AKADEMIA EDUKACYJNO - INŻYNIERSKA

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MATURA STUDIA PRAKTYKA STAŻ PRACA BIZNES PRZEMYSŁ STEAM

KOMPLEKSOWE WSPARCIE EDUKACYJNE **ON – LINE** NA KAŻDYM ETAPIE KSZTAŁCENIA INŻYNIERSKIEGO

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MECHANIKA II

"DYNAMIKA PUNKTU MATERIALNEGO"

PROJEKT

Oblicz:

- długość odcinka
- trajektorię lotu
- prędkość liniową początkową
- prędkość liniową końcową
- energię kinetyczną końcową
- czas trwania lotu

dla układu poruszającego się motocyklisty.

DANE:

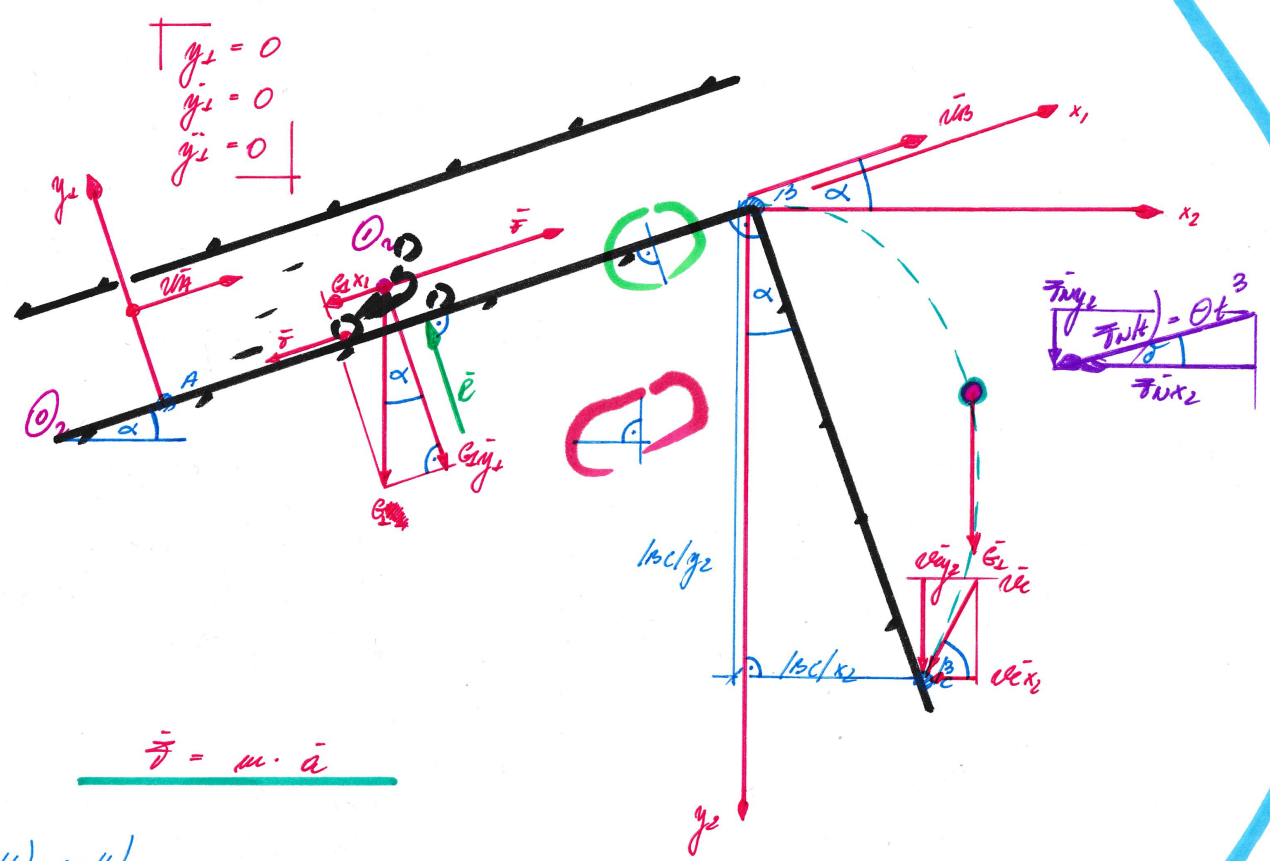
$|AB|, \alpha, \mu, m, F, \tau_{AB} = OK$

SZUKAM:

