OTPORNOST MATERIJALA

VEŽBE BR. 1

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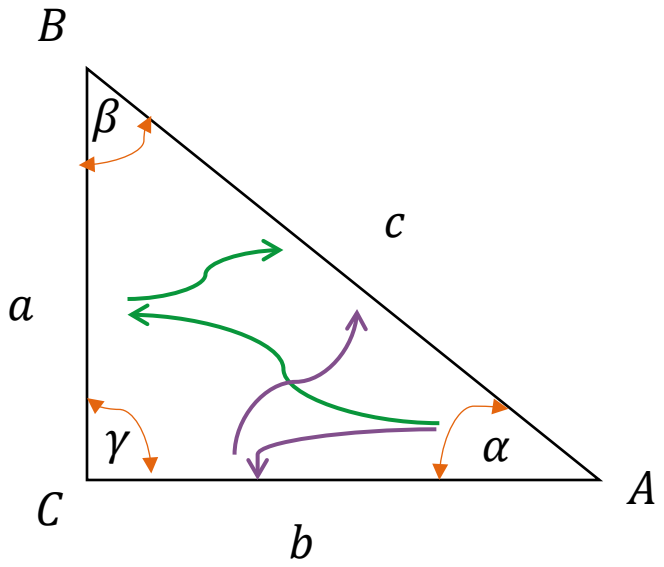
FORMULE



Pitagorina teorema:

$c^2 = a^2 + b^2$

Površina trougla:

$$P = \frac{a * b}{2} \qquad P = \frac{a * h_a}{2} = \frac{b * h_b}{2} = \frac{c * h_c}{2}$$

$\alpha + \beta + \gamma = 180°$

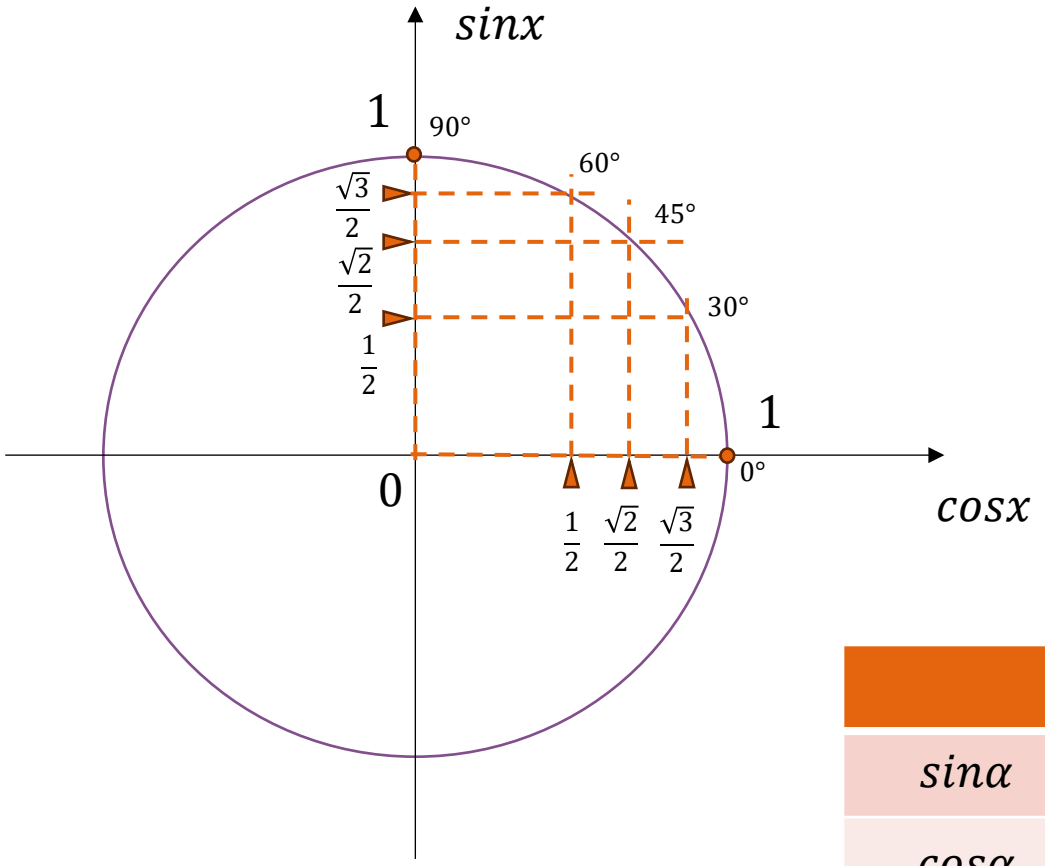
$$sin\alpha = \frac{a}{c} \quad \begin{matrix} \textit{naspramna stranica} \\ \textit{hipotenuza} \end{matrix}$$

$$cos\alpha = \frac{b}{c} \quad \begin{matrix} \textit{nalegla stranica} \\ \textit{hipotenuza} \end{matrix}$$

$$sin\beta = \frac{b}{c} \qquad cos\beta = \frac{a}{c}$$

$$tg\alpha = \frac{sin\alpha}{cos\alpha} \qquad ctg\alpha = \frac{cos\alpha}{sin\alpha}$$

TRIGONOMETRIJSKI KRUG



	0°	30°	45°	60°	90°
$sin\alpha$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$cos\alpha$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0

FORMULE

Jedinice:

