

7. Dano:

$$\vec{a}(t) = 5\vec{i} + t\vec{k} \text{ m/s}^2$$

$$a_x = 5, \quad a_y = 0, \quad a_z = t$$

$$\vec{r}_0 = (0; 0; 0)$$

$$\vec{v}_0 = (0; 3; 0)$$

$$\vec{R} \quad \vec{v}(3)$$

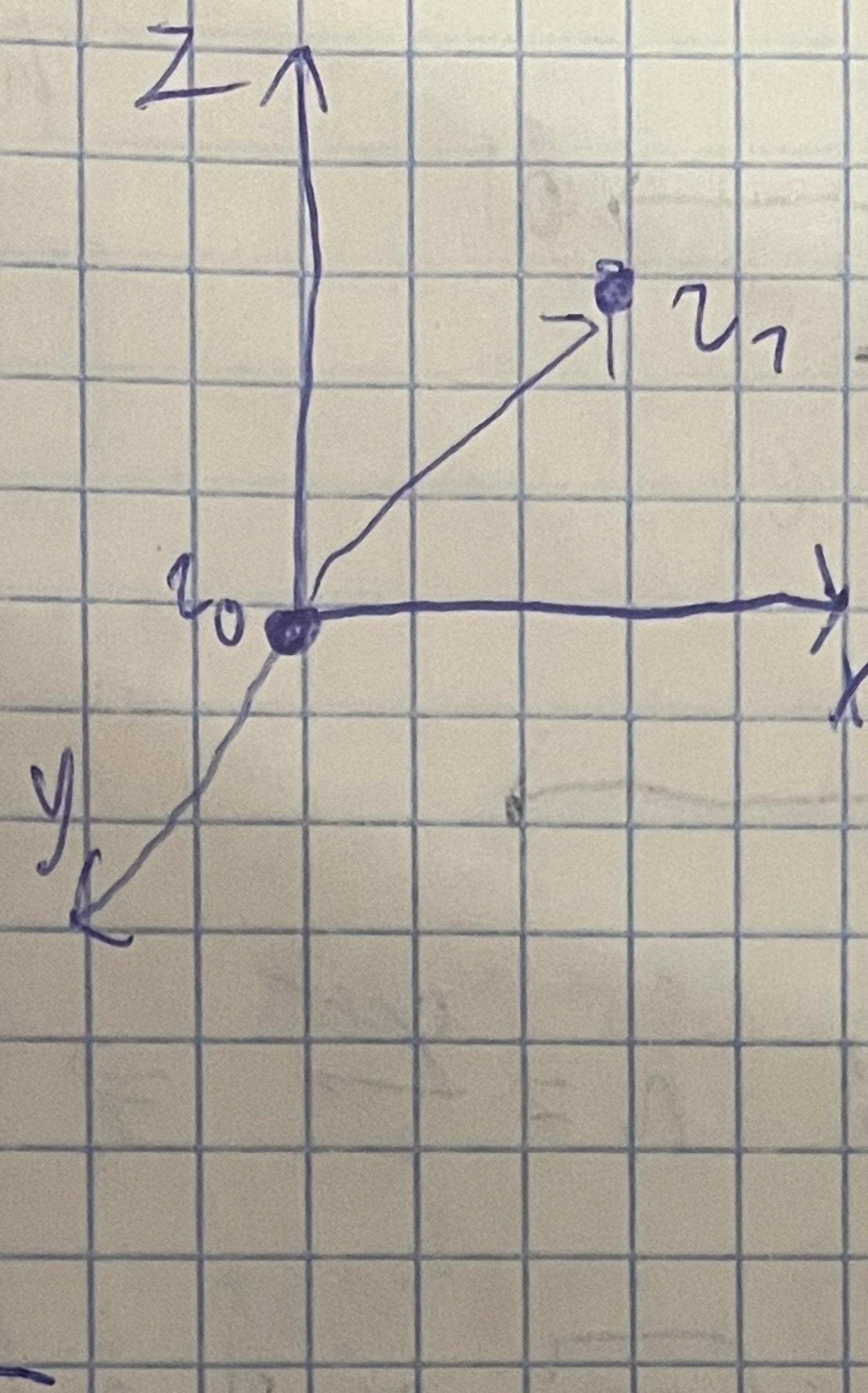
$$\vec{r}(t) = \vec{r}_0 + \int_0^t \vec{v}(T) dT$$