$|BC|, y(x), V_A, V_C, Ek_C\ T_{BC} = ?$

$m, \eta, \bar{\vartheta}, |AB|, \bar{e}, \alpha$

$v_A, J, |BC| - ?$



$\bar{\vartheta} = m \cdot \bar{a}$

$x_1(t), y_1(t)$

I) $\sum F_{ix_1} = m_1 \cdot a_{x_1} = m\ddot{x}_1 = \bar{e} - G\bar{x}_1 - \bar{\vartheta}$

II) $\sum F_{iy_1} = m_1 \cdot a_{y_1} = m\ddot{y}_1 = \bar{e} - G\bar{y}_1$

II) $m\ddot{y}_1 = \bar{e} - G\bar{y}_1$

$\frac{G_{x_1}}{G} = \sin\alpha \Rightarrow G_{x_1} = mg\sin\alpha$

$\frac{G_{y_1}}{G} = \cos\alpha \Rightarrow G_{y_1} = mg\cos\alpha$

$\Rightarrow e = G_{y_1} = mg\cos\alpha$

I) $m_1\ddot{x}_1 = \bar{\vartheta} - G\bar{x}_1 - \bar{\vartheta}$

$\eta = \frac{T}{T_N}$

$\Rightarrow \vartheta = \eta \cdot e = \eta \cdot G_{y_1} = \eta mg\cos\alpha$

$m_1\ddot{x}_1 = \vartheta - mg\sin\alpha - \eta mg\cos\alpha$

$\ddot{x}_1(t) = \frac{T}{m} - g\sin\alpha - \eta g\cos\alpha$

$\Rightarrow \ddot{x}_1(t) = A$

$\ddot{x}(t) = A$

$a = \frac{\Delta v}{\Delta t}$ $\quad \ddot{x} = \frac{d\dot{x}}{dt}$

$v = \frac{\Delta s}{\Delta t}$ $\quad \dot{x} = \frac{dx}{dt}$

$\frac{d\dot{x}_1}{dt} = A \quad / \cdot dt$

$d\dot{x}_1 = A\,dt \quad / \int$

$\int d\dot{x}_1 = A \int dt$

$\int x^a dx = \frac{x^{a+1}}{a+1} + C$

$\dot{x}_1(t) = At + C_1$

$\frac{dx_1}{dt} = At + C_1 \quad / \cdot dt$

$dx_1 = At\,dt + C_1\,dt \quad / \int$

$\int dx_1 = A \int t\,dt + C_1 \int dt$

$x_1(t) = \frac{1}{2}At^2 + C_1 t + C_2$

I) $\ddot{x}_1(t) = A$

II) $\dot{x}_1(t) = At + C_1$

III) $x_1(t) = \frac{1}{2}At^2 + C_1 t + C_2$

II) $\dot{x}_1(t=0) = v_A$

III) $x_1(t=0) = s_A$

II) $v_A = A(0) + C_1$

III) $s_A = \frac{1}{2}A(0)^2 + C_1(0) + C_2$

II) $C_1 = v_A$

III) $C_2 = s_A$

I) $\ddot{x}_1(t) = A$

II) $\dot{x}_1(t) = At + v_A$

III) $x_1(t) = \frac{1}{2}At^2 + v_A t + s_A$ ($s_A = 0$)

