2.7) $x(t) = bt^2 - ct^3$

$b = 2{,}4\ m/s^2$

$c = 0{,}6\ m/s^3$

a) $\bar{v}_{tr}(0-10) = ?$

b) $v(0) = ?$, $v(7) = ?$, $v(10) = ?$

c) $v = a$ ? $t = ?$

$\dot{x} = a \quad \dot{x} = v \quad x = s$

a) $x(10) = 120\ m$

$\Delta x = x(10) - x(0) = x(10)$

$\bar{v}_{tr}(0-10) = \frac{\Delta x}{\Delta t} = \frac{120\ m}{10\ s}$

$\Delta t = 10 - 0 = 10\ s$

$\bar{v}_{tr} = 12\ m/s$

b) $x = bt^2 - ct^3$

$\dot{x} = \frac{dx}{dt}$

$\dot{x} = 2bt - 3ct^2$

$v(t) = 2bt - 3ct^2$

c) $v = 0$

$2bt - 3ct^2 = 0$

2.22) $v_{max} = 73{,}44\ m/s$

$t_0 = 30\ ms \quad t_0 = 30 \cdot 10^{-3}\ s$

$v_0 = 0$

$a = const$

a) $a_x = ?$

b) $x(t_1) = ?$

a) $a_x = \frac{\Delta v}{\Delta t} = \frac{73{,}44}{30 \cdot 10^{-3}} = 2448\ m/s^2$

b) $\dot{x} = a$

$\frac{dx}{dt} = a \quad dx = adt \,/\int \quad x = at + C_1$

$\frac{dx}{dt} = at \quad dx = atdt \,/\int$

$x = \frac{1}{2}at^2$

$x(t) = \frac{1}{2}at^2 \Rightarrow x(t_1) = \frac{1}{2}a_x t_1^2 = 1{,}077\ m$

2.23) $a_{max} = 250\ m/s^2$

$v = 105\ km/h : 3{,}6 = 29{,}16\ m/s \ (x)$

$\dot{x} = a$

$\frac{dx}{dt} = a \quad dx = adt \,/\int$

$\dot{x} = at + C_1 \quad (C_1 = v) \Rightarrow \dot{x}(t) = at + v$

$\frac{dx}{dt} = at + v \quad dx = (at + v)dt$

$x = \frac{1}{2}at^2 + vt + C_1 \quad (C_1 = 0)$

$x(t) = \frac{1}{2}at^2 + vt$

$\dot{x}(t_{min}) = 0$

$at = -v$

$t_z = -\frac{v}{a} = 0{,}1166\ s$

$x(t) = 1{,}69\ m$

2.33) Faza A:

$v_0 = 49300\ km/h = \dot{y}(0)$

$v_1 = 1600\ km/h = a_y(t_1)$

$t_0 = 0 \quad t_1 = 2\ min$

Faza B:

$v_2 = 321\ km/h = 89{,}16\ m/s$

$t_2 = 30\ s$

Faza C:

$v_3 = 0$

$s = y = 75\ m = y(t_3)$

a) $a_A = ?$, $a_B = ?$, $a_C = ?$ $\quad v_0 = 5362\ m/s$ $\quad v_1 = 444\ m/s$

b) $a_y(0-t_3) = ?$

a) $a_0 = ?$ $\quad a_0 = \frac{\Delta v}{\Delta t} = \frac{v_1 - v_0}{t_1 - 0}$

$a_0 = -20148\ m/s^2$

$a_1 = ?$ $\quad a_1 = \frac{v_2 - v_1}{t_2}$

$a_1 = -3{,}91\ m/s^2$

$a_2 = ?$

$\dot{y} = a_y$

$\frac{dy}{dt} = a_y \quad dy = adt \,/\int \quad \dot{y} = at + C_1 \quad (C_1 = v_0)$

$\frac{dy}{dt} = at + v_0 \quad dy = (at + v_0)dt \,/\int$

$y = \frac{1}{2}at^2 + v_0 t$

$\dot{y}(t_3) = 0$

$a_2 t_3 = -v_2$

$t_3 = -\frac{v_2}{a_2}$

$\dot{y}(t) = at + v_0$

$\dot{y}(t_3) = 0$

$-v_2 = at$

$75 = \frac{1}{2}a_2 t_3^2 + v_0 t_3$

$75 = \frac{1}{2}a_2\left(\frac{v_2}{a_2}\right)^2 + v_0\left(-\frac{v_2}{a_2}\right) \Big/ \cdot a_2^2$