$$x(t) = \int_0^t 5T dT = \frac{5}{2} t^2$$

$$y(t) = \int_0^t 3 dT = 3t$$

$$z(t) = \int_0^t \frac{T^2}{2} dT = \frac{1}{6} t^3$$

$$\vec{r}(t) = \frac{5}{2} t^2 \vec{i} + 3t \vec{j} + \frac{t^3}{6} \vec{k}$$



$$\vec{v}(t) = \vec{v}_0 + \int_0^t \vec{a}(T) dT$$

$$v_x(t) = 0 + \int_0^t 5 dT = 5t$$

$$v_y(t) = 3 + \int_0^t 0 dT = 3$$

$$v_z(t) = 0 + \int_0^t T dT = \frac{t^2}{2}$$

$$\vec{v}(t) = 5t \vec{i} + 3 \vec{j} + \frac{t^2}{2} \vec{k}$$

$$\vec{r}(3) = 22,5 \vec{i} + 9 \vec{j} + 4,5 \vec{k}$$

$$R = |\vec{r}(3)| = \sqrt{22,5^2 + 9^2 + 4,5^2} =$$

$$\approx 24,6 \text{ m}$$

$$\vec{v}(3) = 15 \vec{i} + 3 \vec{j} + 9,5 \vec{k}$$

$$|\vec{v}(3)| = \sqrt{15^2 + 3^2 + 9,5^2} = 15,9 \frac{\text{m}}{\text{s}}$$

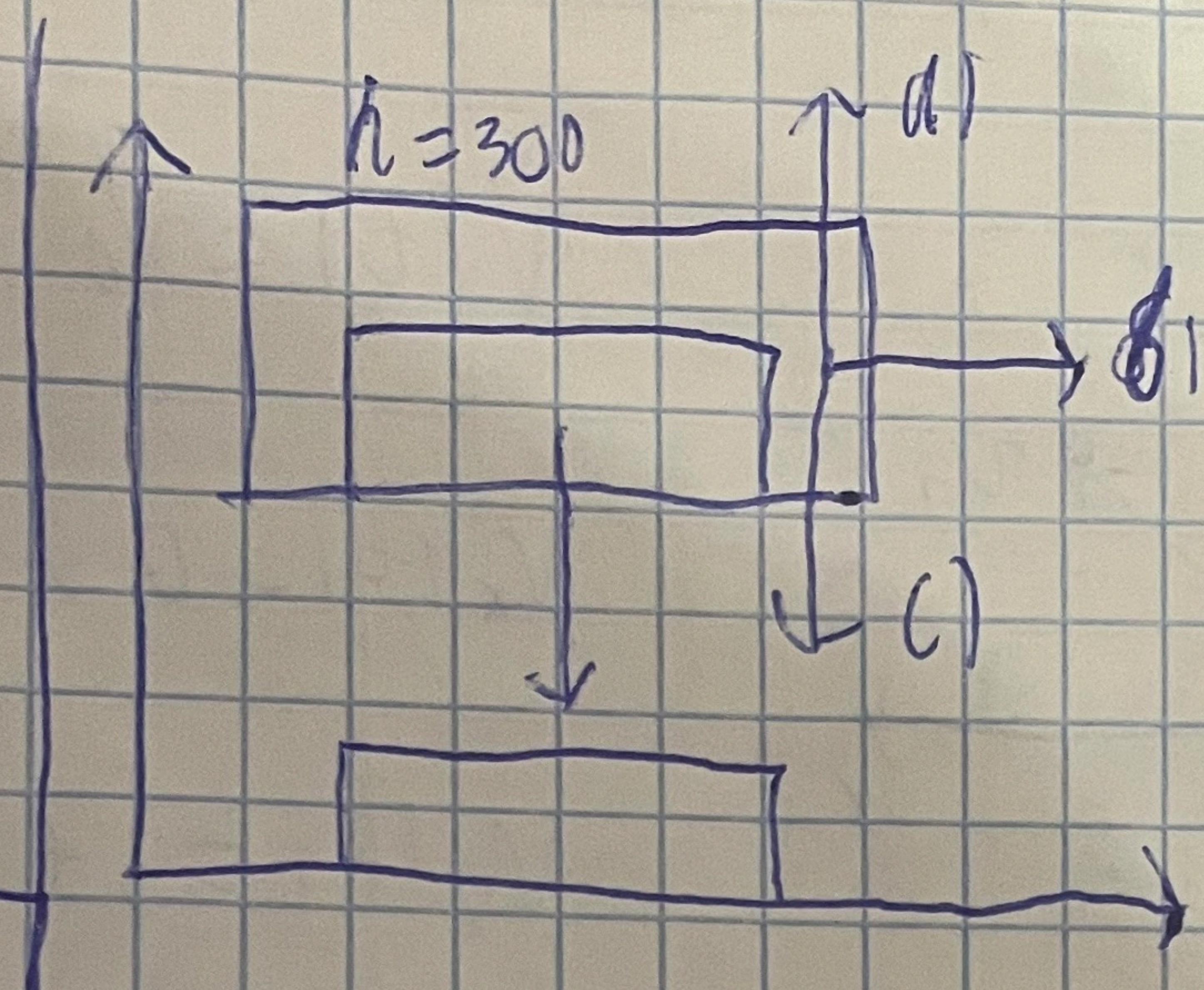
2. Dano:

$$h = 300 \text{ m}$$

$$g = 9,8 \text{ m/s}^2$$

$$V = 5 \text{ m/s}$$

$$t_a, t_b, t_c, t_d$$



$$h = V_{0y} t + \frac{gt^2}{2}$$

a)  $V_{0y} = 0 : h = \frac{gt^2}{2} \Rightarrow t = \sqrt{\frac{2h}{g}}$

$$t_a = \sqrt{\frac{2 \cdot 300}{10}} = \sqrt{60} \approx 7,7 \text{ s}$$

b)  $V_{0y} = 0 ; t_b \approx 7,7 \text{ s}$  (maximalna výška je 0 m)

$$c) 300 = 5t + \frac{10t^2}{2}$$

$$\cancel{5t^2 + 5t = 300}$$

$$D = b^2 - 4ac = 6025$$

$$t_c = \frac{-5 \pm \sqrt{D}}{10} = \frac{-5 + 77,6}{10} =$$

$$\approx 7,2 \text{ s}$$

$$d) 300 = -5t + \frac{10t^2}{2}$$

$$5t^2 - 5t = 300$$

$$\sqrt{D} = 77,6$$

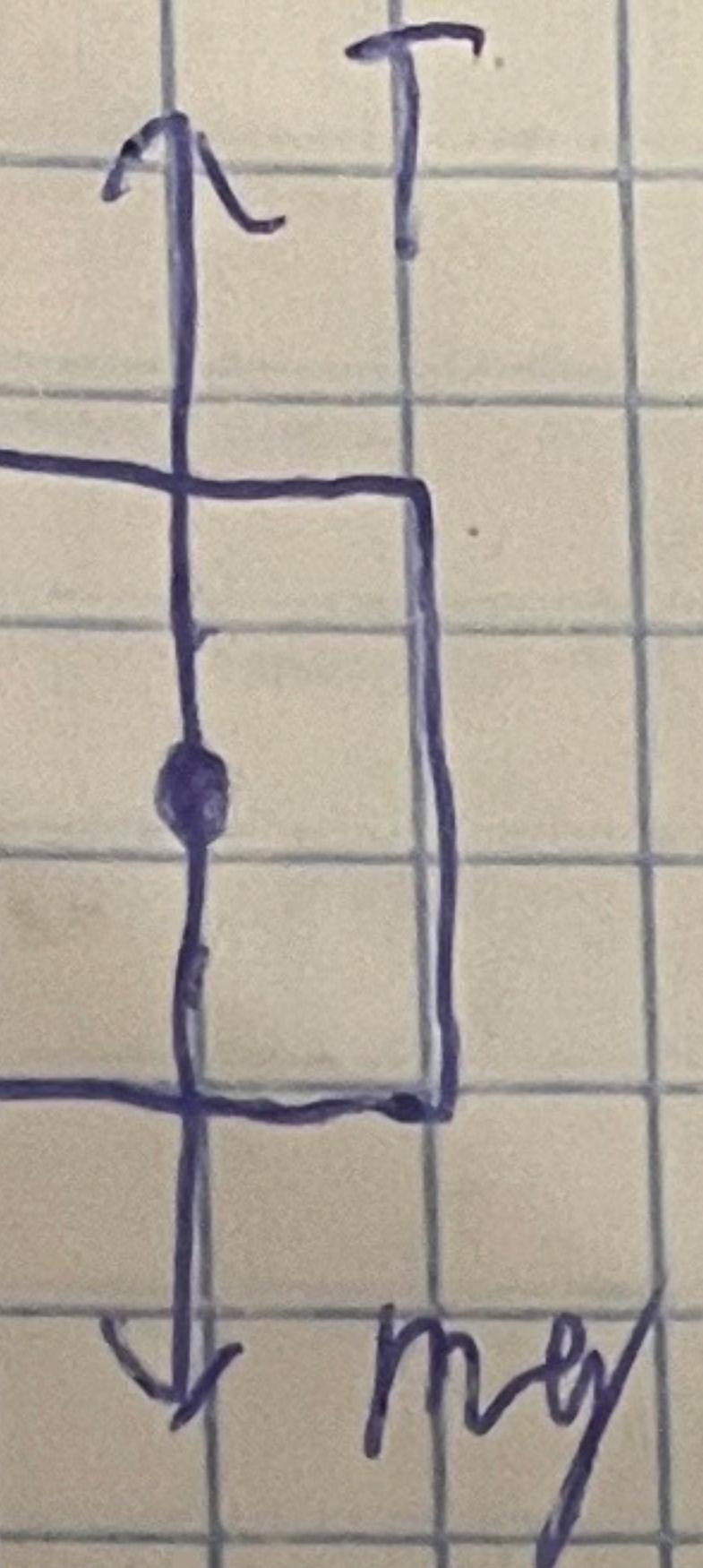
$$t_d = \frac{5 + 77,6}{10} \approx 8,26 \text{ s}$$