$1\,mm = 0.1\,cm$

$1kg = 10\ N \approx 9.81\ N$

$1t = 10\ kN$

$1kN = 1000\ N$

$1000kg = 10.000\ N$

$1\,cm = 0.01\ m$

$1\,mm = 0.001\ m$

$1t = 1000\ kg$

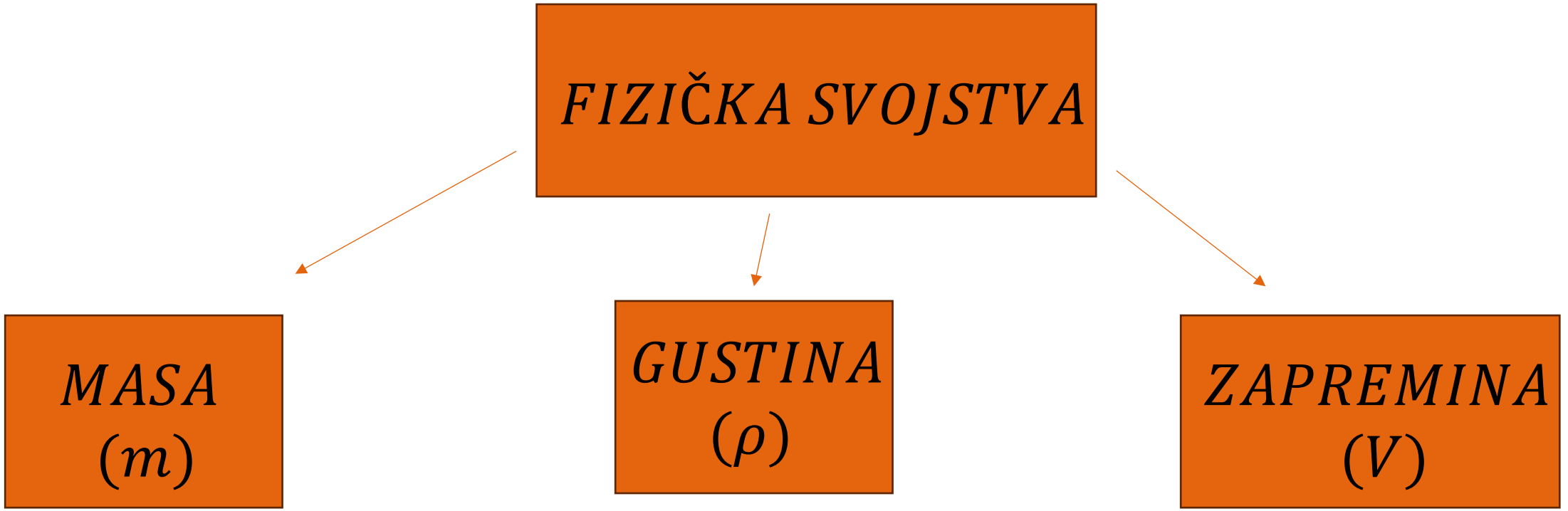
$1dm = 10\ cm$

OSOBINE MATERIJALA

Materijal ima

- *FIZIČKA*
- *HEMIJSKA*
- *TEHNOLOŠKA*
- *MEHANIČKA*

OSOBINE MATERIJALA



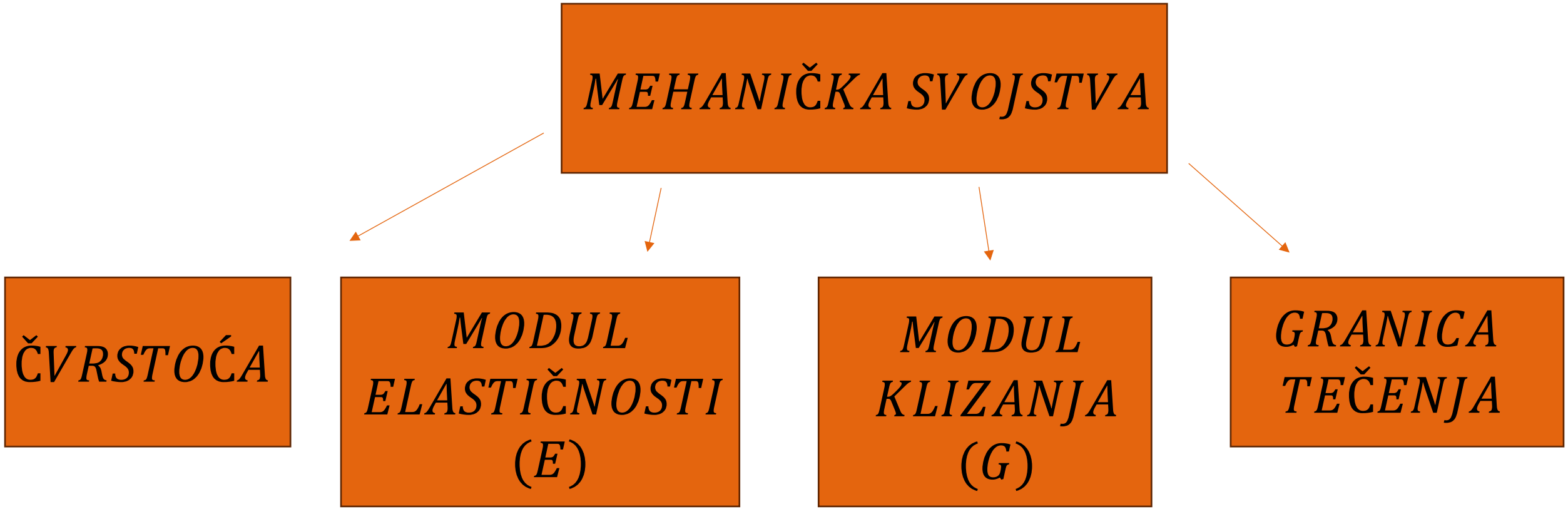
OSOBINE MATERIJALA

$$\rho = \frac{m}{V} \left[\frac{\mathrm{g}}{\mathrm{cm}^3}\right]$$

Tablica gustina

Supstanca	kg/m³	g/cm³	t/m³
Aluminijum	2700	2,7	2,7
Gvožđe	7800	7,8	7,8
Olovo	11300	11,3	11,3
Srebro	10500	10,5	10,5
Voda	1000	1	1
Led	900	0,9	0,9
Ulje	800	0,8	0,8
Alkohol	700	0,7	0,7
Drvo	700	0,7	0,7

