FIZYKA

PDF

ZADANIA

ZADANIA ĆW 2

zadanie 1

$V_k = 108$ km/h - prędkość końcowa

$t = 8s$

z jakim przyspieszeniem jechał?

$a = \frac{dv}{dt} \Rightarrow v = at + v_0$

$V = \frac{ds}{dt} \Rightarrow ds = vdt \Rightarrow ds = (at + v_0)dt \Rightarrow$

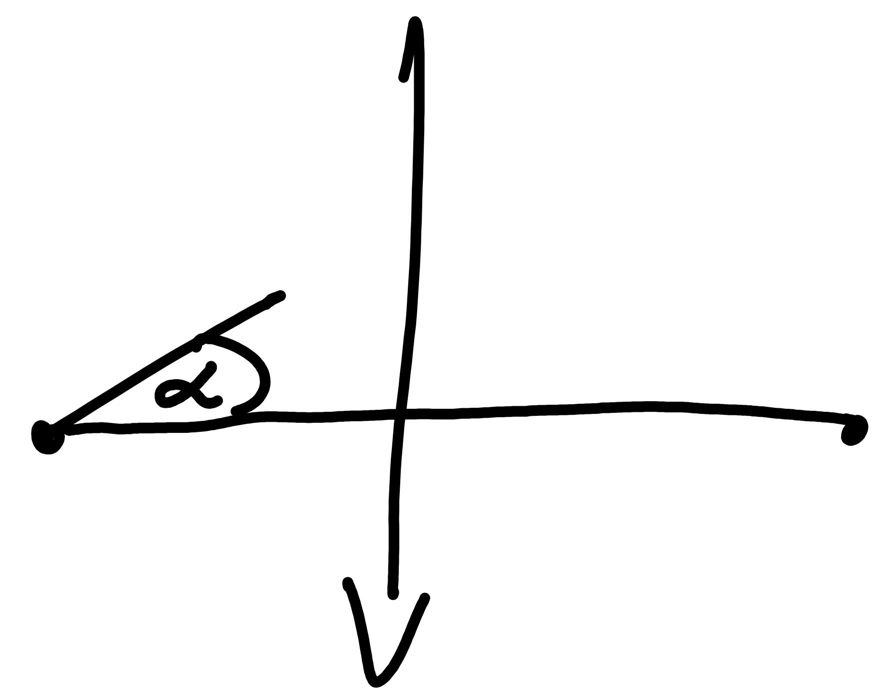
$s = \frac{1}{2}at^2 + V_0 t + s_0$

$V_0 = 0, s_0 = 0 \Rightarrow s = \frac{1}{2}at^2 \Rightarrow s = 32a$

$V_k = 30 \frac{m}{s}$ $\quad V_k = at \Rightarrow \frac{30}{8} = 3{,}75 \frac{m}{s^2}$

$s = 120m$

Zadanie 2



$d = 100\ m.$

$V_1 = 10\ km/h$

$V_2 = 6\ km/h$

$$V_{wyp} = V_1 + V_2$$

$$|V_{wyp}| = |V_1| \cos(\alpha) = \sqrt{V_1^2 + V_2^2} = 8\ km/h = 2{,}22\ \frac{m}{s}$$

$$\cos\alpha = \frac{\sqrt{V_1^2 + V_2^2}}{V_1} = 36^\circ$$

$$V = \frac{s}{t} = \frac{d}{V_{wyp}} = \frac{d}{\sqrt{V_1^2 + V_2^2}} \approx 45 s$$

Zadanie 8

ω_0 – 900 obrotów na minutę

po wyłączeniu – 75 obrotów.

$$\omega = \omega_0 - \epsilon t \; ; \; \alpha = \omega_0 t - \frac{\epsilon t^2}{2}$$

$$\omega_0 = \frac{900 \cdot 2\pi}{60} = 30\pi \frac{rad}{s}$$

$$\omega_k = 0$$

$$\alpha = 75 \text{ obr} = 150\pi \text{ rad}$$

$$\epsilon = \frac{\omega_0}{t}$$

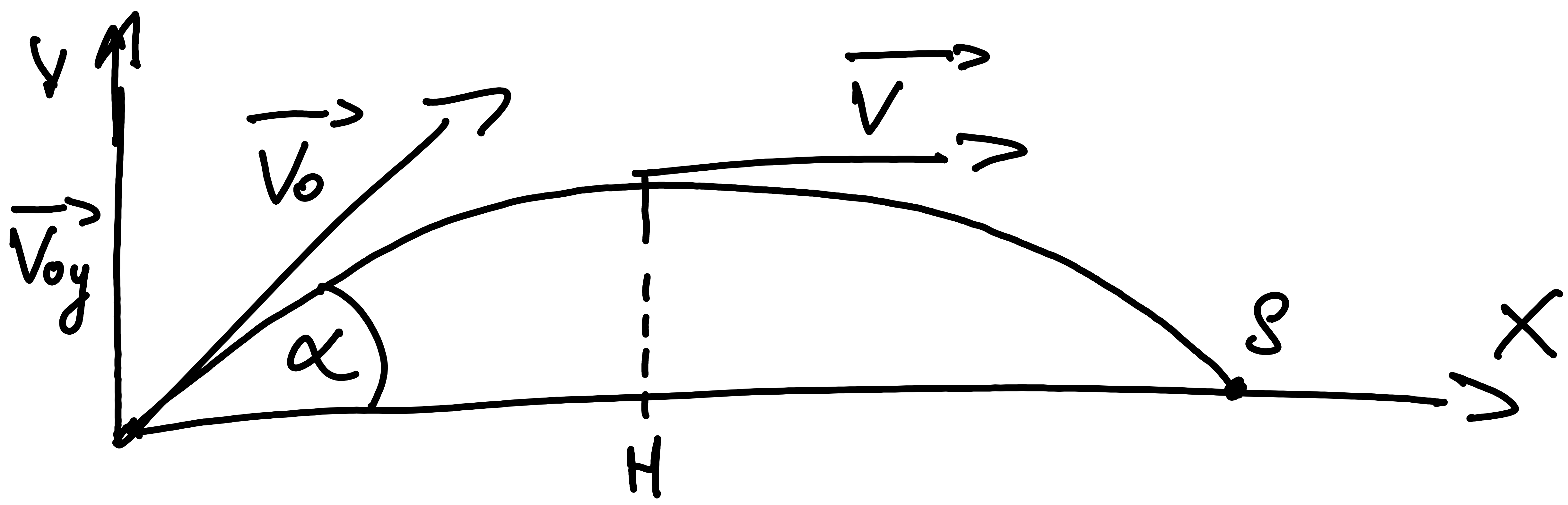
$$\alpha = \omega_0 t - \frac{\omega_0}{\cancel{t}} \cdot \frac{t^{\cancel{2}}}{2} = \frac{\omega_0 t}{2} \Rightarrow t = \frac{2\alpha}{\omega_0} =$$

$$= \frac{300}{30} = 10 s$$

Zadanie 4.

Pocisk wystrzelono z v_0 pod kątem α.