3. Dano:

$$m = 7 \cdot 10^3 = 3000 \text{ kg}$$

$$d = a, u g \mu / \text{m}^2$$

$$g = 10 \text{ m/s}^2$$



$$T_{\uparrow} : T > mg$$

$$T_{\downarrow} : T < mg$$

$$T_{\uparrow}, T_{\downarrow}$$

$$\text{1) } T_{\uparrow} = mg + ma \Rightarrow T_{\uparrow} = m(g+a)$$

$$T_{\uparrow} = 3000 (10 + 0,49) = 37420 \text{ N} \approx \underline{\underline{37,4 \text{ kN}}}$$

$$\text{2) } T_{\downarrow} = mg - ma \Rightarrow T_{\downarrow} = m(g-a)$$

$$T_{\downarrow} = 3000 (10 - 0,49) = 28530 \text{ N} \approx \underline{\underline{28,5 \text{ kN}}}$$

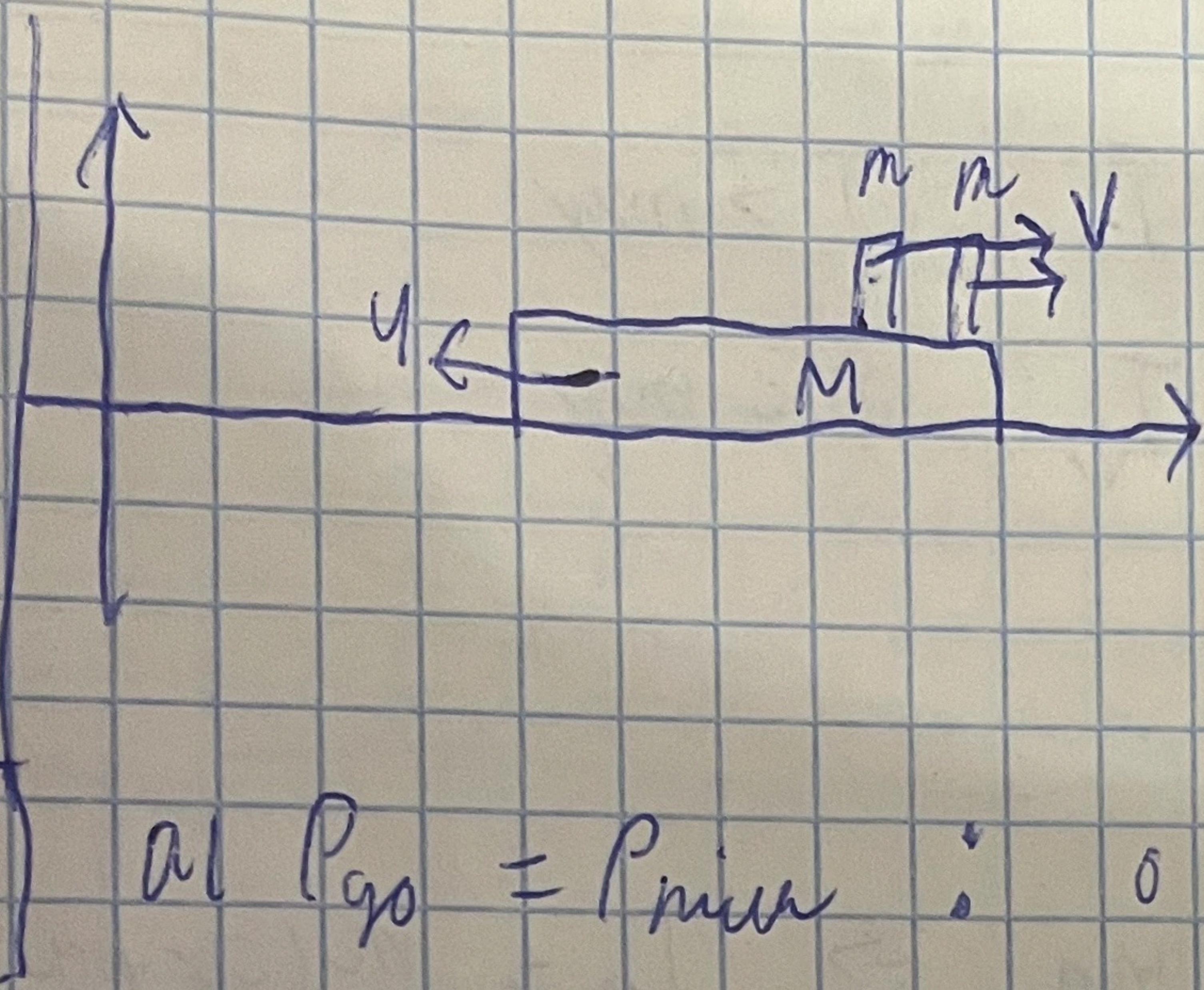
1. Rand:

$M$  (Inlam.)

$m$  (ausgr.)

$V$

$U_1$



$$\text{at } P_{90} = P_{\text{max}} : 0 = M u_a + 2m(u_a + V)$$

$$0 = M u_a + 2m u_a + 2mV \Rightarrow u_a(M + 2m) = -2mV$$

$$u_a = -\frac{2mV}{M+2m}$$

$$|u_a| = \underline{\frac{2mV}{M+2m}}$$

$$\int | \gamma_1 | 0 = (M+m) U_1 + m(U_1 + V) \Rightarrow [M+2m] U_1 = -mV$$

$$U_1 = -mV / (M+2m)$$

$$2) (M+m) \left( \frac{-mV}{M+2m} \right) = M U_2 + m U_2 + mV$$

$$\frac{-m(M+m)V}{M+2m} = (M+m) U_2 + mV \Rightarrow U_2 = \frac{-mV}{M+2m} - \frac{mV}{M+m}$$