OSOBINE MATERIJALA



SILA

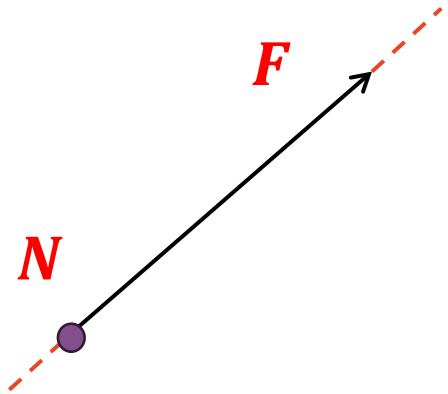
SILA

Pod silom se podrazumeva svaki uzrok koji može da izazove promenu stanja mirovanja ili stanja kretanja jednog tela.

$$\boldsymbol{F = m * a \ \ [N]}$$

Sila je vektorska veličina i određena je:

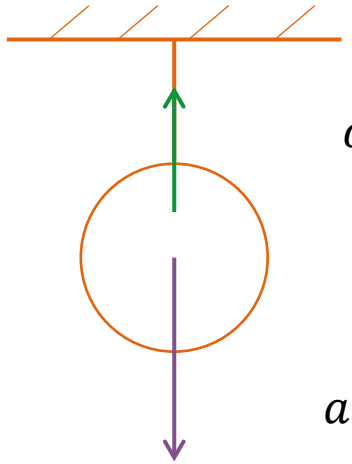
- *pravcem dejstva*
- *smerom dejstva*
- *intenzitetom*



SILA

Aktivne sile – u stanju su da izazovu ili izmene kretanje.

Pasivne sile – ili otporne sile – sprečavaju kretanje.

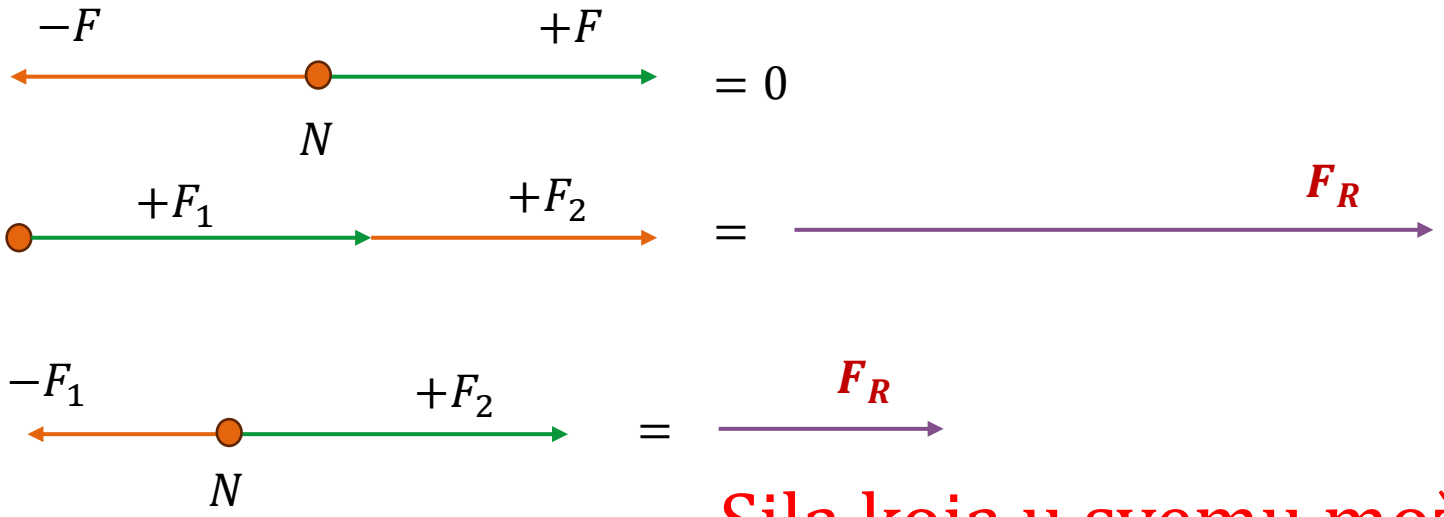


otporna sila – sila u užetu

aktivna sila – sila zemljine teže

SILA

Kolinearne sile – dejstvuju u istom pravcu

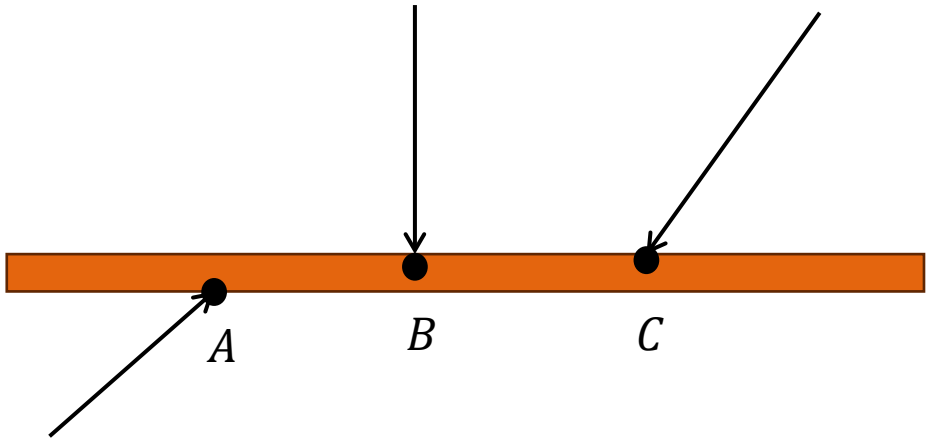


Sila koja u svemu može da zameni dejstvo više pojedinačnih sila, naziva se REZULTANTA.