Znaleźć zasięg S, maksymalne przemieszczenie toru H oraz czas lotu t.



$$V_x = V_{0x} = V_0 \cos(\alpha)$$

$$x = V_{0x} \cdot t = V_0 \cos(\alpha) \cdot t$$

$$V_{0y} = v_0 \sin(\alpha)$$

wyliczamy czas

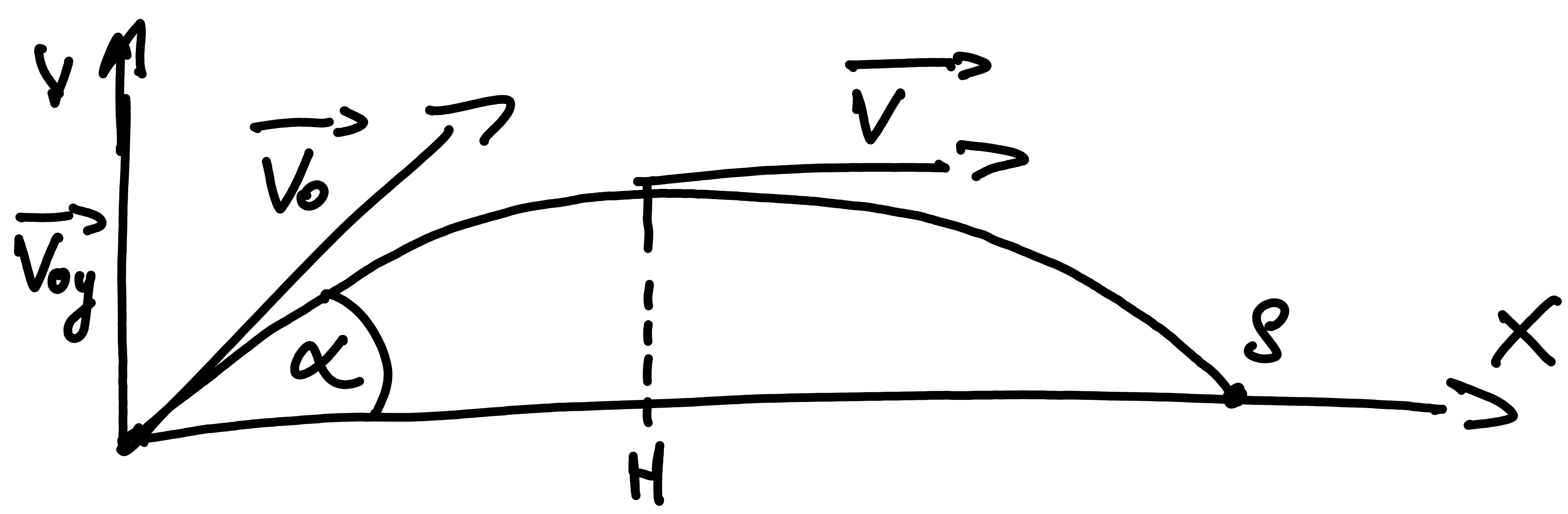
$$V_y = V_{0y} - gt$$

$$y = V_{0y} t - \frac{1}{2} g t^2$$

verte

pocisk wystrzelono z V_0 pod kątem α.

Znaleźć zasięg S, maksymalne przemieszczenie toru H oraz czas lotu t.



$$V_{ox} = V_0 \cos(\alpha)$$

$$V_{oy} = V_0 \sin(\alpha)$$

$$V_x = V_{ox}$$

$$V_y = V_{oy} - gt$$

$$\begin{cases} x = \int V_x \, dt = V_0 \cos(\alpha) t \\ y = \int V_y \, dt = V_0 \sin(\alpha) t - \frac{1}{2} g t^2 \end{cases}$$

$$t = \frac{x}{\cos(\alpha) V_0}$$ — wyliczamy z tego y

$$y = \frac{V_0 \sin(\alpha) x}{V_0 \cos(\alpha)} - \frac{g\left(\frac{x}{V_0 \cos\alpha}\right)^2}{2}$$

$$\begin{cases} x = V_0 \cos(\alpha)\, t \\ y = V_0 \sin(\alpha)\, t - \frac{gt^2}{2} \end{cases}$$

$$t = \frac{x}{V_0 \cos(\alpha)}$$

$$y = \frac{V_0 \sin(\alpha)\, x}{V_0 \cos(\alpha)} - \frac{g\left(\frac{x}{V_0 \cos\alpha}\right)^2}{2} = \dots$$

obliczamy S:

$$x \,\mathrm{tg}(\alpha) = \frac{1}{2}\left(\frac{x}{V_0 \cos(\alpha)}\right)^2$$

$$x = S = 2\frac{V_0^2}{g}\sin\alpha\cos\alpha = \frac{V_0^2}{g}\sin(2\alpha)$$

ĆWICZENIA 2

Zadanie 1.

prędkość v.

zwalnia $-\frac{1}{3}t$

$$a = \frac{dv}{dt} \Rightarrow v = -\frac{1}{3}\int t\,dt = -\frac{1}{6}t^2 + c$$