$$|U_2| = \pm mV \left( \frac{1}{M+2m} + \frac{1}{M+m} \right)$$

5 Danno

$$S = 5 \mu$$

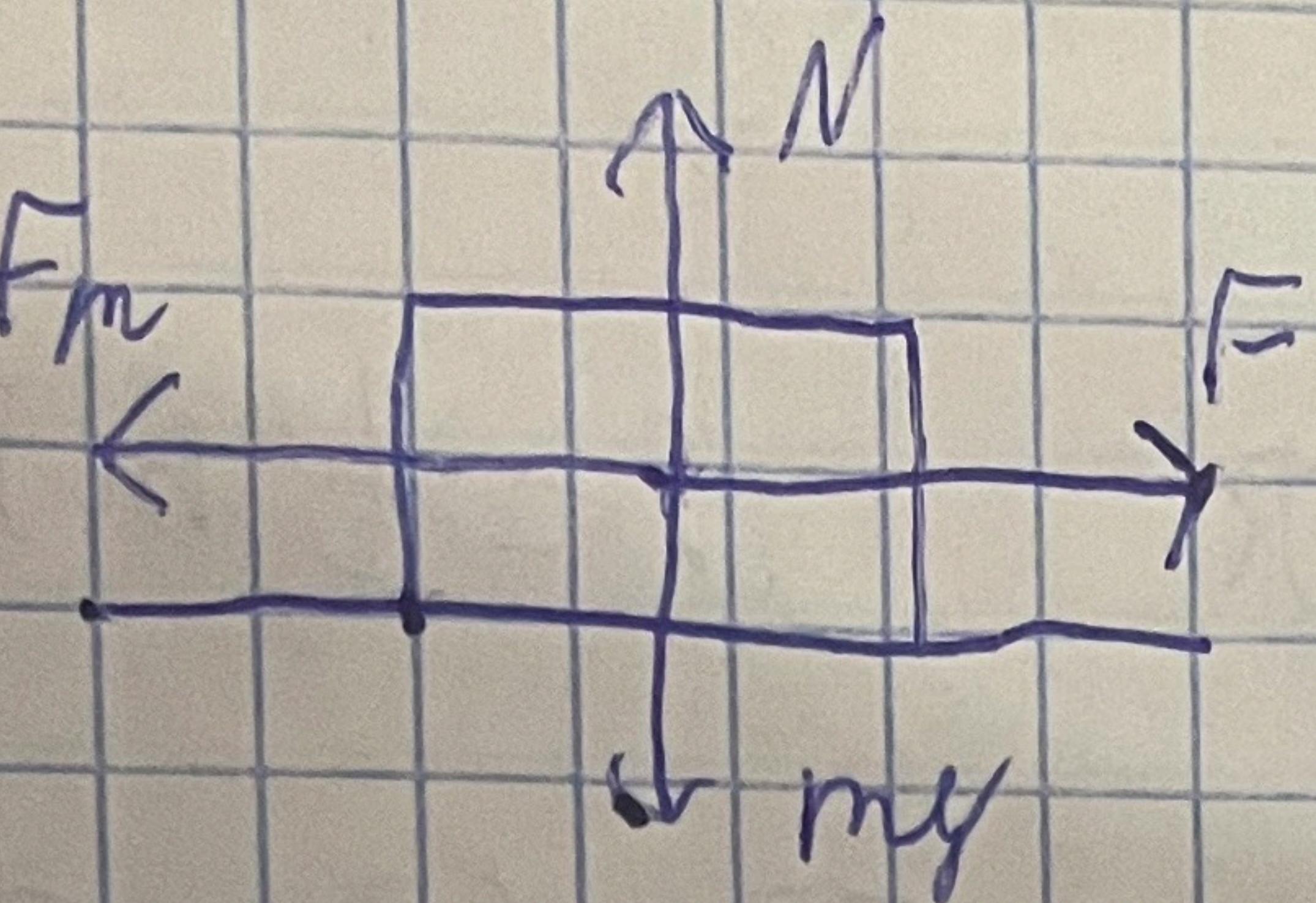
$$V = 2 \text{ m/s}$$

$$m = 400 \text{ kg}$$

$$\mu = 0,07$$

$$g = 10 \text{ m/s}^2$$

A



$$\zeta = \frac{V^2 - V_0^2}{2a} = \frac{V^2}{2a}$$

$$a = \frac{V^2}{2S} = \frac{4}{2 \cdot 5} = 0,4 \frac{\text{m}}{\text{s}^2}$$

$$F - F_m = ma$$

$$F_m = \mu N = M \cdot g = 0,07 \cdot 400 \cdot 10 = 40 \text{ N}$$

$$F = F_m + ma = 40 + 400 \cdot 0,4 = 40 + 160 = 200 \text{ N}$$

$$f = FS = 200 \cdot 5 = 1000 \text{ N} = \underline{10^3 \text{ N}}$$

