# D2.2. KINEMATIKA, KRUŽNA GIBANJA, DINAMIKA

(1.) čestica

$m$ = masa

$x, y$ ravnina

konstante

$$\vec{v} = (v_x) \sin[(\omega_x) t]\,\vec{i} + (v_y) \sin[(\omega_y) t]\,\vec{j}$$

$F = ma \qquad a = \frac{dv}{dt} \rightarrow \vec{a} = v_x \cos[\omega_x t] \cdot (\omega_x \cdot t)'\,\vec{i}$

$$+ v_y \cos[\omega_y t] \cdot (\omega_y \cdot t)'\,\vec{j}$$

$$\vec{a} = v_x \cdot \omega_x \cos[\omega_x t]\,\vec{i} + v_y \omega_y \cos[\omega_y t]\,\vec{j}$$

$$\rightarrow F = m v_x \omega_x \cos[\omega_x t]\,\vec{i} + m v_y \omega_y \cos[\omega_y t]\,\vec{j} \quad (1)$$

2. tablar* $\vec{F} = F_x \cos[\omega_x t]\,\vec{i} + F_y \cos[\omega_y t]\,\vec{j}$

$$m \cdot a = m \cdot a_x \cos[\omega_x t]\,\vec{i} + m \cdot a_y \cdot \cos[\omega_y t]\,\vec{j}$$

$r = \frac{d^2 a}{dt^2} \rightarrow \vec{r}(t) = r_x(t) \cdot \vec{i} + r_y[t]\,\vec{j}$

↳ duplo integral od akceleracije

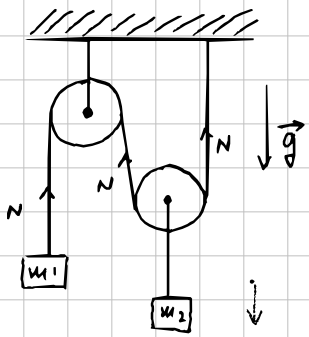
$$\vec{a} = \frac{m \cdot a_x}{m} \cos[\omega_x t)\,\vec{i} + \frac{m \cdot a_y}{m} \cos[\omega_y t]\,\vec{j}$$

* ali nećemo pokratiti jer trebamo $F$

$$\vec{a} = \left(\frac{F_x}{m}\right) \cos[(\omega_x) t]\,\vec{i} + \left(\frac{F_y}{m}\right) \cos[(\omega_y) t]\,\vec{j} \Big/ \int \rightarrow \text{zaokruženo su konstante}$$

$\frac{F_x}{m}$ nešto $\cdot \sin(\omega_x t)\,\vec{i}$ ... $\rightarrow \frac{F_x}{m} \cdot$ nešto drugo $\cdot (-\cos[\omega_x t])\,\vec{i}$

## 2. *Saša Skripta 49.str.




- na tijelo (1) djeluje jedna N, a na tijelo (2) 2N

prema tome $dy_1 = -2dy_2$ (diferencijal y-osi)

$$v_{1y} = -2v_{2y} \quad / \frac{d}{dt}$$

$$a_{1y} = -2a_{2y}$$

$\vec{F}_1 = m_1 a \rightarrow m_1 a_{1y} = T - m_1 \cdot g$ $\quad \#N = T$

$\vec{F}_2 = m_2 a \rightarrow m_2 a_{2y} = 2T - m_2 g$

=> u posebnom slučaju $m_2 = 2m_1$ obje ake. su jednake 0

$$m_1 a_{1y} + m_1 g = T$$

$$m_2 a_{2y} + m_2 g = 2T$$

$$\rightarrow m_1(a_{1y} + g) = 2m_2(a_{2y} + g)$$

povećamo li $2m_2 \rightarrow 2m_1 > m_2$

## 3. $\vec{F}[\vec{v}] = -b\vec{v}$

b - konst. (treba odredit fizikalnu dimenziju b)