SILA

VRSTE OPTEREĆENJA PREMA OBLIKU

KONCENTRISANA



KONTINUALNA

ZADACI

ZADATAK 1.

Kolika je gustina tela mase 20g, ako je njegova zapremina 50 cm^3.

Podaci:

$m = 20\ g$

$V = 50\ cm^3$

$\rho = ?$

$$\rho = \frac{m}{V}$$

$$\rho = \frac{20}{50} \longrightarrow \rho = 0.4\ \frac{g}{cm^3}$$

ZADATAK 2.

Ko ima veću zapreminu, telo od olova mase 226 grama ili telo od srebra mase 210 grama? (Gustina olova iznosi 11300 kg/m³, a gustina srebra 10500 kg/m³).

Podaci:

$m_o = 226\ g$

$m_s = 210\ g$

$\rho_o = 11300\,\frac{kg}{m^3}$

$\rho_s = 10500\,\frac{kg}{m^3}$

$$\rho = \frac{m}{V}$$

$$V = \frac{m}{\rho}$$

$$V_o = \frac{m_o}{\rho_o}$$

$$V_o = \frac{0.226}{11300}$$

$$V_o = 0.00002m^3$$

$$V_s = \frac{m_s}{\rho_s}$$

$$V_s = \frac{0.210}{10500}$$

$$V_s = 0.00002m^3$$

ZADATAK 3.

Kanap može da izdrži teret težine 100 N. Može li se tim kanapom podići drvena daska čije su dimenzije 7m, 3dm i 4 cm?

Podaci:

$F = 100\ N$

$a = 7\ m$

$b = 3\ dm \longrightarrow = 0.3\ m$

$c = 4\ cm \longrightarrow = 0.04\ m$

$\rho_d = 700 \frac{kg}{m^3}$

$$V = a * b * c$$

$$V = 7 * 0.3 * 0.04$$

$$V = 0.084\ m^3$$

težina?

$$F = \mathrm{m} * \mathrm{a} \longrightarrow a = g = 9.81 \frac{m}{s^2}$$

$$\rho = \frac{m}{V}$$

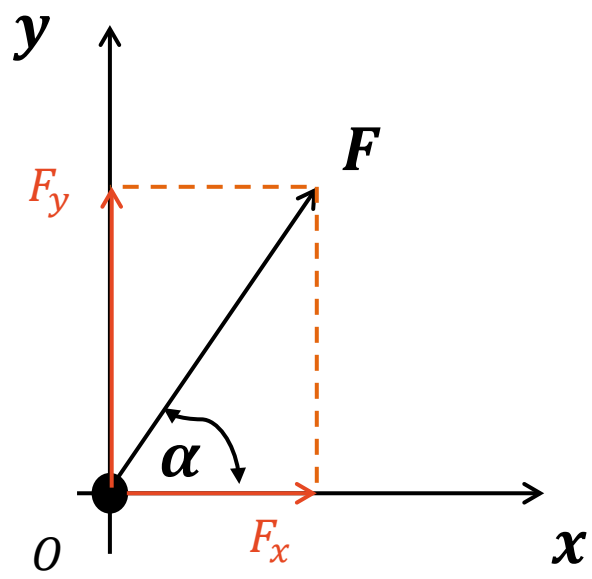
$$m = \rho_d * V$$

$$m = 700 * 0.084 = 56\ \mathrm{kg}$$

$$F = \mathrm{m} * \mathrm{a} \longrightarrow F = 549.36\mathrm{N}$$

PROJEKCIJA SILE NA X I Y OSU

ZADATAK 4.



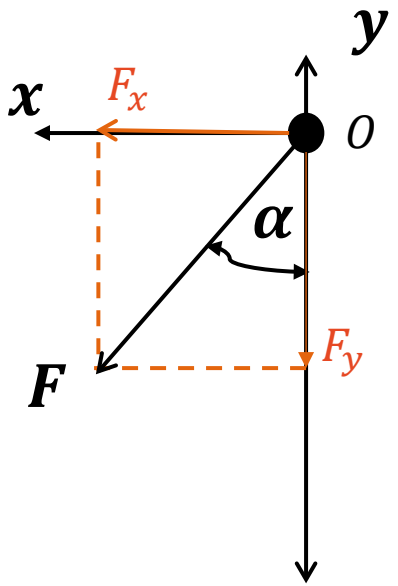
$F_x = ? \; ; F_y = ?$

$$cos\alpha = \frac{F_x}{F} \longrightarrow F_x = F * cos\alpha$$

$$sin\alpha = \frac{F_y}{F} \longrightarrow F_y = F * sin\alpha$$

ZADATAK 5.

Izračunati intenzitete komponenti sile F, ako je $F = 10N, \alpha = 30°$.



