A = 0$$

$$+Y_B * 4m - F_{2y} * 2m - F_{1y} * 3m = 0$$

$$Y_B * 4 = F_{2y} * 2 + F_{1y} * 3$$

$$Y_B = \frac{F_{2y} * 2 + F_{1y} * 3}{4}$$

$$Y_B = 22,54 \text{ kN}$$

Final calculation for Y_A :

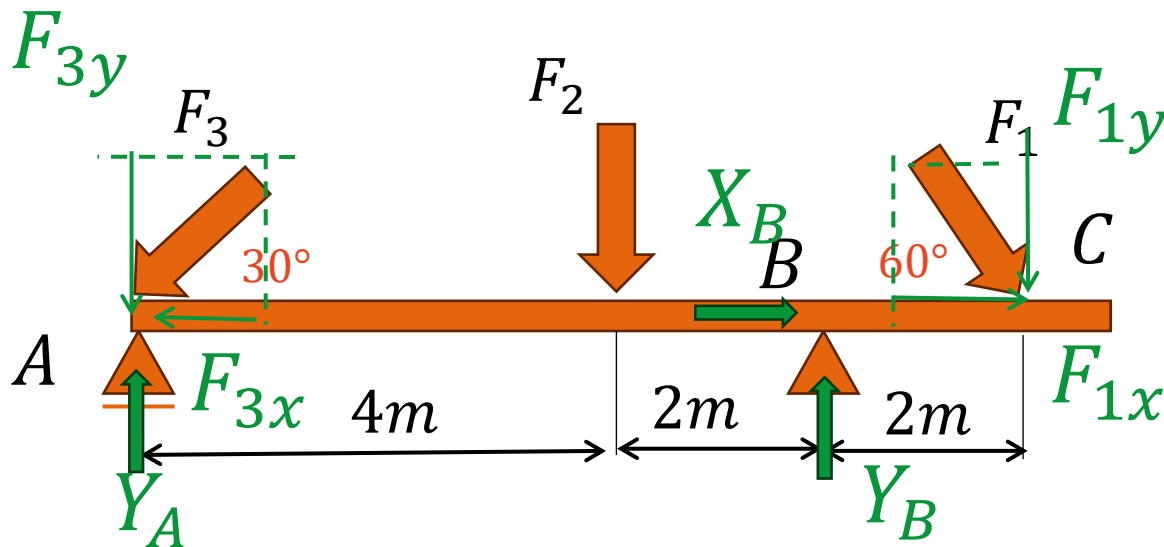
$$Y_A = -32,58 - Y_B$$

$$Y_A = -32,58 - 22,54$$

$$Y_A = -55,12 \text{ kN}$$

ZADATAK 3.

- Neka je prosta greda AB, opterećena koncentrisanim silama $F_1 = 10\text{ kN}$, $F_2 = 6\text{ kN}$, $F_3 = 16\text{ kN}$ prema slici. Analitičkim putem odrediti otpore oslonaca.



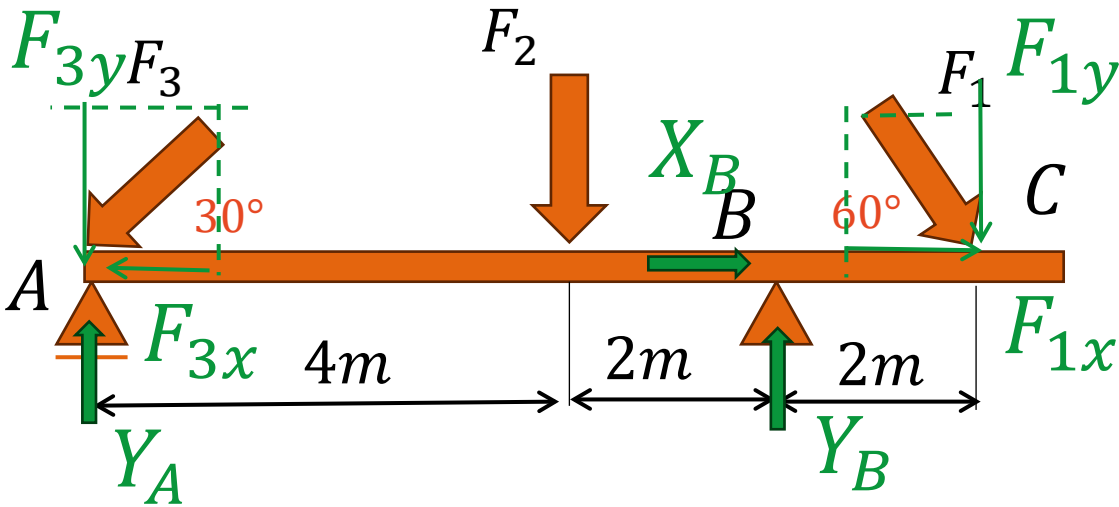
$$F_{1x} = F_1 * \cos 60 = 5\text{ kN}$$

