Общая физика

Семинар - 1

$x(t)$, $v(t) = \frac{dx}{dt}$ $a(t) = \frac{dv}{dt}$

→ дифф. ← инт. → дифф. ← инт.

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(1) Дано:

$v_0 = 30$ км/ч

$a_0 = -4$ м/с^2

Найти: ℓ

Решение:

1) $\frac{dv}{dt} = -a_0 \Rightarrow v(t) = a_0 t + C$

2) $v(0) = v_0$

$a_0 \cdot 0 + C = v_0 \Rightarrow C = v_0 \Rightarrow$

$\Rightarrow v(t) = a_0 t + v_0$

3) $\int dx = \int v\,dt = \int (a_0 t + v_0)\,dt$

$\Delta x = \frac{a_0 t^2}{2}\Big|_0^{t_{ос}} + v_0 t\Big|_0^{t_{ос}}$

$v(t_{ост}) = 0 \Rightarrow t_{ост} = -\frac{v_0}{a_0} \Rightarrow$

$\frac{a_0}{2}\left(-\frac{v_0}{a_0}\right)^2 + v_0\left(-\frac{v_0}{a_0}\right) = \frac{v_0^2}{2a_0} - \frac{v_0^2}{a_0} = \frac{-v_0^2}{2a_0} = \frac{-\left(\frac{30}{3{,}6}\right)^2}{2\cdot(-4)}$

$\approx 8{,}7$ (м)

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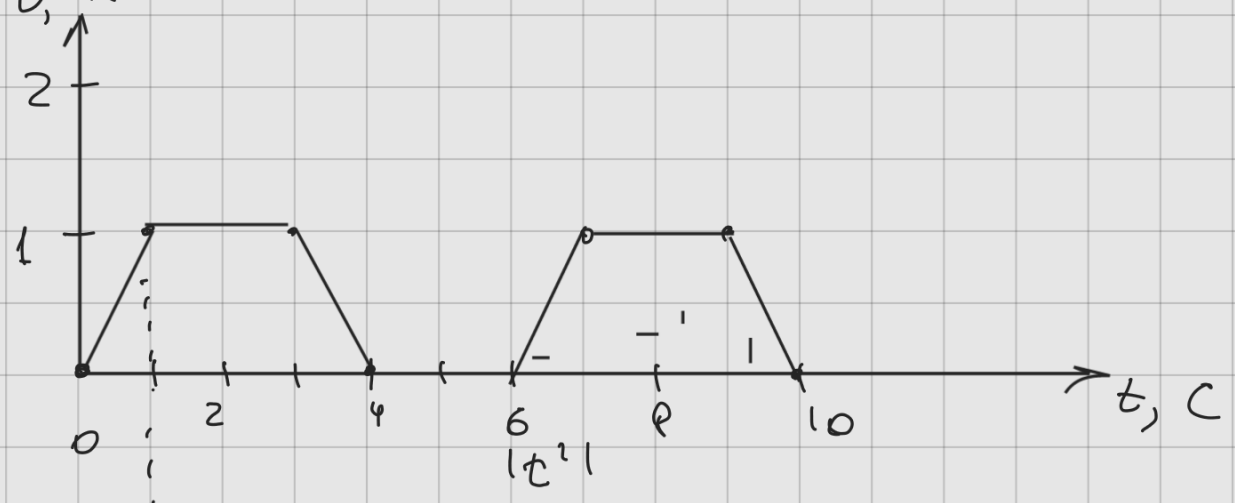
25 м/с



$t \in (0,1)$:

$$x(t) = \int_0^t t\,dt = \frac{t^2}{2} = \int_0^t v(t)\,dt =$$

$$x(1) = \frac{1}{2}$$

$t \in (1,3]$: $\Rightarrow x(t) = \frac{1}{2} + \int_1^t 1\,dt = = \frac{1}{2} + t - 1 = t - \frac{1}{2}$

$$x(3) = \frac{5}{2}$$

$t \in (3,4]$: $\Rightarrow x(t) = \frac{5}{2} + \int_3^t (4-t)\,dt = \frac{1}{2} + 4(t-3) - \frac{t^2}{2} + \frac{9}{2} =$