$$V = \frac{ds}{dt} \Rightarrow S = -\frac{1}{6}\int (t^2 + c)\,dt =$$

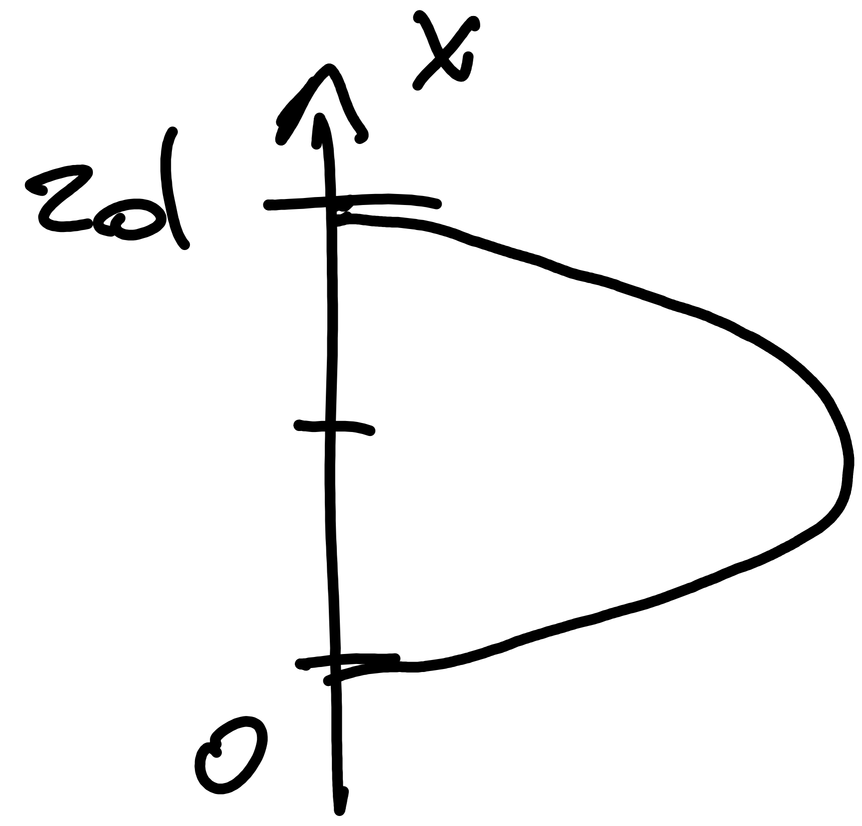
$$= -\frac{1}{18}t^3 + ct$$

$$t_k = \sqrt{6v}$$

$$S = -\frac{1}{18}\left(\sqrt{6v}\right)^3 + v\sqrt{6v}$$

$$S = -\frac{17}{18}v\sqrt{6v}$$

ZADANIE 2



$V(2d) = V(0) = 0$

$V(d) = V_1$

$V = ax^2 + bx + c$

$V(0) = a \cdot 0 + b \cdot 0 + c \Rightarrow c = 0$

$V(d) = ad^2 + db$

$V(2d) = 4ad^2 + 2db \Rightarrow b = -2ad$

$V_1 = ad^2 - 2ad^2 \Rightarrow a = \frac{-V_1}{d^2}, \; b = \frac{V_1}{d}$

$V_x = \frac{-V_1}{d^2} x^2 + \frac{V_1}{d} x$ – prędkość wody

V_2 – prędkość łódki

$V(t) = \frac{-V_1}{d^2} (V_2 t)^2 + \frac{V_1}{d} (V_2 \cdot t)$

$y = \int v \, dt$

$y = \frac{1}{3} V_2^2 +$

ZADANIE 4

$F = ma$

w tym przypadku: $F = -kv$

$-kv = ma$

$a = \frac{dv}{dt}$

$-\frac{k}{m} v = \frac{dv}{dt} \Rightarrow -\frac{k}{m} dt = \frac{dv}{v} \; \Big/ \int$

$-\frac{kt}{m} = \ln v + C \Rightarrow v = Ce^{-\frac{kt}{m}}$

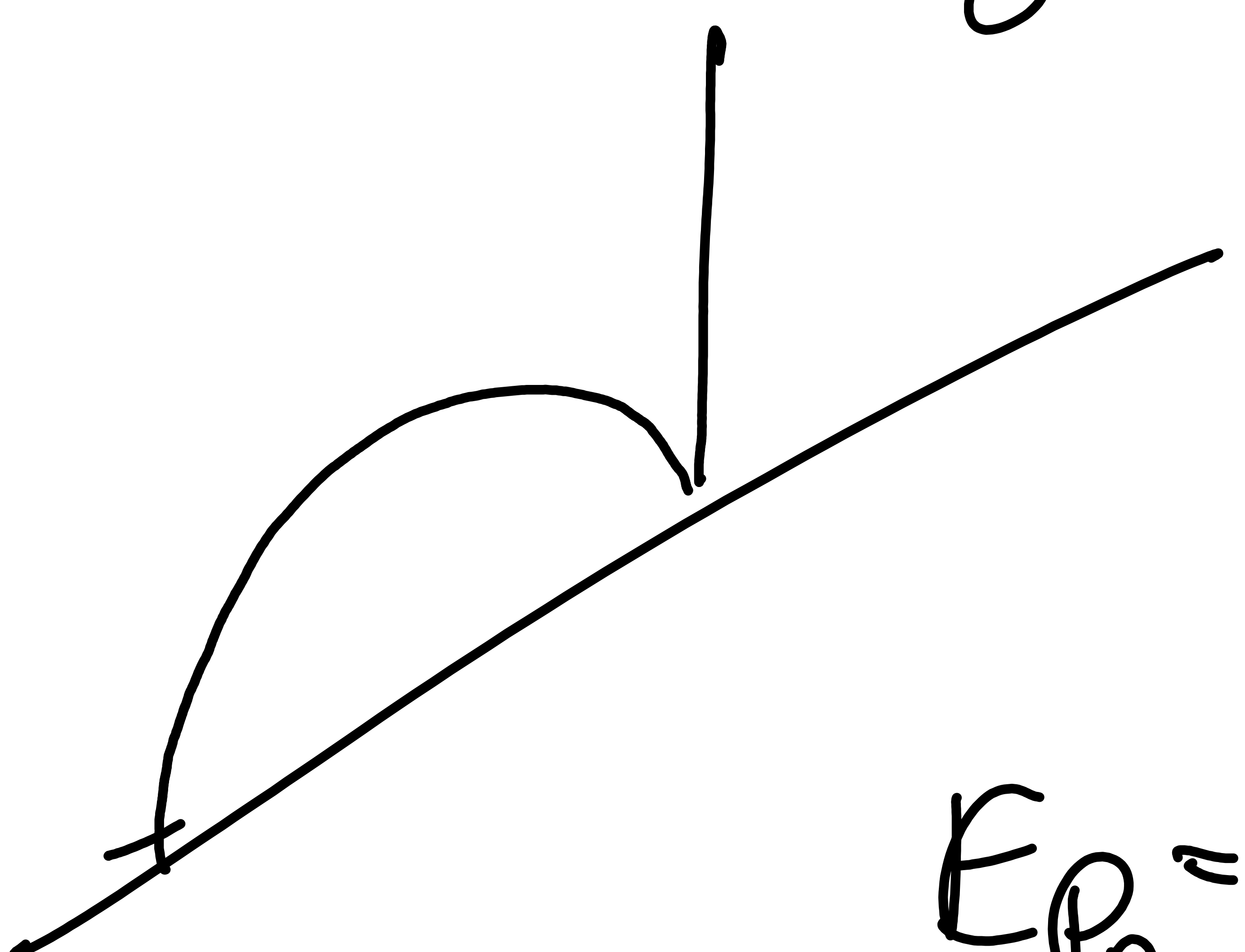
$v(t=0) = v_0 = C$

$S = \int_0^\infty v_0 e^{-\frac{kt}{m}} dt$

ZADANIE 5

Kulka spada z H, odbija się o α

obliczyć odległość kulki.



