• do sad: $g = \text{const.}$

$g \propto \frac{1}{r^2}$

1. Primenom Ojler-Kromerove metode odrediti domet i maksimalnu visinu kosog hica koji je ispaljen brzinom $v_0 = 100\frac{\text{m}}{\text{s}}$ i pod uglom od $\alpha = 45^o$:

   a) ako na njega deluje samo homogeno polje Zemljine teže; $g = \text{const.}$

   b) ako na njega deluje sila otpora vazduha čiji je intenzitet dat kao:

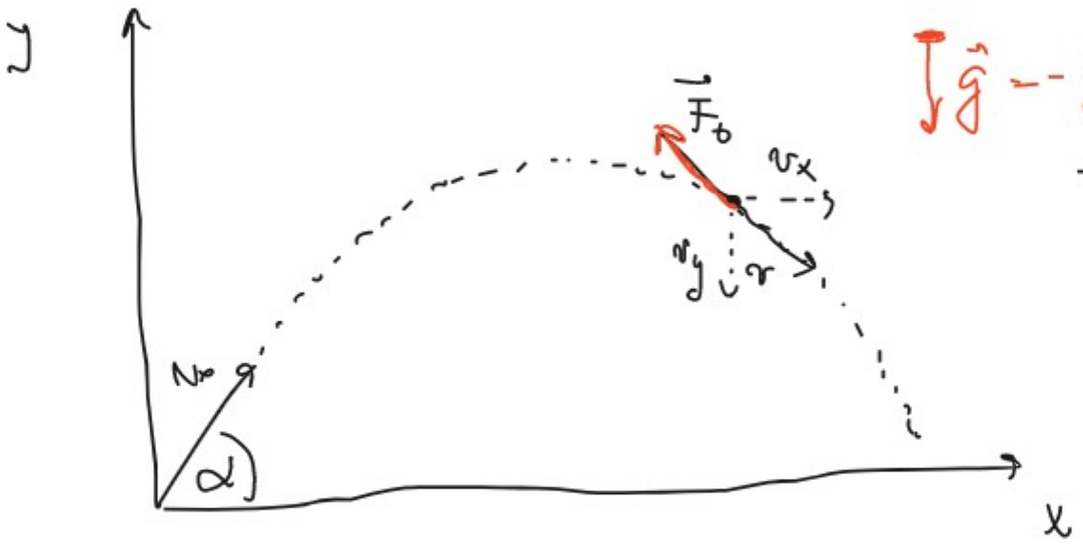
$$\rightarrow \quad \boxed{F_o = -\frac{1}{2} C_o S \rho v^2,}$$

   gde je C_0 koeficijent otpora (zavisi od mnogo faktora poput oblika tela, njegove veličine, brzine kretanja, Mahovog broja...), S je referentna površina tela, a $\rho = 1.23\frac{\text{kg}}{\text{m}^3}$ je gustina atmosfere. Uzeti da je $C_oS = 0.001$, a masa tela m=1kg.
   Prikazati putanje iz oba (a) i b)) primera.

$$F_o = -\frac{1}{2} C_o S \rho v^2$$

• sila otpora → suprotno od pravca kretanja

$$\vec{F_o} = -\frac{1}{2} C_o S \rho v^2 \frac{\vec{v}}{v} \quad (=\vec{o}^*)$$



$\vec{g} = -g\vec{e_y}$

$$\vec{o}^* = -\frac{1}{2} C_o S \rho v (v_x \vec{e_x} + v_y \vec{e_y})$$

$$m\vec{a} = \sum_i \vec{F_i} = m\vec{g} + \vec{F_o}$$

! $v = \sqrt{v_x^2 + v_y^2}$

(x): $ma_x = -\frac{1}{2} C_D S \rho v v_x$

$$\boxed{a_x = -\frac{1}{2m} C_D S \rho v v_x}$$

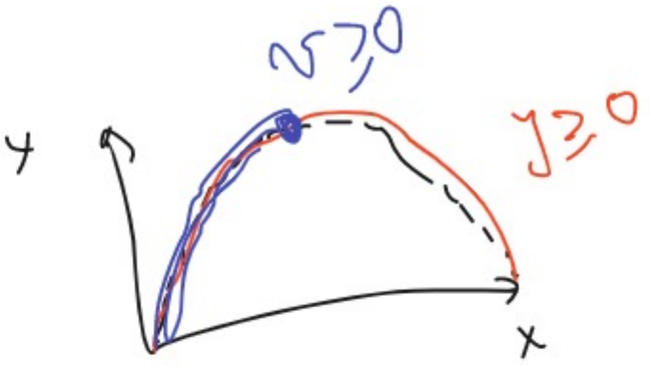
(y): $ma_y = -mg - \frac{1}{2} C_D S \rho v v_y$

$$\boxed{a_y = -g - \frac{1}{2m} C_D S \rho v v_y}$$

a_x, a_y

$$\begin{cases} v(t+\Delta t) = v(t) + a(t)\Delta t \\ r(t+\Delta t) = r(t) + v(t+\Delta t)\Delta t \end{cases}$$