$\tilde{t}$ - czas ruchu $|AB|$

II) $\dot{x}_1(t = \tilde{t}) = v_B$

III) $x_1(t = \tilde{t}) = s_B = |AB|$

II) $v_B = A\tilde{t} + v_A$

III) $|AB| = \frac{1}{2}A\tilde{t}^2 + v_A\tilde{t}$ $\quad$ 2 i

III) $|AB| = \frac{1}{2}A\tilde{t}^2 + v_A\tilde{t}$

$-v_A\tilde{t} = |AB| - \frac{1}{2}A\tilde{t}^2 \quad / : \tilde{t}$

$v_A = -\frac{1}{2}A\tilde{t} + \frac{|AB|}{\tilde{t}}$

II) $v_B = A\tilde{t} + v_A$

$v_B = A\tilde{t} - \frac{1}{2}A\tilde{t} + \frac{|AB|}{\tilde{t}}$

$v_B = \frac{1}{2}A\tilde{t} + \frac{|AB|}{\tilde{t}}$

2) $x_2(t),\ y_2(t)$

I) $\sum F_{ix_2} = m_1 \ddot{x}_2 = 0$

II) $\sum F_{iy_2} = m_1 \ddot{y}_2 = \bar{G}_1$

I) $m_1 \ddot{x}_2 = 0$

$\ddot{x}_2(t) = 0$

$\dot{x}_2(t) = C_3$

$x_2(t) = C_3 t + C_4$

$\ddot{x}_2(t) = 0$

$\dot{x}_2(t) = C_3$

$x_2(t) = C_3 t + C_4$

$\dot{x}_2(t=0) = v_{B3x_2} = v_{B3}\cos\alpha$

$x_2(t=0) = s_{B3x_2}$

$C_3 = v_{B3}\cos\alpha$

$C_4 = s_{B3x_2}$

$\ddot{x}_2(t) = 0$

$\dot{x}_2(t) = v_{B3}\cos\alpha$

$x_2(t) = v_{B3} t \cos\alpha + s_{B3x_2}^{0}$

τ = czas wyjścia /BC/

II) $\dot{x}_2(t-\tau) = v_{Bx_2}$

II) $x_2(t-\tau) = l_{BC}/x_2$

I) $v_{B3}\cos\alpha = v_{Bx_2}$

II) $v_{B3}\tau\cos\alpha = l_{BC}\sin\alpha$

3?

$m_1 \ddot{y}_2 = \bar{G}_1$

$\cancel{m_1} \ddot{y}_2 = \cancel{m_1} g$

$\ddot{y}_2(t) = g$

$\dot{y}_2(t) = gt + C_5$

$y_2(t) = +\frac{1}{2} g t^2 + C_5 t + C_6$

$\ddot{y}_2(t) = g$

$\dot{y}_2(t) = gt + C_5$

$y_2(t) = \frac{1}{2} g t^2 + C_5 t + C_6$

$\dot{y}_2(t=0) = -v_{By_2} = -v_{B3}\sin\alpha$

$y_2(t=0) = s_{By_2}$

$C_5 = -v_{B3}\sin\alpha$

$C_6 = s_{By_2}$

$\ddot{y}_2(t) = g$

$\dot{y}_2(t) = gt - v_{B3}\sin\alpha$

$y_2(t) = \frac{1}{2} g t^2 - v_{B3} t \sin\alpha + s_{By_2}^{0}$

τ = czas wyjścia /BC/

II) $\dot{y}_2(t-\tau) = v_{By_2}$

II) $y_2(t-\tau) = l_{BC}/y_2$

III) $g\tau - v_{B3}\sin\alpha = v_{By_2}$

IV) $\frac{1}{2} g\tau^2 - v_{B3}\tau\sin\alpha = l_{BC}\cos\alpha$

3?