$$E_k = \frac{1}{2} m V^2$$

$$E_p = mgh$$

$$E_{p_A} = mgh \quad E_{k_A} = 0$$

$$E_{p_B} = 0 \quad E_{k_B} = \frac{1}{2} m V_B^2$$

$$mgh = \frac{1}{2} m V_B^2$$

$$gh = \frac{1}{2} m V_B^2$$

$$V_B^2 = 2gh$$

$$V_B = \sqrt{2gh}$$

ĆWICZENIA 3

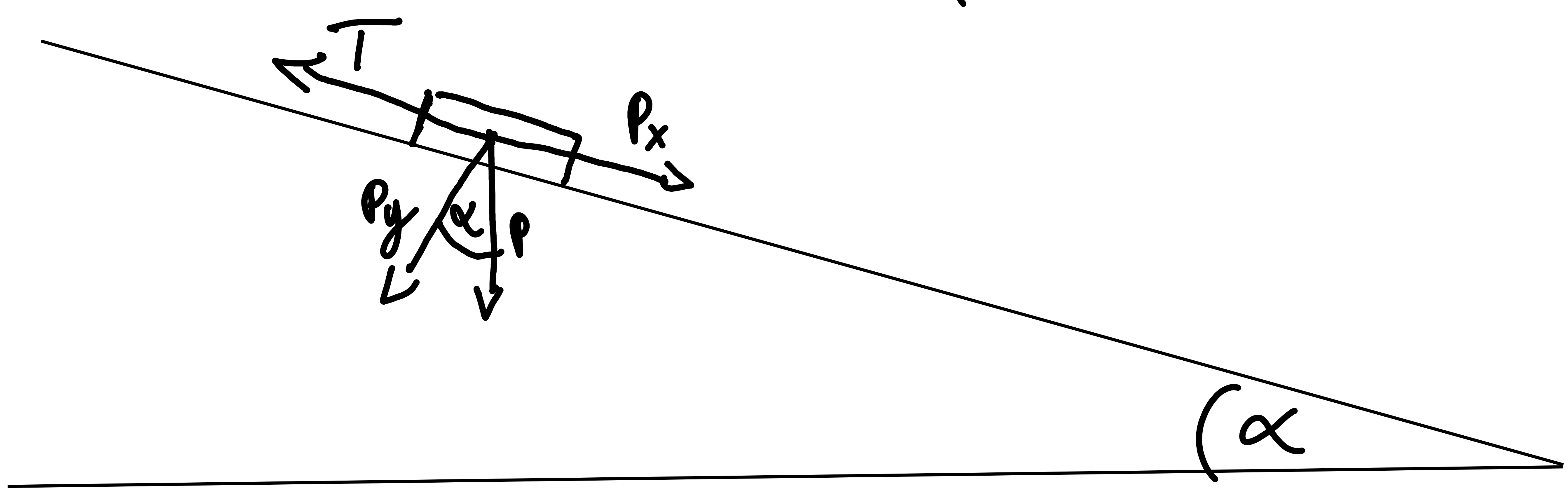
Zadanie 2

$$\left.\begin{array}{l} F = a m_c \\ m_c = m + M \\ F = mg \end{array}\right\} Mg = a(m+M)$$

$$a = \frac{gM}{(m+M)}$$

Zadanie 3 Z jakim przyśpieszeniem zsuwa się ciało?

f - siła tarcia



$F = am \quad P = mg$

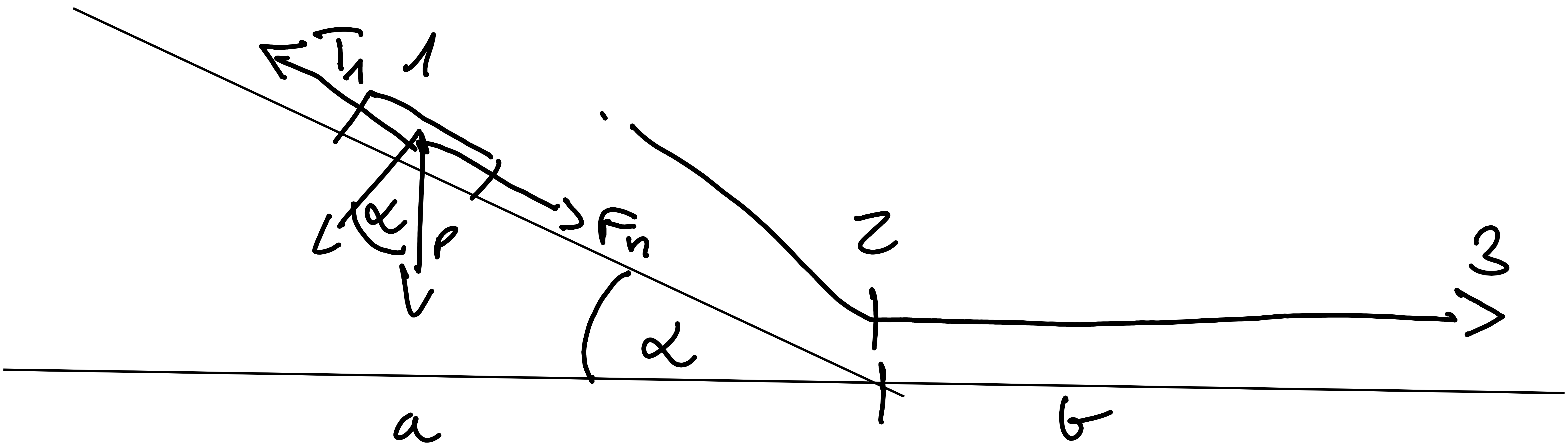
$P_x = P\sin(\alpha) \quad P_y = P\cos(\alpha)$

$T = f P_y = fmg\cos(\alpha)$

$F = P_x - T = mg\sin(\alpha) - fmg\cos(\alpha) = mg(\sin(\alpha) - f\cos(\alpha))$

$$a = \frac{\cancel{m}g(\sin(\alpha) - f\cos(\alpha))}{\cancel{m}} = g(\sin(\alpha) - f\cos(\alpha))$$

Zadanie 4. Oblicz przyśpieszenie sanek na odcinku poziomym.



$T_1 = \mu N_1 = \mu mg\cos(\alpha) \quad N = mg\cos(\alpha)$

$T_2 = \mu P = \mu mg$

$E_{p1} = mgh \quad E_{p2} = 0$

$E_{k2} = \frac{mv_2^2}{2} \quad E_{p1} = E_{p2} + E_{k2} + W_{1,2}$

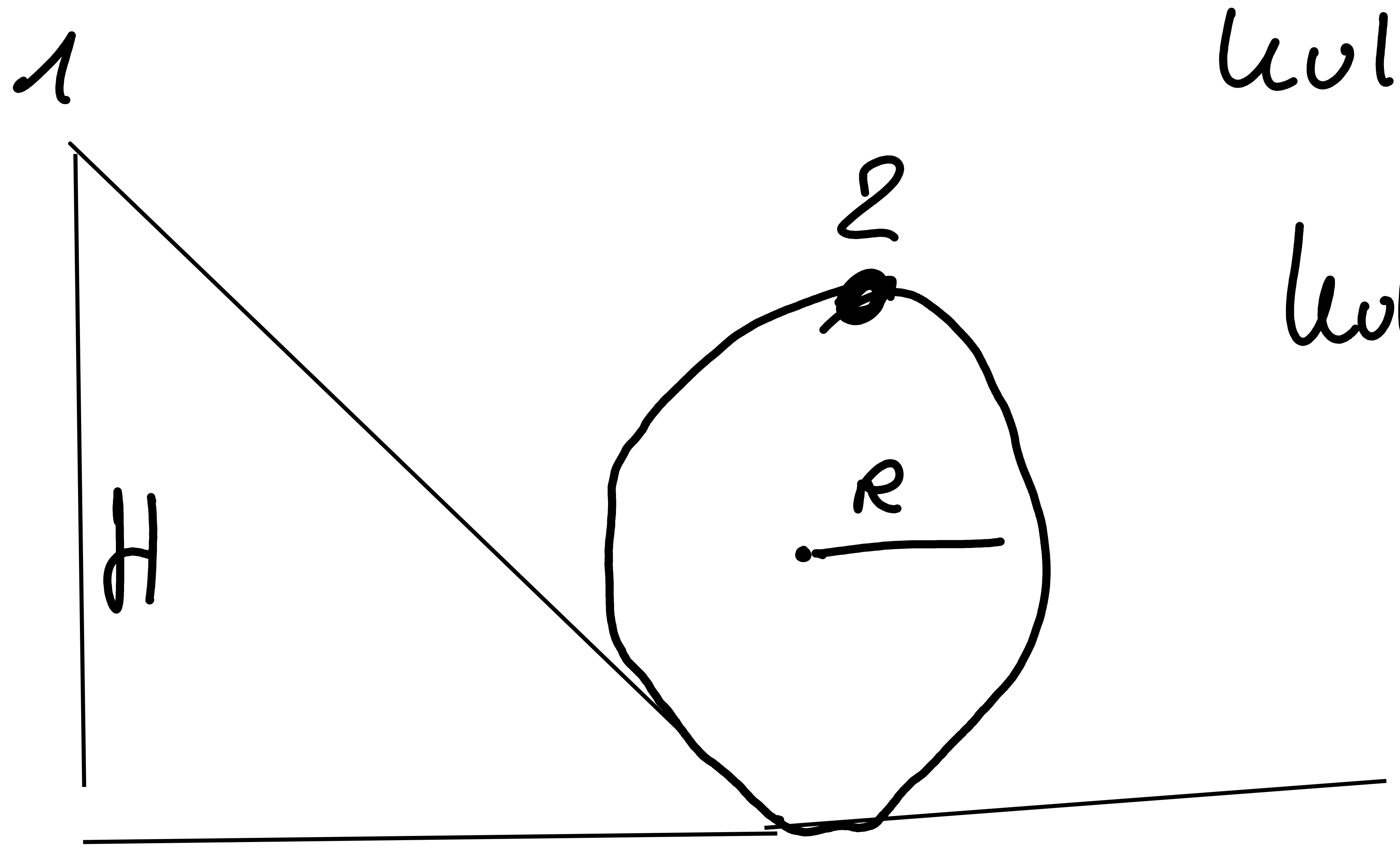
$E_{k2} = E_{p1} - W_{1,2} \quad W = \vec{F}\vec{S}$