KOSI HITAC



zaisnostud mase: $r\alpha - \frac{1}{m}$

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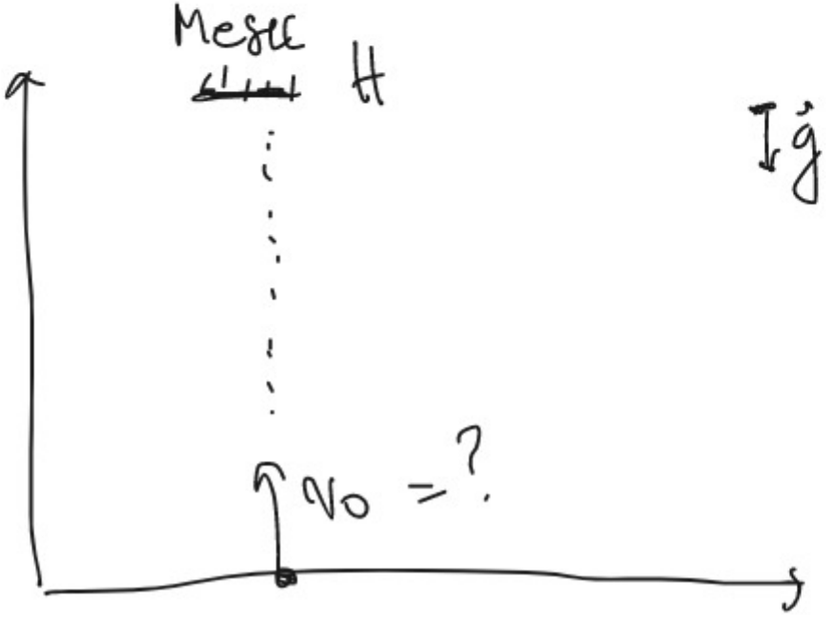
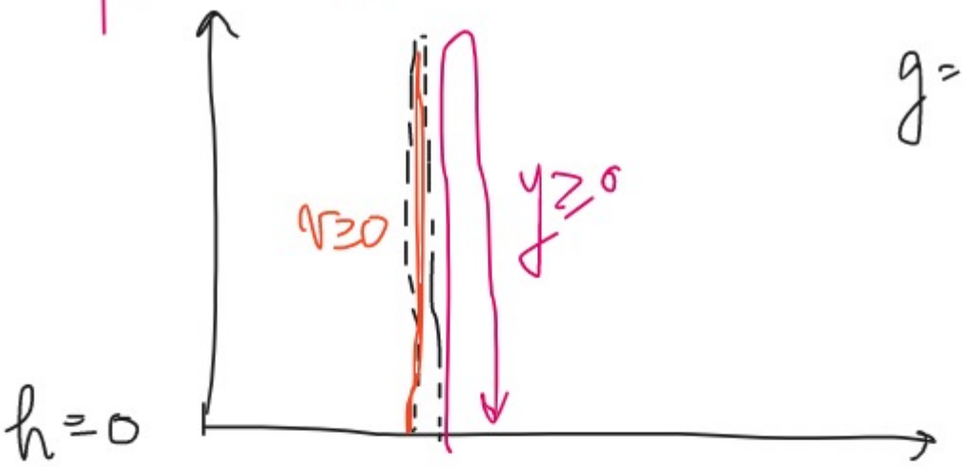
(2)



$I\dot{g} = -g\vec{cg}$

$H = 3{,}84 \cdot 10^8\ m$

prośli zad.