$F_x = ?\,; F_y = ?$

$$F_x = F * sin\alpha$$

$$F_x = 10 * sin30°$$

$$F_x = 10 * \frac{1}{2}$$

$$F_x = 5\ N$$

$$F_y = F * cos\alpha$$

$$F_y = 10 * cos30°$$

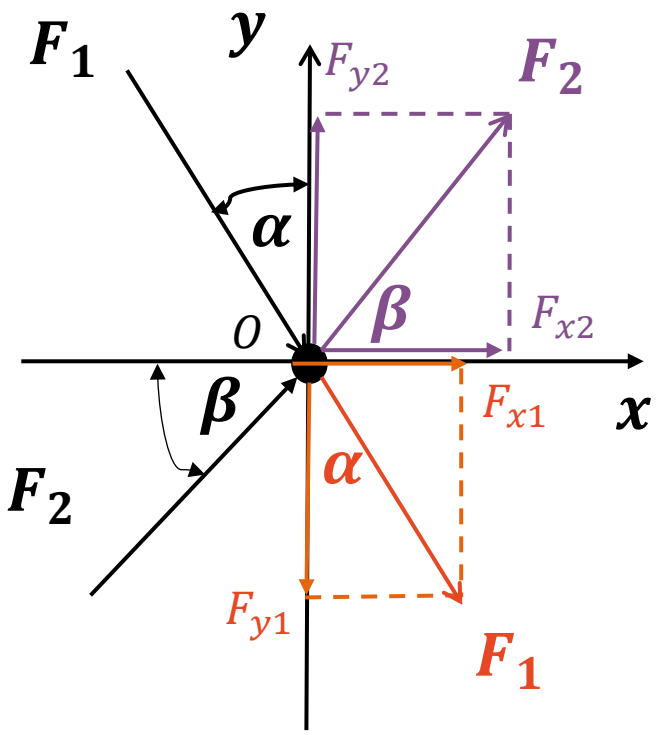
$$F_y = 10 * \frac{\sqrt{3}}{2}$$

$$F_y = 5\sqrt{3}\mathrm{N}$$

ZADATAK 6.

Izračunati intenzitete komponenti sila F_1 *i* F_2*, ako je* $F_1 = 12N, F_2 = 8N, \alpha = 30°, \beta = 60°.$