6. Danie:

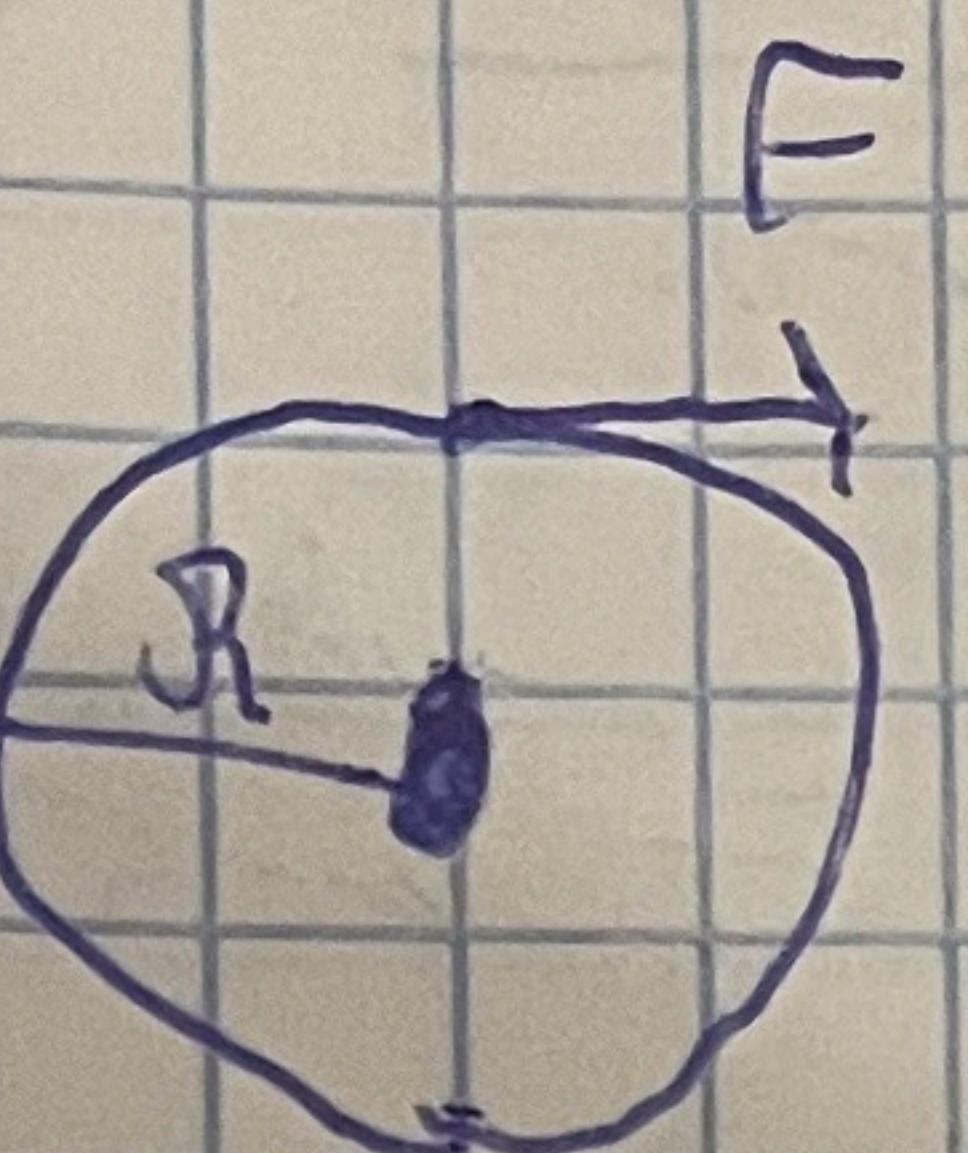
$$m = 2 \text{ kr}$$

$$F = 27,3 \text{ N}$$

$$t = 10 \text{ s}$$

$$\omega_0 = 0$$

$$E_K$$



$$M = FR$$

$$J = \frac{1}{2} m R^2$$

$$M = J \cdot \epsilon : FR = \left( \frac{1}{2} m R^2 \right) \epsilon$$

$$\epsilon = \frac{FR}{\frac{1}{2} m R^2} = \frac{2F}{mR}$$

(kym. vrtukoperaatio)

$$U_I = \epsilon \cdot t = \frac{2Ft}{mR}$$

(kym. vahvuuskiemi)

$$E_K = \frac{1}{2} \frac{J \omega^2}{2} = \frac{1}{2} \left( \frac{1}{2} m R^2 \right) \left( \frac{2Ft}{mR} \right)^2 =$$

