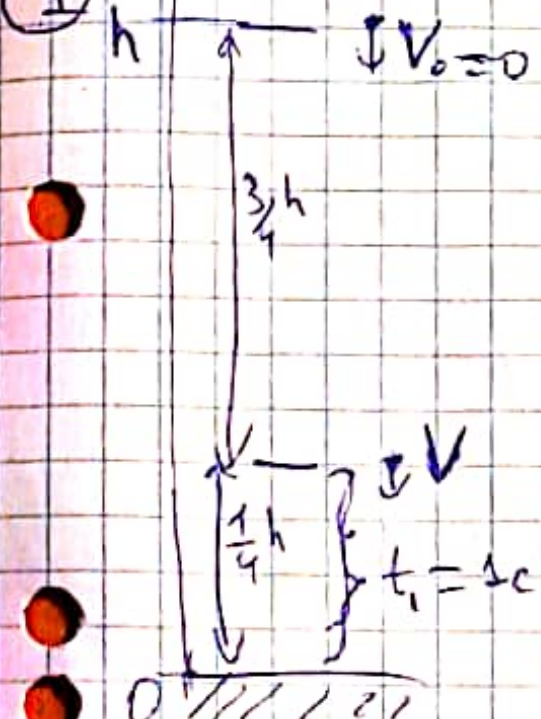


① 

$$\downarrow V_0 = 0 \frac{m}{s}$$

$$\frac{3}{4}h = \frac{V^2 - V_0^2}{2g} \Rightarrow V = \sqrt{\frac{3gh}{2}}$$

$$\frac{1}{4}h = Vt_1 - \frac{gt_1^2}{2}$$

$$\frac{1}{4}h = \sqrt{\frac{3gh}{2}} t_1 - \frac{gt_1^2}{2}$$

$$\left(\frac{1}{4}h + \frac{gt_1^2}{2}\right)^2 = \frac{3gh}{2} \cdot t_1^2$$

$$\frac{1}{16}h^2 + 2 \cdot \frac{1}{4}h \cdot \frac{gt_1^2}{2} + \frac{g^2 t_1^4}{4} = \frac{3gh}{2} t_1^2$$

$$= \frac{3gh}{2} t_1^2$$

$$\frac{1}{16}h^2 - \frac{5}{4}ght_1^2 + \frac{g^2 t_1^4}{4} = 0 \quad | \cdot 16$$

$$h^2 - 20gh t_1^2 + \frac{g^2 t_1^4}{4} \cdot 16 = 0$$

$$h^2 - 20 \cdot 10 \cdot 1^2 \cdot h + \frac{10^2 \cdot 1^4}{4} \cdot 16 = 0$$

$$h^2 - 200h + 400 = 0$$

$$D = 40000 - 1600 = 38400 \approx (195)^2$$

$$h = \frac{200 \pm \sqrt{D}}{2} = \frac{200 \pm 195}{2} = \underline{197,5 \text{ m}}$$

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \cdot 197,5 \text{ m}}{10 \frac{m}{s^2}}} \approx \underline{6,3 \text{ s}}$$

$$② \quad \vec{r} = (3-t^2)\vec{i} + 4t\vec{j}$$

$$\vec{r} = (3-t^2, 4t)$$

$$a) \quad \vec{v} = \frac{d\vec{r}}{dt} = \left(\frac{d(3-t^2)}{dt}, \frac{d(4t)}{dt} \right) =$$

$$= (-2t, 4) = -2t\vec{i} + 4\vec{j};$$

$$\vec{a} = \frac{d\vec{v}}{dt} = \left(\frac{d(-2t)}{dt}, \frac{d(4)}{dt} \right) = (-2, 0) =$$

