

Zadanie 1

$$\begin{aligned}
 (a) \quad & V_1 = v_0 - gt \quad ; \quad v_2 = -g(t-1) \\
 & v_1^2 = v_0^2 + 2gh \quad ; \quad v_2^2 = 2gh \\
 & v_1 = -\sqrt{v_0^2 + 2gh} \quad ; \quad v_2 = -\sqrt{2gh} \\
 & gt = v_0 + \sqrt{v_0^2 + 2gh} \quad ; \quad gt = \sqrt{2gh} + g \\
 & \left[\sqrt{v_0^2 + 2gh} \right]^2 = \left[\sqrt{2gh} + g - v_0 \right]^2 \\
 & \sqrt{2gh} \stackrel{(b)}{(g - v_0)} = g \left(v_0 - \frac{g}{2} \right) \stackrel{(c)}{=} \\
 & h = \frac{1}{2g} \left[\frac{g \left(v_0 - \frac{g}{2} \right)}{g - v_0} \right]^2
 \end{aligned}$$

$$(b) \quad g - v_{\max} > 0$$

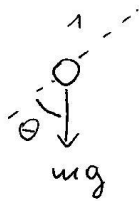
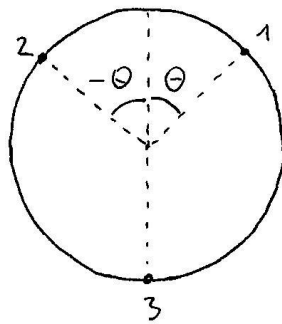
$$v_{\max} < 9,8 \text{ m/s}$$

$$(c) \quad v_{\min} - \frac{g}{2} > 0$$

$$v_{\min} > 4,9 \text{ m/s}$$

□

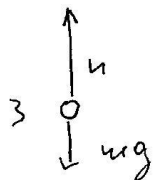
Zadanie 2



$$\begin{cases} mg \cos \theta = m \frac{v^2}{R} \\ mg R (1 - \cos \theta) = \frac{mv^2}{2} \end{cases}$$

$$\theta = \arccos \frac{2}{3} \quad a = g$$

$$-\theta = -\arccos \frac{2}{3} \quad a = g$$



$$\begin{cases} n - mg = m \frac{v^2}{R} \\ mg 2R = \frac{mv^2}{2} \\ a = \frac{v^2}{R} \end{cases}$$

$$a = 4g$$

□

Zadanie 3

$$\begin{cases} p_1 V_1^\gamma = p_2 V_2^\gamma \\ \gamma = \frac{5}{3} \\ p_2 = \frac{p_1}{2} \end{cases}$$

$$V_2 = 2^{\frac{3}{5}} V_1$$

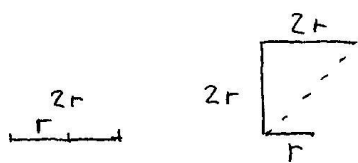
$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2} \rightarrow T_2 = \frac{T_1}{2^{\frac{2}{5}}}$$

$$\begin{cases} U = \frac{3}{2} n R T \\ W = \frac{3}{2} n R (T_1 - T_2) \quad (W > 0) \\ p_1 V_1 = n R T_1 \end{cases}$$

$$W = \frac{3}{2} \left(1 - \frac{1}{2^{\frac{2}{5}}} \right) p_1 V_1$$

□

Zadanie 4



$$\begin{cases} k \frac{q_1}{r} + k \frac{Q}{2r} = 0 \\ k \frac{q_2}{r} + k \frac{Q}{\sqrt{(2r)^2 + (2r)^2}} = 0 \end{cases}$$

$$q_2 - q_1 = \frac{Q}{2} \left(1 - \frac{\sqrt{2}}{2} \right)$$

□