$E_{k2} = W_{2,3}$

$E_{p1} = W_{1,2} + W_{2,3}$

$W_{1,2} = T_1 \cdot S_{1,2} \quad S_{1,2} = \frac{h}{\sin(\alpha)}$

Zadanie 5



jakie powinno być H, aby kulka przebyła pętlę?

kulka porusza się bez tarcia.

warunek minimum

$$mg = \frac{mV^2}{R} \Rightarrow V = \sqrt{gR} \quad *$$

$$E_{k1} = 0 \qquad E_{p1} = mgh$$

$$E_{k2} = \frac{mV^2}{2} \qquad E_p = mg2R$$

$$E_{k1} + E_{p1} = E_{k2} + E_{p2} \Rightarrow \cancel{m}gh = \frac{\cancel{m}V^2}{2} + \cancel{m}g2R$$

$$V^2 = 2g(H-2R) \Rightarrow \cancel{g}R = 2\cancel{g}(H-2R)$$

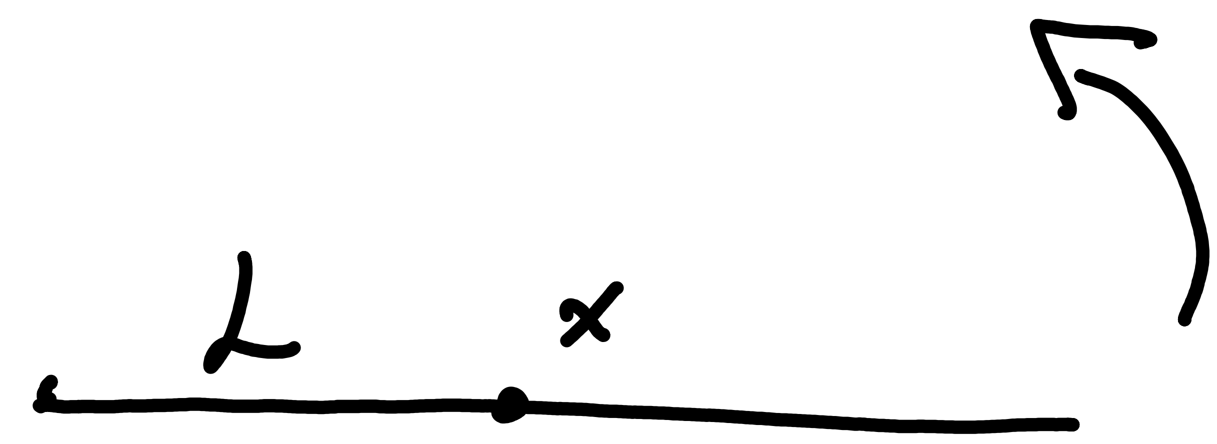
$$R = 2H - 4R \Rightarrow H = 2{,}5R$$

Zadanie 6

?

ĆWICZENIA 4

Zadanie 1.



$\frac{M}{L}$ - gęstość belki

dzielimy na części - $dm = \left(\frac{M}{L}\right) dx$

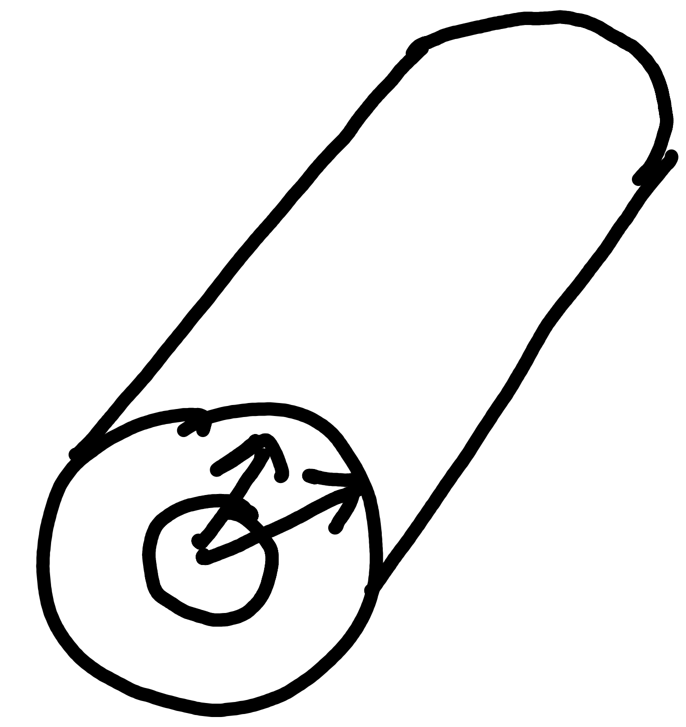
$$dI = x^2\, dm$$

$$dI = x^2\, dm = \left(\frac{M}{L}\right) x^2\, dx$$

$$I = \int_{-\frac{1}{2}L}^{\frac{1}{2}L} \left(\frac{M}{L}\right) x^2\, dx = \frac{ML^2}{12}$$ - dla odniesienia w środku

$$I = \int_{0}^{L} \left(\frac{M}{L}\right) x^2\, dx = \frac{1}{3} ML^2$$ - dla odniesienia na końcu