$$= -2\vec{i};$$

$$\vec{v}(t=2) = -4\vec{i} + 4\vec{j}$$

$$|\vec{v}| = \sqrt{(-4)^2 + (4)^2} = 4\sqrt{2} \approx 5,7 \frac{m}{s}$$

$$\vec{a}(t=2) = -2\vec{i}$$

$$|\vec{a}| = \sqrt{(-2)^2} = 2 \frac{m}{s^2}$$

$$b) \quad S(\Delta t = 3-2=1) = |\vec{r}(t=3) - \vec{r}(t=2)| =$$

$$= \left| \underbrace{(3-3^2)}_{-6}\vec{i} + \underbrace{4 \cdot 3}_{12}\vec{j} - \left(\underbrace{(3-2^2)}_{-1}\vec{i} + \underbrace{4 \cdot 2}_{8}\vec{j} \right) \right| =$$

$$= \left| -5\vec{i} + 4\vec{j} \right| = \sqrt{(-5)^2 + 4^2} = \sqrt{25+16} =$$

$$= \sqrt{41} \text{ m} \approx \underline{6,4 \text{ m}}$$

$$(3) \quad x = A + Bt + Ct^3$$

$$A = 3 \text{ m/s}, \quad B = 2 \frac{\text{m/s}}{\text{s}}, \quad C = 1 \frac{\text{m/s}}{\text{s}^3}$$

$$v = \frac{dx}{dt} = B + 3Ct^2$$

$$a = \frac{dv}{dt} = \frac{d^2x}{dt^2} = 6Ct$$

$$v(t=10) = 2 \frac{\text{m/s}}{\text{s}} + 3 \cdot 1 \frac{\text{m/s}}{\text{s}^3} \cdot 10^2 \text{ s}^2 =$$

$$= \underline{302 \frac{\text{m/s}}{\text{s}}}$$

$$a(t=10) = 6 \cdot 1 \frac{\text{m/s}}{\text{s}^3} \cdot 10 \text{ s} = \underline{60 \frac{\text{m/s}}{\text{s}^2}}$$

$$v_{cp} = \frac{x(t=10) - x(0)}{t} = \frac{3 \text{ m/s} + 2 \frac{\text{m/s}}{\text{s}} \cdot 10 \text{ s} + 1 \frac{\text{m/s}}{\text{s}^3} \cdot 10^3 \text{ s}^3 - 3 \text{ m/s}}{10 \text{ s}} =$$

$$= \underline{102 \frac{\text{m/s}}{\text{s}}}$$

$$\Delta s = x(t=10) - x(0) = 3 \text{ m/s} + 2 \frac{\text{m/s}}{\text{s}} \cdot 10 \text{ s} + 1 \frac{\text{m/s}}{\text{s}^3} \cdot 10^3 \text{ s}^3 - 3 \text{ m/s}$$

$$= \underline{1020 \text{ m/s}}$$

$$④ \quad \vec{r} = 2t^2 \vec{i} + t \vec{j} + \vec{k}$$

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{d(2t^2)}{dt} \vec{i} + \frac{d(t)}{dt} \vec{j} + \frac{d(1)}{dt} \vec{k} =$$

$$= 4t \vec{i} + \vec{j}$$

$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d(4t)}{dt} \vec{i} + \frac{d(1)}{dt} \vec{j} = 4 \vec{i} + 0 \vec{j} = 4 \vec{i}$$

$$|\vec{v}| = \sqrt{(4t)^2 + 1^2} = \sqrt{16t^2 + 1}$$

$$|\vec{v}|_{t=2} = \sqrt{16 \cdot 2^2 + 1} \approx \underline{8,1 \frac{m}{s}}$$

$$s = |\vec{r}(t=10) - \vec{r}(t=9)| =$$

$$= |2 \cdot 10^2 \vec{i} + 10 \vec{j} + \vec{k} - 2 \cdot 9^2 \vec{i} - 9 \vec{j} - \vec{k}| =$$

$$= |38 \vec{i} + \vec{j}| = \sqrt{38^2 + 1^2} \approx \underline{38 \text{ m}}$$