$g = const$

digresija:

$F_z \rightarrow g \propto \frac{1}{r^2}$

$H = 3{,}84 \cdot 10^8\ m$

$g = const. = 9{,}81$

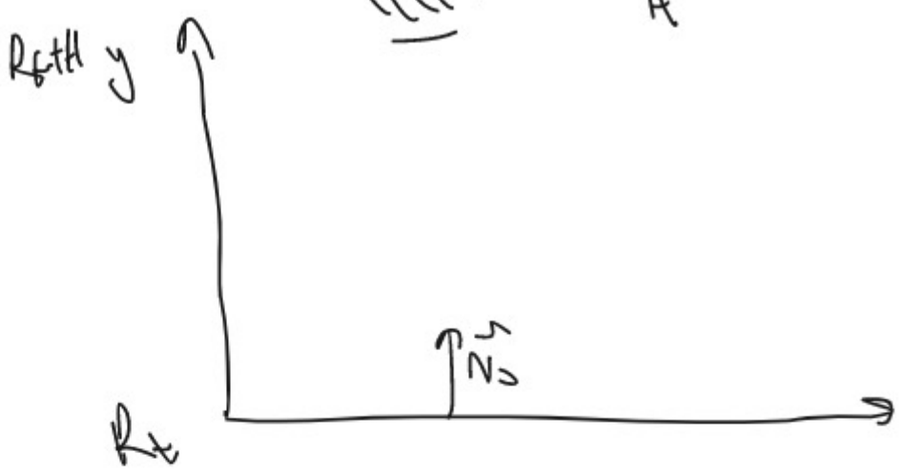
$v_0 = ?$

$$H_{max} = \frac{v_0^2}{2g}$$

$$v_0 = \sqrt{2 g H_{max}} =$$

$$= \sqrt{2 \cdot 9{,}81 \cdot 3{,}84 \cdot 10^8} = 86{,}8\ km/s$$

b)



$$\downarrow \vec{g} = -\frac{\mu M}{r^2}\vec{e_y}$$

$$H_{max} = \frac{v_0^2 R_t^2}{2\mu M - v_0^2 R_t}$$

$$2\mu MH - v_0^2 R_t H = v_0^2 R_t^2$$

$$v_0 = \sqrt{\frac{2\mu MH}{R_t H + R_t^2}}$$

$N_0 \approx 11$ km/s

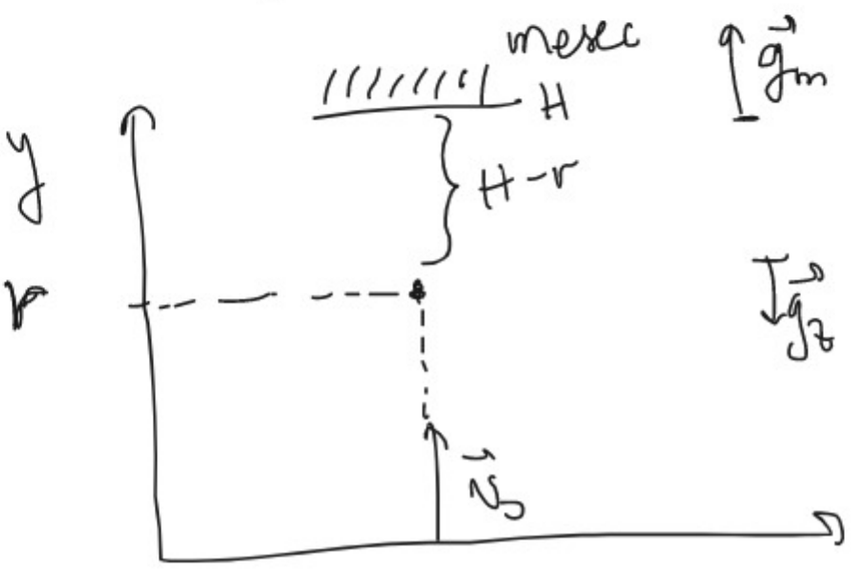
$\gamma = 6{,}67 \cdot 10^{-11} \frac{m^3}{kg s^2}$

$R_z = 6{,}378 \cdot 10^6$ m

$H = 3{,}84 \cdot 10^8$ m

$M = 5{,}97 \cdot 10^{24}$ kg

C) dalsza i M i Z



$\vec{g}_z = -\frac{\gamma M_z}{r^2}$

$\vec{g}_M = +\frac{\gamma M_M}{(H-r)^2}$

$$a = -\frac{\gamma M_з}{r^2} + \frac{\gamma M_м}{(H-r)^2}$$

$$a\,dr = v\,dv$$

$M_м = 7{,}348 \cdot 10^{22}$ кг

$v_0 = ?$ $\qquad v_0 \approx 11$ км/с