$M^\alpha L^\beta T^\gamma$

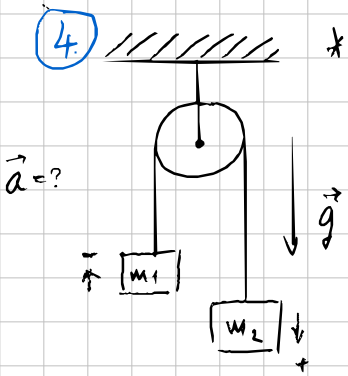
masa, duljina, mjerna

$v = \left[\frac{m}{s}\right]$

$F = kg \frac{m}{s^2} \rightarrow kg \frac{1}{s} \cdot \frac{m}{s}$

$M^1 \cdot L^0 \cdot T^{-1}$

$\alpha = 1 \quad \beta = 0 \quad \gamma = -1$

**4** 


* Atwoodov padostroj

$a_2 = -a_1$

* 1. način

$m_1 a = T - m_1 g \rightarrow T = m_1 a + m_1 g$

$m_2 a = m_2 g - T \rightarrow T = m_2 g - m_2 a$

* odmax promijenimo mjesta članova predznake $T$ i $mg$

$m_1 a + m_1 g = m_2 g - m_2 a$

$a(m_1 + m_2) = g(m_2 - m_1)$

$a = \frac{m_2 - m_1}{m_1 + m_2} g = \frac{2}{8} g$

$a = \frac{1}{4} g$

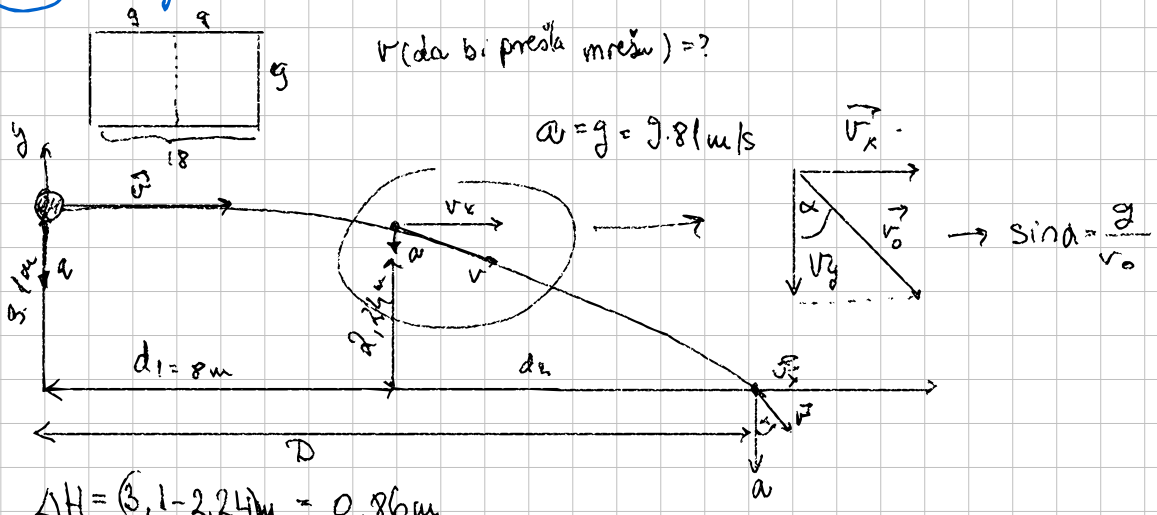
\#2. način $m_1 a_1 = T - m_1 g$

$m_2 a_1 = T - m_2 g$

$\rightarrow a_2 = -a_1$

i onda to uvrstimo pa se nakradno drugu predznaci

**5.** Odbojka – vodoravni hitac




$v$ (da bi prešla mrežu) = ?

$a = g = 9.81\,m/s$

$\Delta H = (3,1 - 2,24)m = 0,86m$

Horizontalni hitac: $v_0 = \frac{D}{t}$ $\quad \frac{2H}{g} = t^2 \rightarrow t = \sqrt{\frac{2H}{g}}$

$H = \frac{gt^2}{2}$

$D = v_0 t$

trebamo

$v_0 = \frac{D}{\sqrt{\frac{2\Delta H}{g}}} = \frac{8}{\sqrt{\frac{2 \cdot 0,86}{9,81}}}$

$\boxed{v_0 = 19,106\,m/s}$

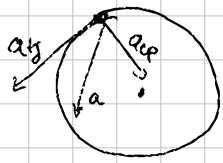
**7.** vodoravna kružnica

$a_{cp} = tg\alpha \cdot g$

$v = 370\,km/h$

$\alpha = 20°$

$r = ?$


$F = m \cdot a$

$a_{cp} = \frac{v^2}{R} \rightarrow tg\alpha \cdot g = \frac{v^2}{R}$

$F_{tj,y} =$

$\frac{370.000}{3600} = 102,78\,m/s$

$R = \frac{v^2}{tg\alpha \cdot g} = \frac{(102,78)^2}{tg(20°) \cdot g}$

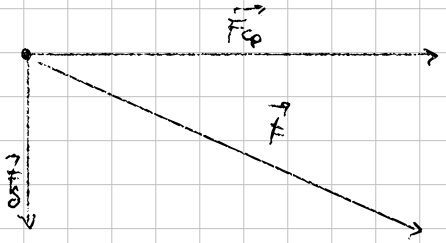
$R = 2958,57\,m$

**8.** $v = 113\,km/h \rightarrow 31,38\,m/s$

$m = 1\,kg$

$F = 12,8\,N$

$r = ?$




$F^2 = F_{cp}^2 + F_g^2$

$F_{cp} = \sqrt{F^2 - F_g^2}$

$F_{cp} = \sqrt{12,8^2 - 10^2}$

$F_{cp} = 7.99\,N$

$\frac{v^2}{R} m = F_{cp}$

$R = \frac{v^2 m}{F_{cp}} = \frac{31,38^2}{7.99} = 123.24$