$$= \frac{1}{4} m R^2 \cdot \frac{4F^2 t^2}{m^2 R^2} = \frac{F^2 t^2}{m}$$

$$E_K = \frac{(27,3)^2 \cdot 10^2}{7} = \frac{74529}{7} =$$

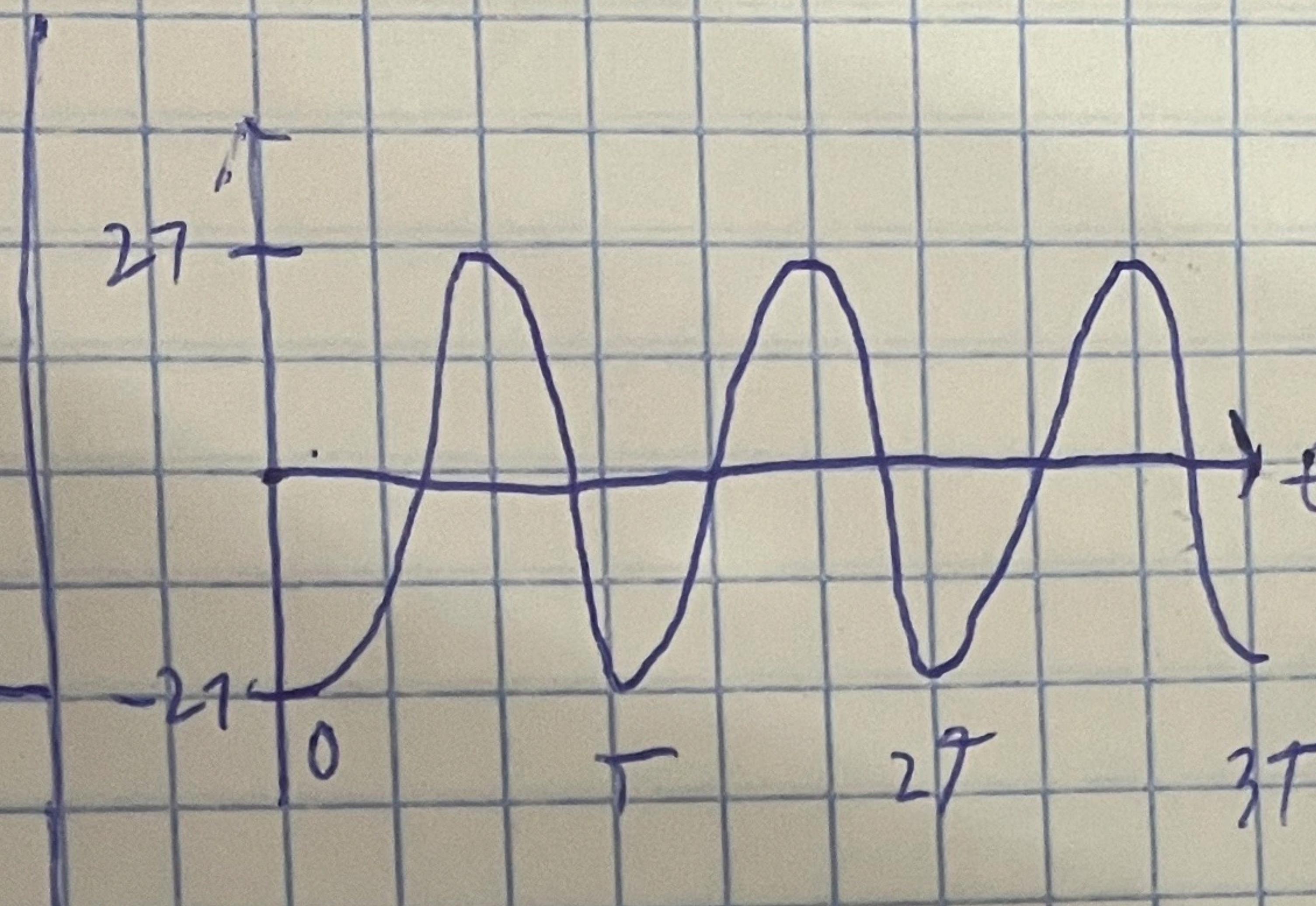
$$= 70697 \text{ Jm} \approx \underline{\underline{70,65 \text{ kDm}}}$$

7. Дано:

$$x(t) = 27 \sin(0,5\pi t) \text{ см}$$

$$t = 27$$

$$L, N$$



$$x(t) = A \sin(\omega t)$$

$$L = A - (-A) = 2A = \underline{42 \text{ см}} \quad (\text{крайни рел.})$$

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{0,5\pi} = \frac{20}{5} = 4 \text{ с} \quad (\text{период})$$

$$N = \frac{60}{T} = 60/4 = \underline{15}$$