$$= 7 + 4t - 12 - \frac{t^2}{2} = 4t - \frac{t^2}{2} - 5$$

$(5,6]$

$$x(t) = 3 + \int_0^{t'} t'\,dt' = 3 + \frac{t'^2}{2} = 3 + \frac{(t-6)^2}{2}$$

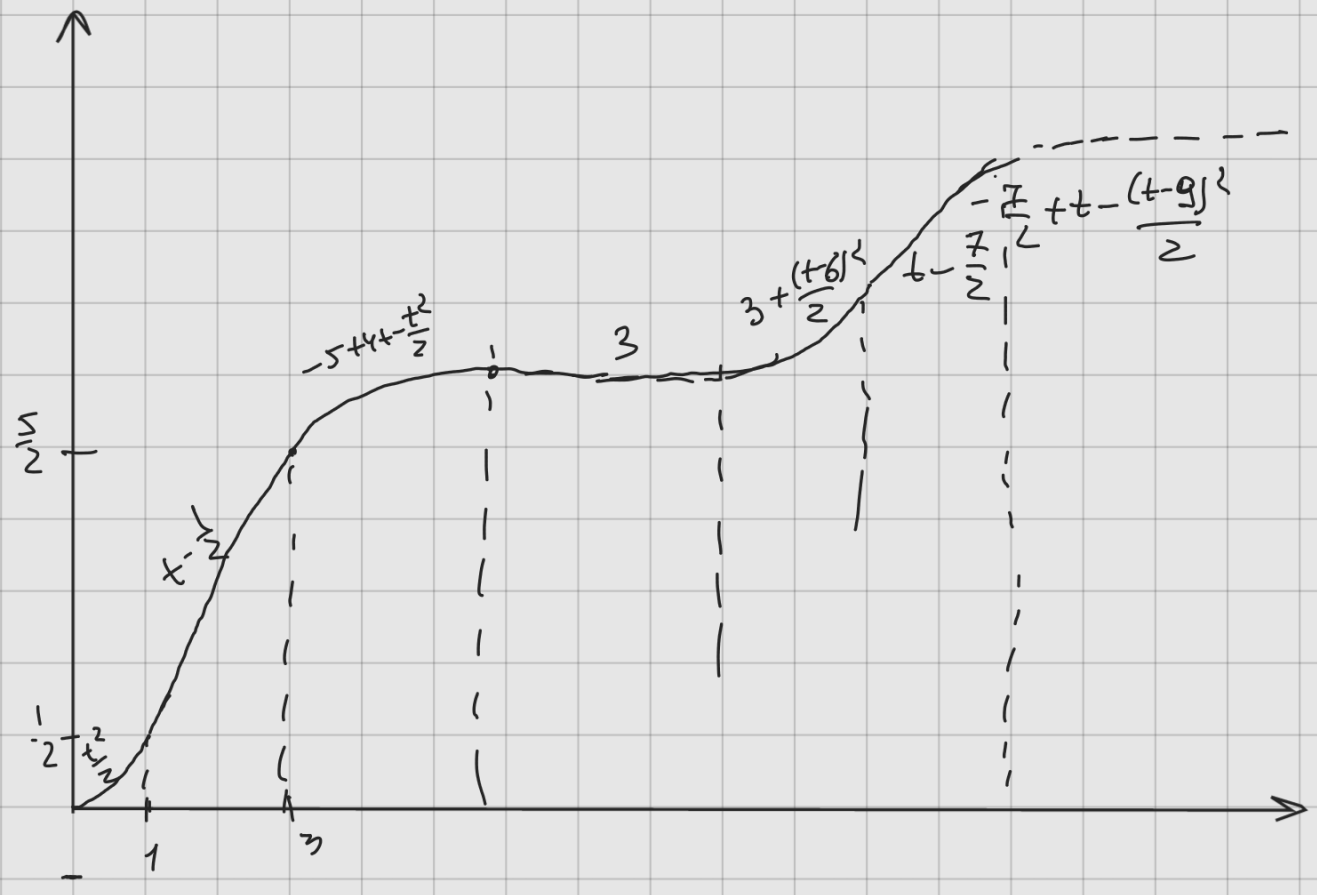
$$\int_0^{t'}$$

$t \in (7,9)$: $x(t) = \frac{7}{2} + \int_0^{t'''} 1\,dt''' = \frac{7}{2} + t''' = \frac{7}{2} + (t-7)$

$= t - \frac{7}{2}$

$t(9,10]$: $x(t) = \frac{11}{2} + \int_0^{t'''} (1-t''')\,dt''' = \frac{11}{2} + t''' - \frac{t'''^2}{2} =$