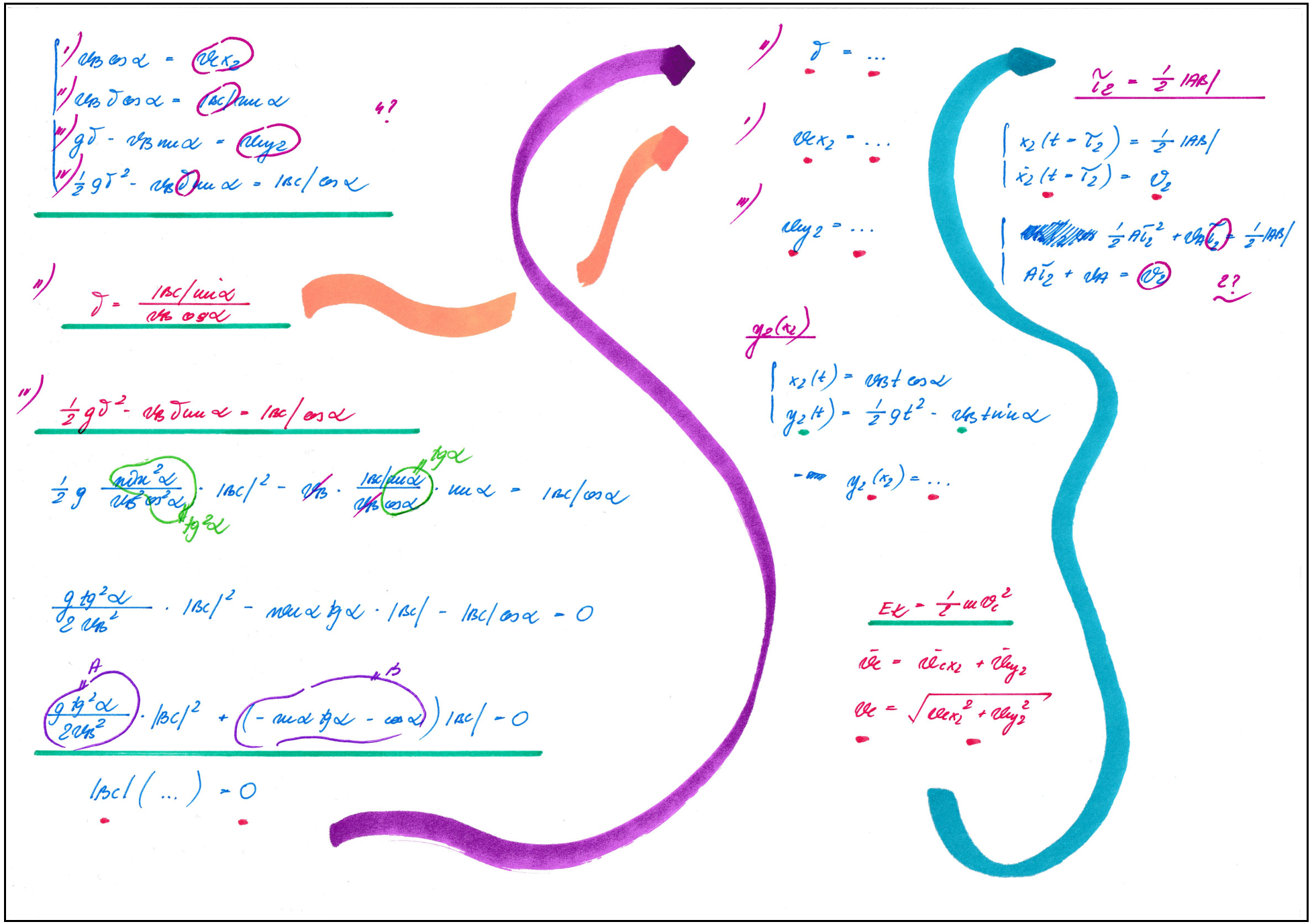
I) $v_{B3}\cos\alpha = v_{Bx_2}$

II) $v_{B3}\tau\cos\alpha = l_{BC}\sin\alpha$

III) $g\tau - v_{B3}\sin\alpha = v_{By_2}$

IV) $\frac{1}{2} g\tau^2 - v_{B3}\tau\sin\alpha = l_{BC}\cos\alpha$

4?


I) $v_B \cos\alpha = v_C x_2$
II) $v_B \tau \cos\alpha = \frac{1}{2}|BC| \sin\alpha$
III) $g\tau \cdot v_B \sin\alpha = v_{y_2}$
IV) $\frac{1}{2} g\tau^2 - v_B \tau \sin\alpha = |BC| \cos\alpha$
4?
II) $\tau = \frac{|BC| \sin\alpha}{v_B \cos\alpha}$
IV) $\frac{1}{2} g\tau^2 - v_B \tau \sin\alpha = |BC| \cos\alpha$
$\frac{1}{2} g \frac{\sin^2\alpha}{v_B^2 \cos^2\alpha} \cdot |BC|^2 - v_B \cdot \frac{|BC| \sin\alpha}{v_B \cos\alpha} \cdot \sin\alpha = |BC| \cos\alpha$
$\operatorname{tg}\alpha$
$\operatorname{tg}^2\alpha$
$\frac{g \operatorname{tg}^2\alpha}{2 v_B^2} \cdot |BC|^2 - \sin\alpha \operatorname{tg}\alpha \cdot |BC| - |BC| \cos\alpha = 0$
A
B
$\frac{g \operatorname{tg}^2\alpha}{2 v_B^2} \cdot |BC|^2 + \left(-\sin\alpha \operatorname{tg}\alpha - \cos\alpha\right) |BC| = 0$
$|BC| (\dots) = 0$
II) $\tau = \dots$
I) $v_C x_2 = \dots$
III) $v_{y_2} = \dots$
$y_2(x_2)$
$x_2(t) = v_B t \cos\alpha$
$y_2(t) = \frac{1}{2} g t^2 - v_B t \sin\alpha$
$\dots \; y_2(x_2) = \dots$
$E_k = \frac{1}{2} m v_c^2$
$\vec{v_c} = \vec{v_{cx_2}} + \vec{v_{y_2}}$
$v_c = \sqrt{v_{cx_2}^2 + v_{y_2}^2}$
$\tilde{t}_2 = \frac{1}{2}|AB|$
$x_2(t - \tilde{t}_2) = \frac{1}{2}|AB|$
$\dot{x}_2(t - \tilde{t}_2) = v_2$
$\frac{1}{2} A \tilde{t}_2^2 + v_B \tilde{t}_2 = \frac{1}{2}|AB|$
$A\tilde{t}_2 + v_B = v_2$
2?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