$$b) \quad v = (12t - 3t^2) \frac{\text{м}}{\text{с}}$$

$$v(0) = 12 \cdot 0 - 3 \cdot 0 = 0 \quad - \text{начальная скорость}$$

$$v(t) = 12t - 3t^2 = 0, \quad \text{так как в момент остановки скорость равна нулю}$$

$$t = 4 \text{ с}$$

$$x = v(0)t + \frac{at^2}{2}$$

$$a = \frac{v - v_0}{t}$$

$$x = v_0 t + \frac{v - v_0}{t} \cdot \frac{t^2}{2} = 0 + \frac{vt}{2} =$$

$$\frac{(12 \cdot t - 3t^2) \cdot t}{2} = \frac{(12 \cdot 4 - 3 \cdot 4^2) \frac{\text{м}}{\text{с}} \cdot 4 \text{ с}}{2} =$$

$$x = \int_0^4 v dt = \int_0^4 12t dt - \int_0^4 3t^2 dt =$$

$$= 12 \cdot \frac{t^2}{2} \Big|_0^4 - 3 \cdot \frac{t^3}{3} \Big|_0^4 = 6t^2 \Big|_0^4 - t^3 \Big|_0^4 =$$

$$= 6 \cdot 4^2 - 4^3 - (6 \cdot 0^2 - 0^3) = 32 \text{ м}$$

$$⑥ \quad a_x = 4t \frac{m}{c^2}; \quad dV = a dt$$

$$V_x - V_0 = \int_{t_0}^t a_x dt = \int_{t_0}^t 4t dt = 4 \frac{t^2}{2} \Big|_{t_0}^t =$$

$$= 2(t^2 - t_0^2) = 2t^2 \quad t_0 = 0$$

$$\cancel{V_x = V_0 + 2(t^2 - t_0^2)} = 0 \quad - \text{некорректная запись}$$

$$dX = V_x dt$$

$$X - X_0 = (2t^2 + V_0) dt$$

$$X = X_0 + \int_0^2 2t^2 + \int_0^2 V_0 dt =$$

$$= X_0 + 2 \cdot \frac{t^3}{3} \Big|_0^2 + V_0 t \Big|_0^2 =$$

$$= 6m + \frac{2}{3} \cdot 2^3 m + 2 \cdot 2m = 15 \frac{1}{3} m \approx 15,3 m$$

(7) $a_x = 2 + 0,2t$

$$dV_x = a_x dt$$

$$V_x - V_0 = \int_0^5 (2 + 0,2t) dt =$$

$$= \int_0^5 2 dt + \int_0^5 0,2 t dt = 2 \cdot t \Big|_0^5 + 0,2 \frac{t^2}{2} \Big|_0^5 =$$

$$= 2 \cdot 5 + 0,1 \cdot 5^2 = 10 + 2,5 = \underline{12,5 \frac{m}{s}}$$

$$dX = V_0 dt$$

$$X - X_0 = \int_0^5 (2t + 0,2t^2) dt + \int_0^5 V_0 dt$$

$$X = X_0 + 2 \cdot \frac{t^2}{2} + 0,2 \frac{t^3}{3} + V_0 \cdot t =$$

$$= -12m + 5^2m + \frac{0,2}{3} \cdot 5^3m = \underline{21,3m}$$

$$V = 12,5 \frac{m}{s}$$

$$S = X - X_0 = 21,3m - 12m = 9,3m$$

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$$V_0 = 20 \cdot \frac{1000}{3600} \frac{\text{m}}{\text{s}} = 5,6 \frac{\text{m}}{\text{s}}$$

$$S = V_0 t - \frac{a t^2}{2} = 5,6 \cdot 1 \text{ m} - \frac{1}{2} \text{ m} = 5,1 \text{ m}$$

$$X = S - l = 5,1 \text{ m} - 10 \text{ m} = \underline{\underline{-4,9 \text{ m}}}$$