$= t - \frac{7}{2} - \frac{(t-9)^2}{2}$



Дано:

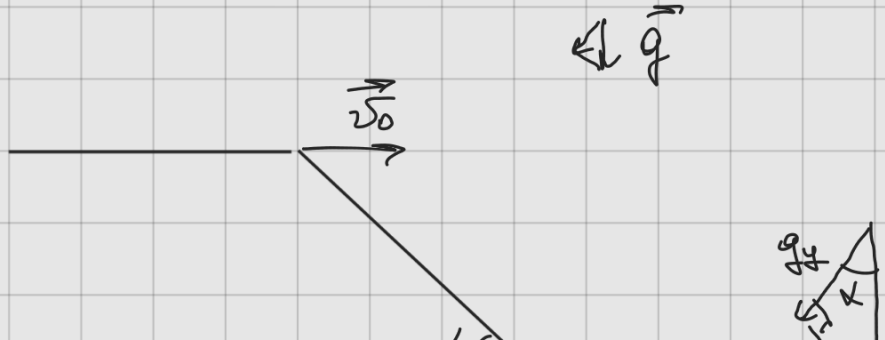
$\alpha = 45°$

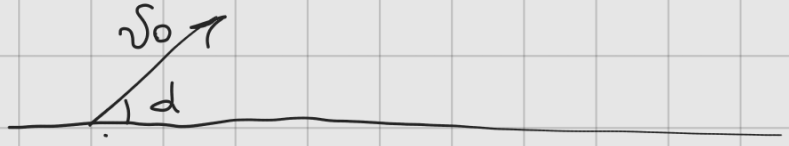
$v_0 = 10$ м/с

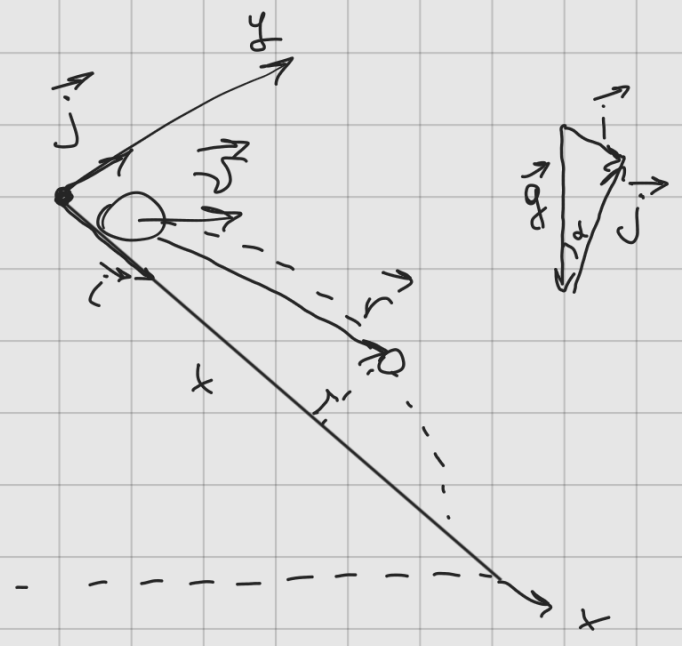
$g = 9{,}8$ м/с²

Найти: l, $v_к$

Решение:







$$\frac{d\vec{v}}{dt} = \vec{g} \Rightarrow \vec{v}(t) = \vec{g}t + \vec{v}_0$$

$$\vec{r}(t) = \frac{\vec{g}t^2}{2} + \vec{v}_0 t + \vec{r}_0$$

$$x = \vec{r}\cdot\vec{i} = |\vec{r}|\cdot|\vec{i}|\cdot\cos\alpha = \frac{\vec{g}\vec{i}\cdot t^2}{2} + \vec{v}_0\vec{i}\,t + \vec{r}_0\vec{i}$$

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

$$= g\sin\alpha\cdot\frac{t^2}{2} + v_0\cos\alpha\, t$$

$$y = \vec{r}\vec{j} = -g\cos\alpha\frac{t^2}{2} + v_0\sin\alpha\, t$$

$$y(0) = 0 \Rightarrow (t=0) \cup \left(t_n = \frac{2v_0\sin\alpha}{g\cos\alpha}\right)$$

$$x(t_n) = \frac{2v_0^2\sin^3\alpha}{g\cos^2\alpha} + \sin\alpha\Big) = \frac{2v_0^2\sin\alpha}{g\cos^2\alpha}$$