$F_{x1} = ?\,; F_{y1} = ?\,; F_{x2} = ?\,; F_{y2} = ?$



$$sin\alpha = \frac{F_{1x}}{F_1}$$

$$F_{1x} = F_1 * sin\alpha$$

$$F_{1x} = 12 * sin30°$$

$$F_{1x} = 12 * \frac{1}{2}$$

$F_{1x} = 6\ N$

$$cos\alpha = \frac{F_{1y}}{F_1}$$

$$F_{1y} = F_1 * cos\alpha$$

$$F_{1y} = 12 * cos30°$$

$$F_{1y} = 12 * \frac{\sqrt{3}}{2}$$

$F_{1y} = 6\sqrt{3}\text{N}$

$$F_{2x} = F_2 * cos\beta$$

$$F_{2x} = 8 * cos60°$$

$$F_{2x} = 8 * \frac{1}{2}$$

$F_{2x} = 4\text{N}$

$$F_{2y} = F_2 * sin\beta$$

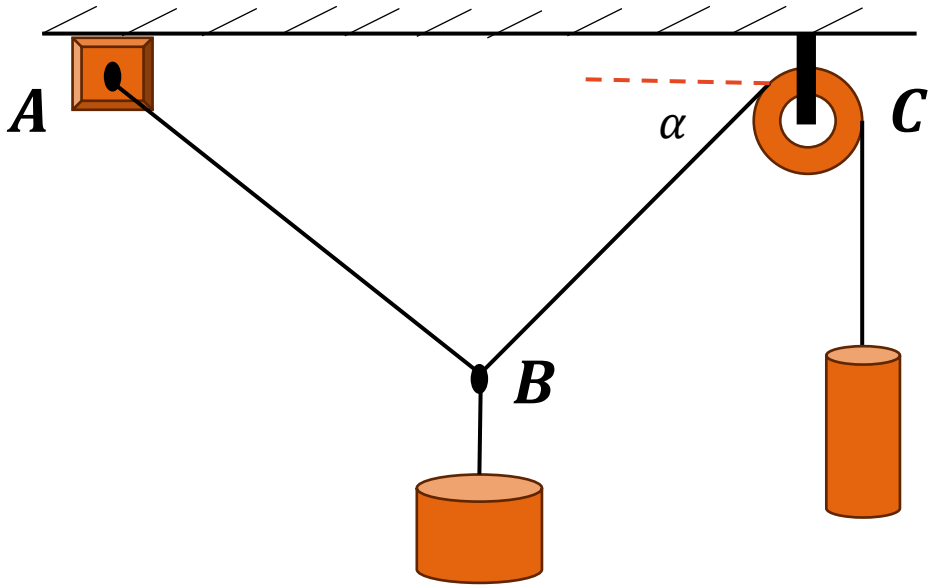
$$F_{2y} = 8 * sin60°$$

$$F_{2y} = 8 * \frac{\sqrt{3}}{2}$$

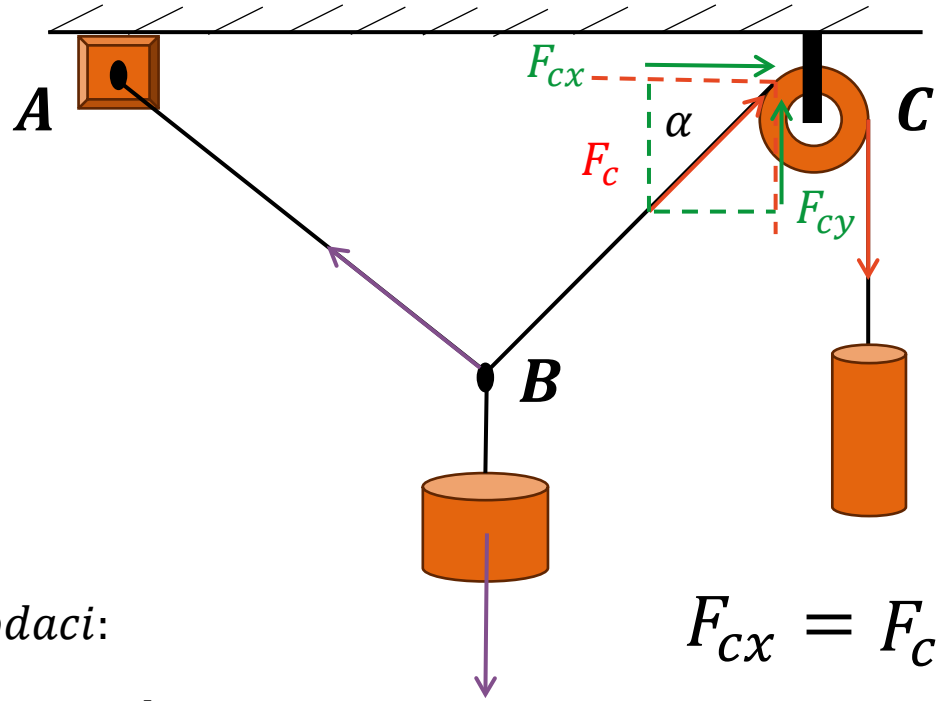
$F_{2x}y \quad 4\sqrt{3}\text{N}$

ZADATAK 7.

- Za sistem prikazan na slici, potrebno je odrediti komponente sile u užetu BC. Ako je težina tela u tački B =*30kg* a u tački C =*78kg*, ugao $\alpha = 30°$.



ZADATAK 7.



$$F_c = m_c * \mathrm{a} \longrightarrow a = g = 9.81\ \frac{m}{s^2}$$

$$F_c = 78 * 9.81$$

$$F_c = 765.18\ N$$

Podaci:

$m_b = 30\ kg$

$m_c = 78\ kg$

$\alpha = 30°$

$F_{cx} = ?\quad F_{cy} = ?$

$$F_{cx} = F_c * cos\alpha$$

$$F_{cx} = 765.18 * cos30$$

$$F_{cx} = 662.665\ N$$

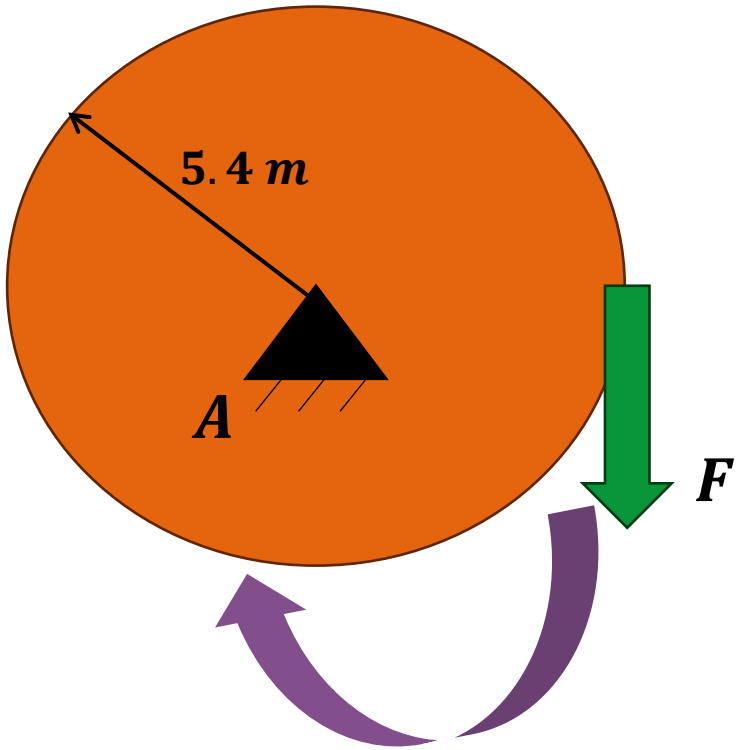
$$F_{cy} = F_c * sin\alpha$$

$$F_{cy} = 765.18 * sin30$$

$$F_{cy} = 382.59\ N$$

ZADATAK 8.

- Odrediti momente za tačku A, ako je $\boldsymbol{F = 23N}$.