$$F_{1y} = F_1 * \sin 60 = 8,66\text{ kN}$$

$$F_{3x} = F_3 * \cos 30 = 13,85\text{ kN}$$

$$F_{3y} = F_3 * \sin 30 = 8\text{ kN}$$

ZADATAK 3.



$$\sum_{i=1}^n Y_i = 0$$

$$Y_B - F_{1y} - F_2 - F_{3y} + Y_A = 0$$

$$Y_B + Y_A = F_{1y} + F_2 + F_{3y}$$

$$Y_B + Y_A = 22,66$$

$$Y_A = 22,66 - Y_B$$

$$Y_A = 22,66 - 15,547$$

$$Y_A = 7,113 \text{ kN}$$

$$\sum_{i=1}^n M_A = 0$$

$$Y_B * 6m - F_{1y} * 8m - F_2 * 4m = 0$$

$$Y_B * 6 = F_{1y} * 8 + F_2 * 4$$

$$Y_B = \frac{F_{1y} * 8 + F_2 * 4}{6}$$

$$Y_B = \frac{8,66 * 8 + 6 * 4}{6}$$

$$Y_B = 15,547 \text{ kN}$$

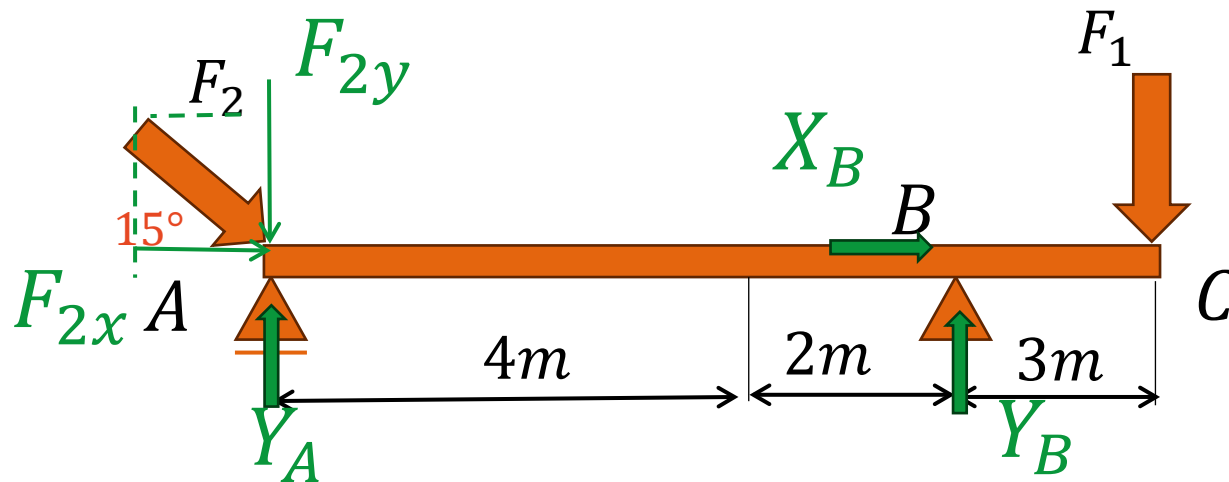
$$\sum_{i=1}^n X_i = 0$$

$$X_B - F_{3x} + F_{1x} = 0$$

$$X_B = F_{3x} - F_{1x} = 8,85 \text{ kN}$$

ZADATAK 4.