Zadanie 2. ρ - gęstość



$dm = \rho dV = 2\pi \rho r l\, dr$

z definicji: $dI = dm \cdot r^2 = 2\pi \rho r^3 l\, dr$

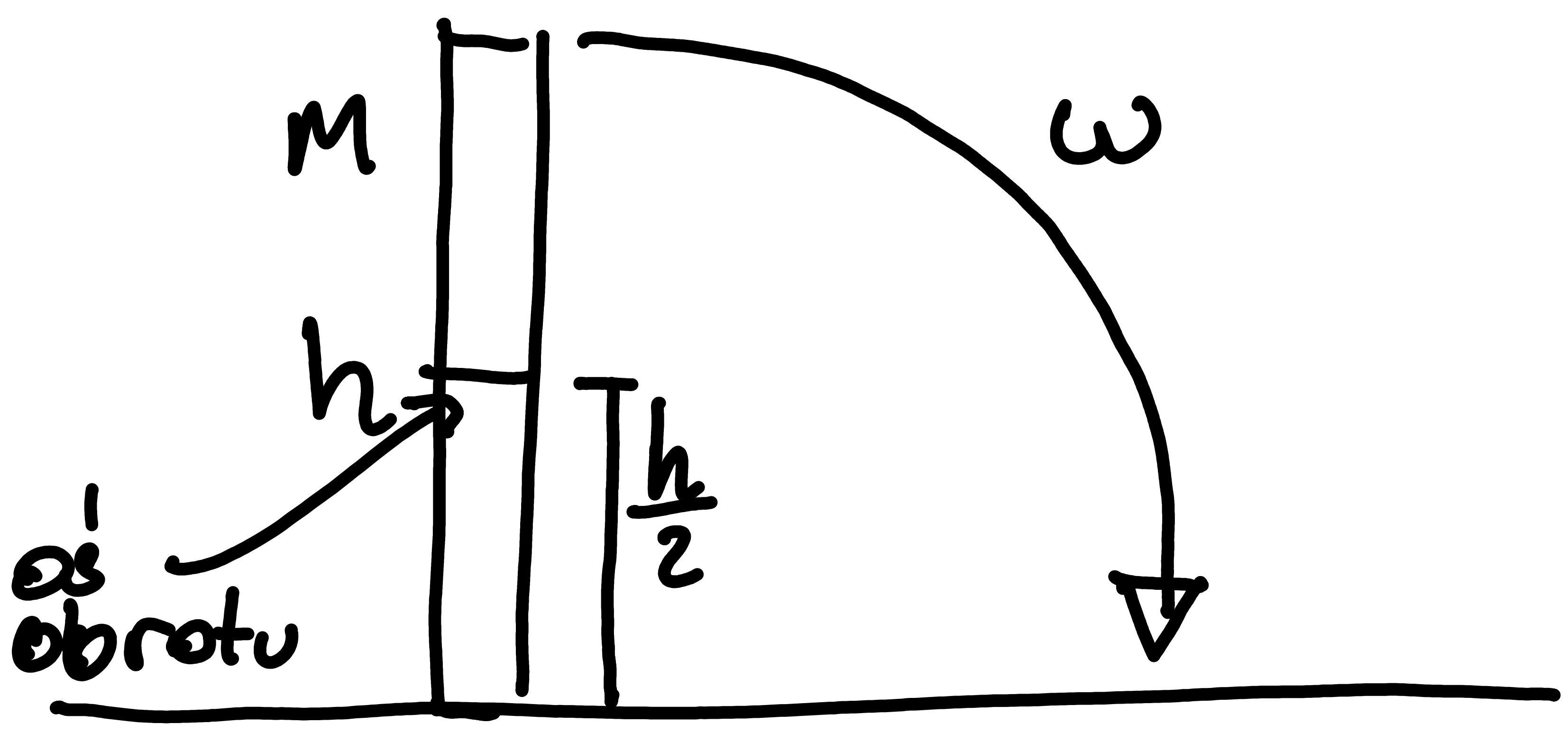
$$I = \int_{R_w}^{R_z} 2\pi \rho r^3 l\, dr = \frac{1}{2}\pi \rho \left(R_z^4 - R_w^4\right)$$

Odejmujemy puste pole: $M = \pi \rho l\left(R_z^2 - R_w^2\right)$

$$I = \frac{1}{2} M \left(R_z^2 + R_w^2\right)$$

zadanie 3:

Z jaką prędkością upadnie wierzchołek?



$$E_{kin} = \frac{I\omega^2}{2}$$ – energia kinetyczna w ruchu obrotowym.

$$\omega = \frac{v}{r} \qquad \Delta E_{kin} + \Delta E_{pot} = 0$$

Steiner – $I = md^2 + I_0$

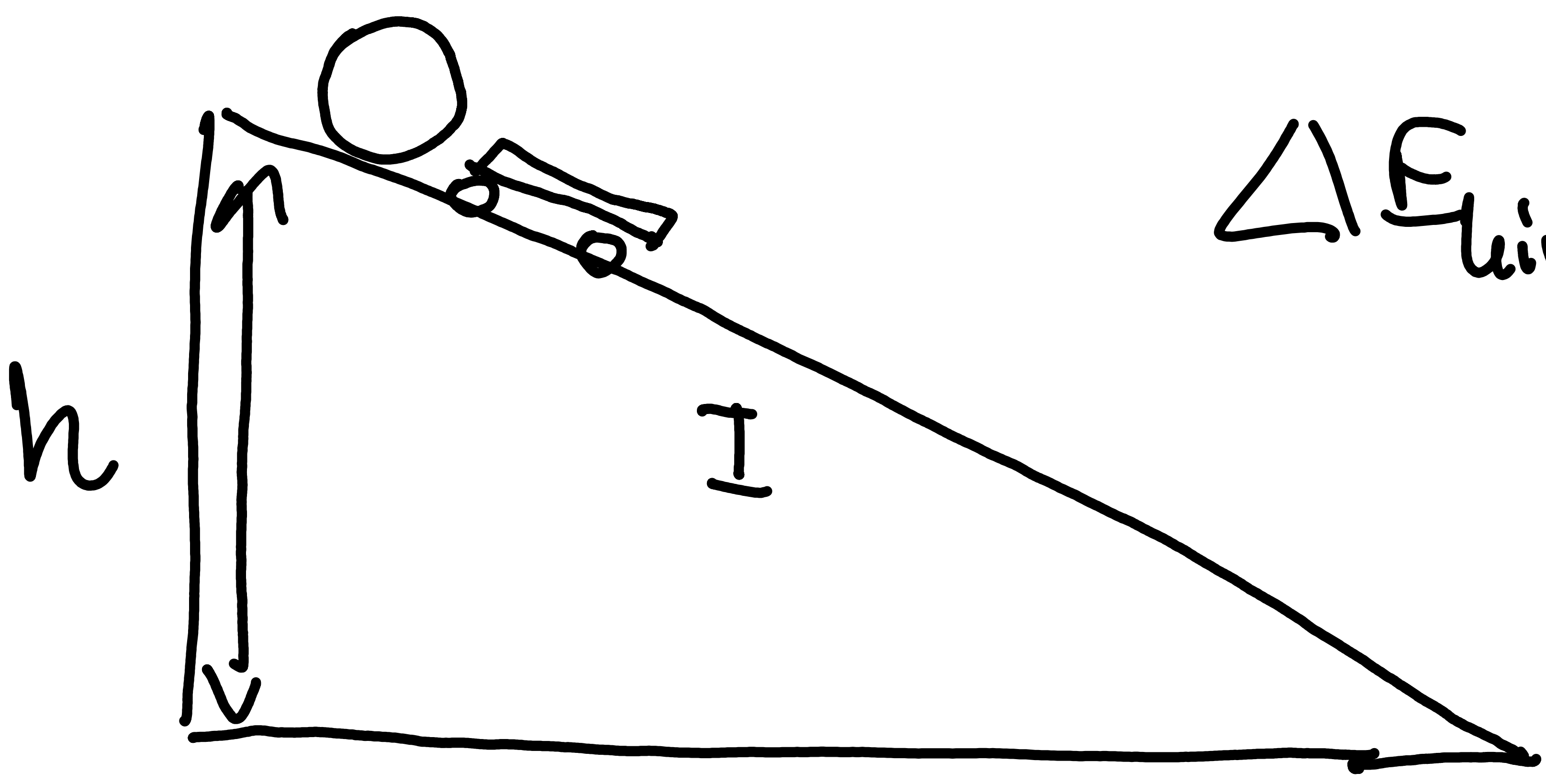
$$v = \omega h \,, \quad I_0 = \frac{mh^2}{12}$$

$$I = I_0 + \frac{mh^2}{4} = \frac{mh^2}{3}$$

???