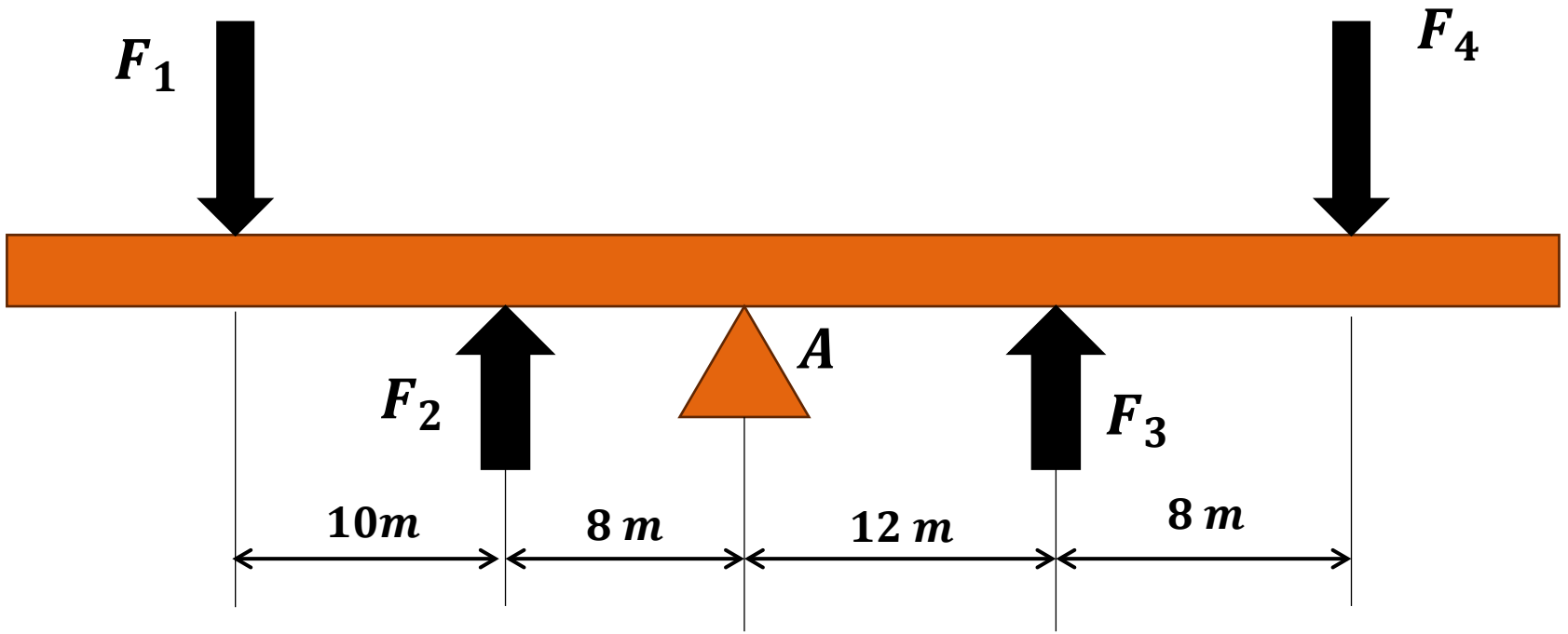
$$\boldsymbol{M_A = -F * 5.4}$$

$$\boldsymbol{M_A = -23 * 5.4}$$

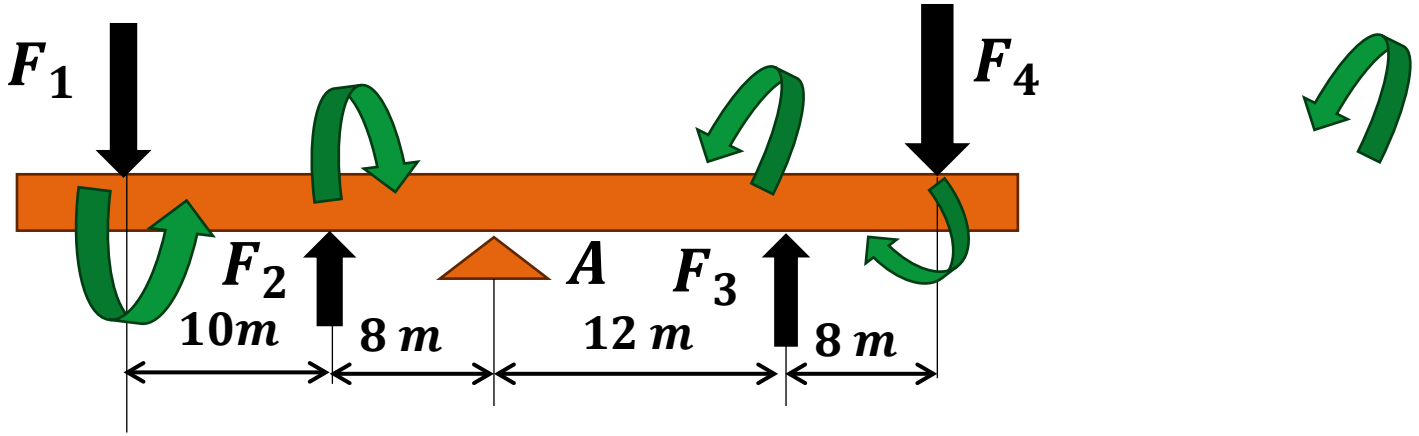
$$\boldsymbol{M_A = -124.2\ Nm}$$

ZADATAK 9.

- Odrediti veličine i smerove momenata od sila, za tačku A. Ako su poznate sile $\boldsymbol{F_1 = 10N, F_2 = 20N, F_3 = 8N, F_4 = 19N}$.



ZADATAK 9.



Podaci:

$F_1 = 10N$

$F_2 = 20N$

$F_3 = 8N$

$F_4 = 19N$

$$M_A = -F_4 * 20 + F_3 * 12 - F_2 * 8 + F_1 * 18$$

$$M_A = -19 * 20 + 8 * 12 - 20 * 8 + 10 * 18$$

$$M_A = -264\ Nm$$

Greda će se okrenuti na desnu stranu.

ZADATAK 10.

Masa prazne menzure je 40 grama. Kada su u nju sipa 8cm³ neke tečnosti masa menzure sa tečnošću iznosi 46,4 grama. Kolika je gustina te tečnosti?