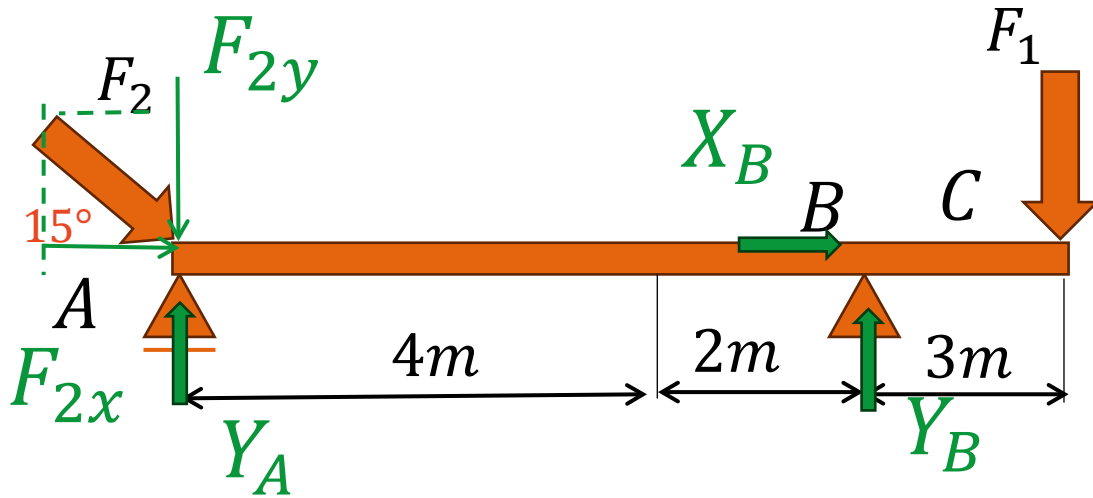
- Neka je prosta greda AB, opterećena koncentrisanim silama $F_1 = 16\text{ kN}$, $F_2 = 21\text{ kN}$, $F_3 = 12\text{ kN}$ prema slici. Analitičkim putem odrediti otpore oslonaca.



$$F_{2x} = F_2 * \cos 15 = 20,284\text{ kN}$$

$$F_{2y} = F_2 * \sin 15 = 5,435\text{ kN}$$

ZADATAK 4.