$$E_{kin} = \frac{I\omega^2}{2} = \frac{mh^2\omega^2}{6}$$

Zadanie 4.



$\omega = \frac{v_1}{r}$ $I = mr^2 b$

$\Delta E_{kin} = \frac{m v_1^2}{2} + \frac{\omega^2}{2} I$

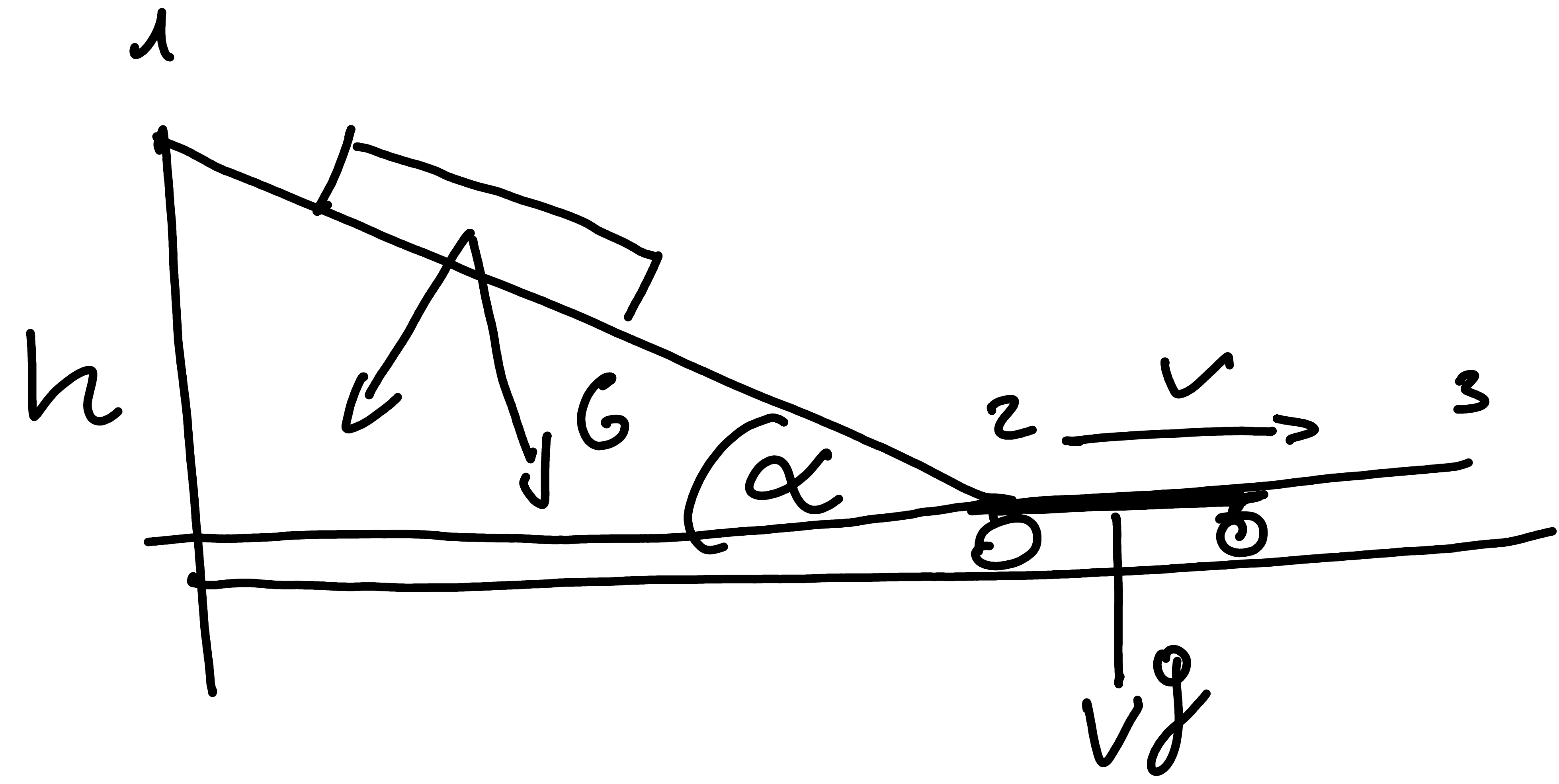
Dla wózka: $\Delta E_{kin} + \Delta E_{pot} = 0$

$\Delta E_{kin} = -mgh$

$\Delta E_{pot} = \frac{mv^2}{2}$

$-mgh + \frac{m v_2^2}{2} = 0 \Rightarrow v_2 = \sqrt{2gh}$

ĆWICZENIA 5



Zadanie 1.