Podaci:

$m_m = 40\ g$

$V = 8\ cm^3$

$m_{m+t} = 46.4\ g$

$\rho = ?$

$$\rho = \frac{m}{V}$$

$$m_m = m_{m+t} - m_m$$

$$m_m = 46.4 - 40$$

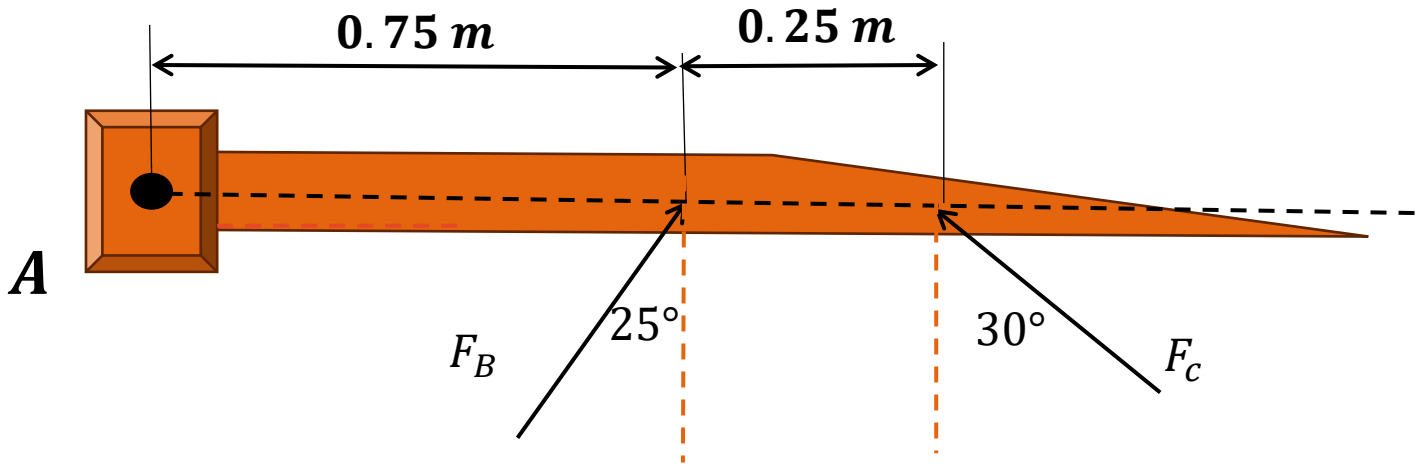
$$m_m = 6.4\ g$$

$$\rho = \frac{6.4}{8}$$

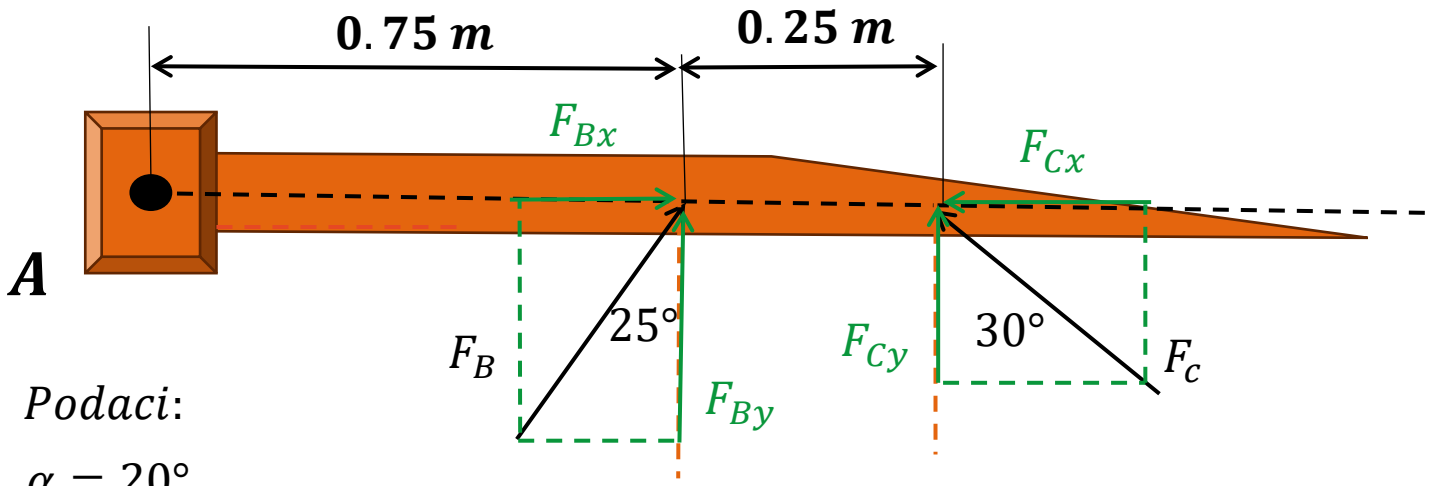
$$\rho = 0.8\ \frac{g}{cm^3}$$

ZADATAK 11.

- Odrediti momente za tačku A, od svake sile pojedinačno ako su $\boldsymbol{F_c = 230N, F_B = 180N}$



ZADATAK 11.



Podaci:

$\alpha = 20°$

$\boldsymbol{F_c = 230N}$

$\boldsymbol{F_B = 180N}$

Sile koje prave moment za tačku A:

$F_{By} = F_B * cos25°$

$F_{Cy} = F_C * cos30°$

$\boldsymbol{M_A} = F_{Cy} * 1 + F_{By} * 0.75$

$\boldsymbol{M_A} = 230 * cos30 * 1 + 180 * cos25 * 0.75$

$\boldsymbol{M_A} = 321.537\ Nm$

HVALA NA PAŽNJI!