$$\sum_{i=1}^n X_i = 0$$

$$X_B + F_{2x} = 0$$

$$X_B = -F_{2x} = -20,284 \text{ kN}$$

$$\sum_{i=1}^n Y_i = 0$$

$$Y_B - F_{2y} - F_1 + Y_A = 0$$

$$Y_B + Y_A = F_1 + F_{2y}$$

$$Y_B + Y_A = 21,435$$

$$Y_A = 21,435 - Y_B$$

$$Y_A = 21,435 - 24$$

$$Y_A = -2,565 \text{ kN}$$

$$\sum_{i=1}^n M_A = 0$$

$$Y_B * 6m - F_1 * 9m = 0$$

$$Y_B * 6 = F_1 * 9$$

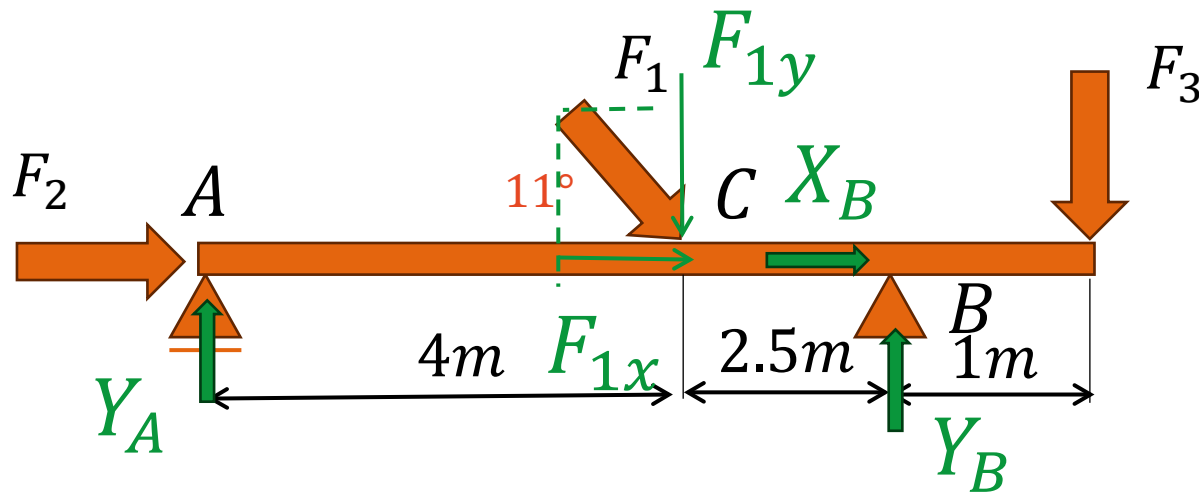
$$Y_B = \frac{F_1 * 9}{6}$$

$$Y_B = \frac{16 * 9}{6}$$

$$Y_B = 24 \text{ kN}$$

ZADATAK 5.

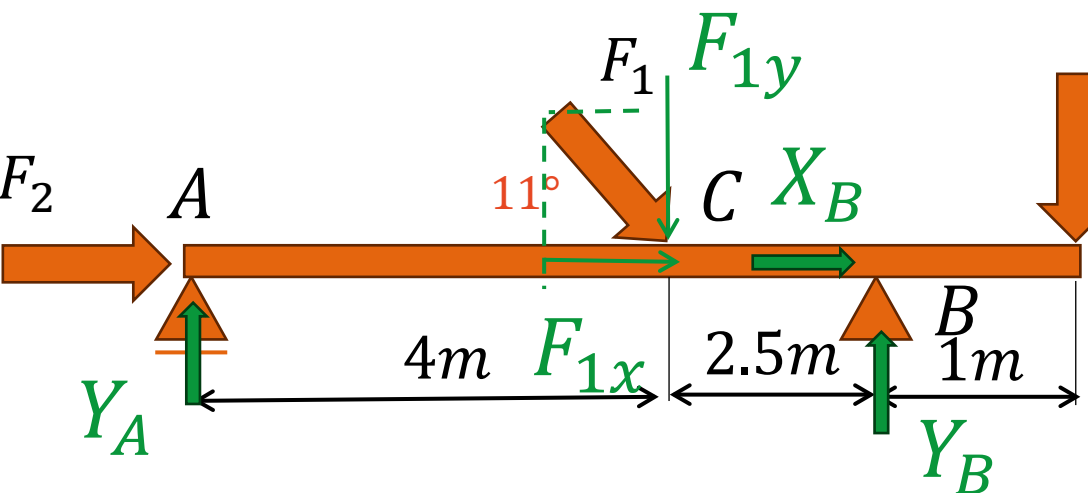
- Neka je prosta greda AB, opterećena koncentrisanim silama $F_1 = 19\text{ kN}$, $F_2 = 9\text{ kN}$, $F_3 = 24\text{ kN}$ prema slici. Analitičkim putem odrediti otpore oslonaca.



$$F_{1x} = F_1 * \cos 11 = 18,65\text{ kN}$$

$$F_{1y} = F_1 * \sin 11 = 3,625\text{ kN}$$

ZADATAK 5.



$$\sum_{i=1}^n Y_i = 0$$

$$Y_B - F_{1y} - F_3 + Y_A = 0$$

$$Y_B + Y_A = F_{1y} + F_3$$

$$Y_B + Y_A = 27,625$$

$$Y_A = 27,625 - Y_B$$

$$Y_A = 27,625 - 29,923$$

$$Y_A = -2,298 \text{ kN}$$

$$\sum_{i=1}^n X_i = 0$$

$$X_B + F_{1x} + F_2 = 0$$

$$X_B = -F_{1x} - F_2 = -27,65 \text{ kN}$$

$$\sum_{i=1}^n M_A = 0$$

$$Y_B * 6,5\text{m} - F_{1y} * 4\text{m} - F_3 * 7,5 = 0$$

$$Y_B * 6,5 = F_{1y} * 4 + F_3 * 7,5$$

$$Y_B = \frac{F_{1y} * 4 + F_3 * 7,5}{6,5}$$

$$Y_B = \frac{3,625 * 4 + 24 * 7,5}{6,5}$$

$$Y_B = 29,923 \text{ kN}$$

HVALA NA PAŽNJI!

PITANJA?