$$m = \frac{G}{g}$$

$$mgh = \frac{mv^2}{2} \quad V_1 = \sqrt{2gh}$$

W chwili upadku ciało ma pęd: $\vec{p_1} = m\vec{V_1}$

$$P_{1x} = mV_1 \cos(\alpha)$$

$$P_{1y} = mV_1 \sin(\alpha)$$

ciężar po upadku na platformę: $M = \frac{G+G_1}{g}$

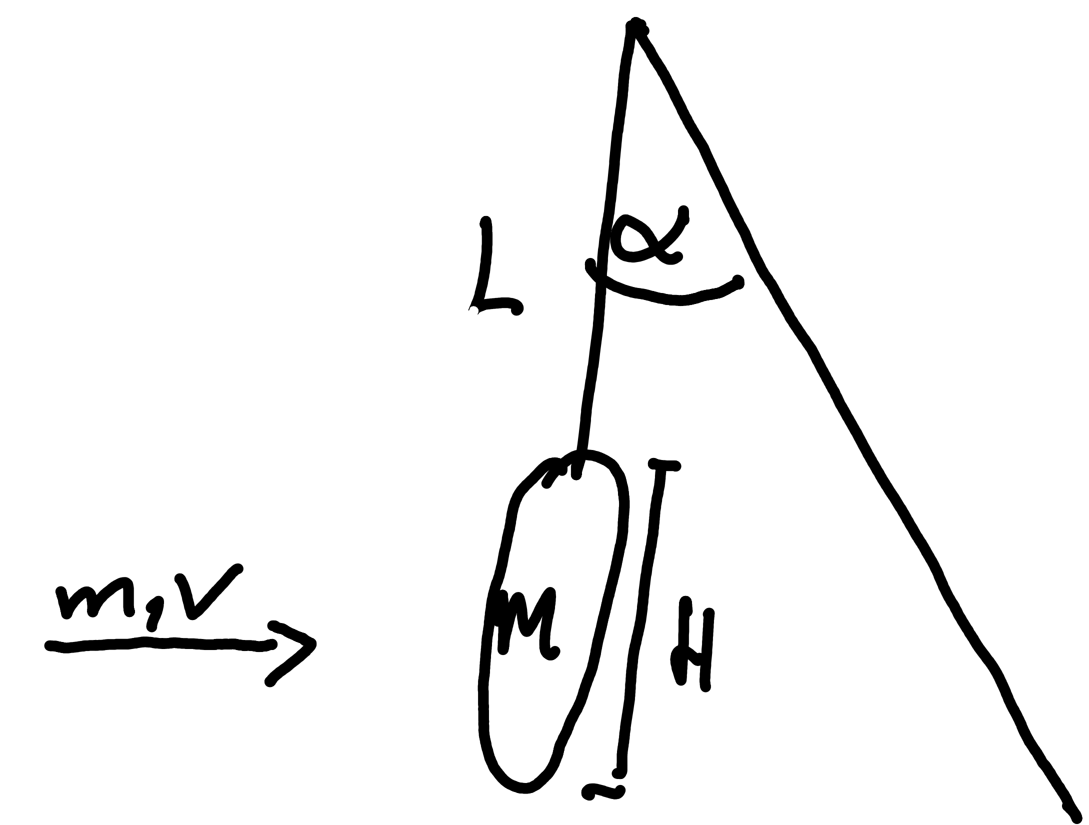
$$\vec{P_2} = M\vec{V_2}$$

$$V_{x1} = V_1 \cdot \cos(\alpha) = \sqrt{2gh} \cdot \cos(\alpha)$$

$$M \cdot V_x = m V_{1x}$$

$$\frac{G+G_1}{g} \cdot V = \frac{G}{g} V_1 x \implies \frac{G+G_1}{g} \cdot V = \frac{G}{g} \sqrt{2gh} \cdot \cos(\alpha)$$

Zadanie 2



niesprężyste, zasada zachowania pędu.

$$mV = (M+m)\cdot U \Rightarrow U = \frac{m}{(M+m)}V$$

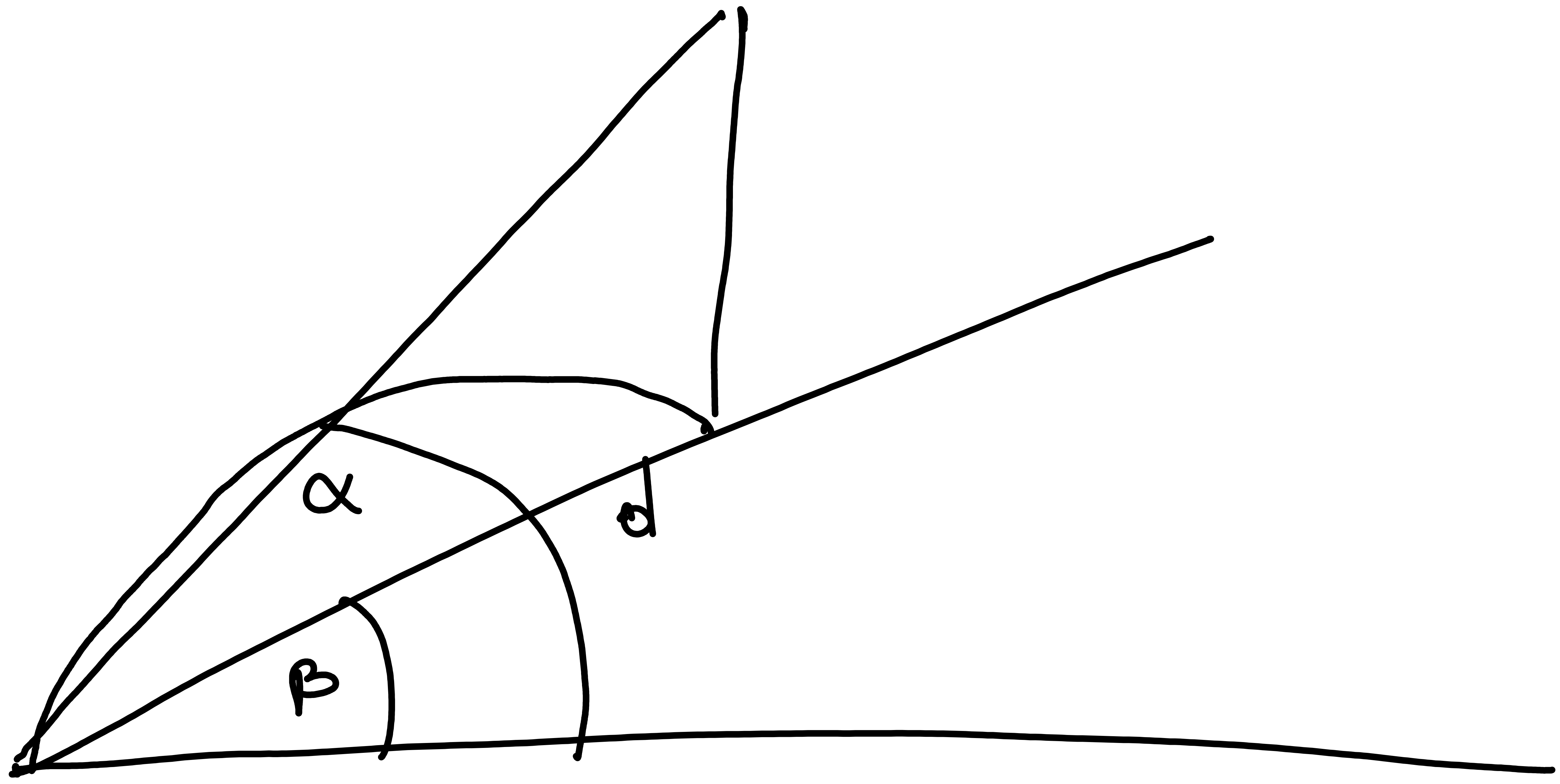
$$E_k = \int M\cdot V\,dt = \frac{(M+m)\left[\frac{m}{(m+M)}V\right]^2}{2} = \frac{1}{2}\frac{m^2V^2}{m+M}$$

$$E_p = (m+M)gh$$

z zależności tryg: $\cos(\alpha) = \frac{L-H}{L} = 1-\frac{L}{H}$

$$E_p = (m+M)gL(1-\cos(\alpha)$$

przyrównać, obliczyć V.



$$V_x = V_{0x} = V_0 \cos(\alpha)$$

$$x = V_0 t \cos(\alpha)$$

$$V_y = V_0 \sin(\alpha) - gt$$

$$y = V_0 t \sin(\alpha) - \frac{1}{2} g t^2$$

wyliczamy t

$$y = x \, tg(\beta)$$

$$y_A = x \, tg(\beta) = x_A \, tg(\alpha) - \frac{1}{2} \frac{g}{}$$

OD

NOWA