$150\, a_2 = v_2^2 + (-v_2 v_0) \cdot 2$

$150\, a_2 = -v_2^2$

$a_2 = -\frac{v_2^2}{150} = -52{,}996\ m/s^2$

b) $s_3 = 75\ m$, $s_2 = ?$, $s_1 = ?$ $\quad s = s_1 + s_2 + s_3 = 0{,}+75\ km + 21\ km + 26\ km = 72\ km$

$\Rightarrow s_2 = \frac{1}{2}a_1 t_2^2 + v_1 t_2$

$s_2 = 26\ km$

S2) $\dot{y} = a_x$

$\frac{dy}{dt} = a_x \quad dy = a_x dt \,/\int$

$\dot{y} = a_x t + C_1 \quad (C_1 = v_0)$

$\dot{y}(t) = a_x t + v_0$

$\frac{dy}{dt} = a_x t + v_0$

$dy = (a_x t + v_0)dt \,/\int$

$y = \frac{1}{2}a_x t^2 + v_0 t + C_2 \quad (C_2 = 0)$

$y(t) = \frac{1}{2}a_x t^2 + v_0 t$

S1) $\dot{y} = a_0$

$\frac{dy}{dt} = a_0 \quad dy = a_0 dt \,/\int$

$\dot{y} = a_0 t + C_1 \quad (C_1 = v_0)$

$\dot{y}(t) = a_0 t + v_0$

$\frac{dy}{dt} = a_0 t + v_0 \quad dy = (a_0 t + v_0)dt \,/\int$

$y = \frac{1}{2}a_0 t^2 + v_0 t + C_2 \quad (C_2 = 0)$

$y(t) = \frac{1}{2}a_0 t^2 + v_0 t$

$y(t_1) = 6562{,}16\ m \approx 6{,}57\ km$

$y(t_1) > 6{,}57\ km$

2.34) $a_{0x} = 3{,}20\ m/s^2$, $v_{0x} = 0$

$v_{1x} = 20\ m/s$

a) $x(t) = x_1(t)$

b) $x_2(t) = ?$

a) $\dot{x} = a_x$

$\frac{dv_x}{dt} = a_x \quad dv_x = a_{0x} dt \,/\int$

$v_x = a_{0x} t + C_1 \quad (C_1 = 0)$

$v_x(t) = a_{0x} t$

$\frac{dx_x}{dt} = a_{0x} t \quad dx_x = a_{0x} t\, dt \,/\int$

$x_x = a_{0x} \frac{t^2}{2} + C_2 \quad (C_2 = 0)$

$x_x(t) = a_{0x} \frac{t^2}{2}$

$\dot{x}_1 = v_{1x}$

$\frac{dx_1}{dt} = v_{1x} \quad dx_1 = v_{1x} dt \,/\int$

$x_1 = v_{1x} t + C_3 \quad (C_3 = 0)$

$x_1(t) = v_{1x} t$

$a_{0x} \frac{t^2}{2} = v_{1x} t \,/\cdot a_{0x}$

$t = \frac{2 v_{1x}}{a_{0x}} = 12{,}5\ s$

$x_1(t) = 250\ m$

b) $\dot{x}_2(t) = 40\ m/s$

2.44) $v_{0z} = 5\ m/s \uparrow$

$y(t_2) = 5\ m/s$

$y(t_1) = 40\ m$

a) $y_1(0,25) \rightarrow \ ?$ $\quad y_1(t_1) = ?$

b) $y_1(t_1) = 0$

$t_2 =$ od vrha do pada

c) $y_1(t_1') = ?$

d) $y_{1max}(t) = ?$


Faza 1: $v_0 = 5\ m/s = \dot{y}(0)$

(Calo kretanje) $v_x = 0\ m/s + \dot{y}(t)$

$\dot{y}(t) = -g$

$\frac{dy}{dt} = -g$

$dy = -gdt \,/\int$

$y = -gt + C_1 \quad (C_1 = v_0)$

$y(t) = -gt + v_0$

$\frac{dy}{dt} = gt + v_0 \quad dy = (gt + v_0)dt \,/\int$

$y = \frac{1}{2}gt^2 + v_0 t + C_2 \quad (C_2 = 0)$

$y(t) = \frac{1}{2}gt^2 + v_0 t$

$-gt + v_0 = 0$

$-gt = -v_0$

$t = \frac{v_0}{g} = 0{,}5\ s$

$y(t) = 1{,}27\ m$

a) $y(0,25) = 0{,}9\ m + 30\ m = 40{,}9\ m$

$y(0,25) = 2{,}043\ m/s$

Faza 2:

$v_0' = 0\ m/s = \dot{y}'(0)$

$\ddot{y}' = g$

$\frac{d\dot{y}}{dt} = g \quad d\dot{y} = g\,dt \,/\int$

$\dot{y} = gt + C_1 \quad (C_1 = 0)$

$\dot{y}(t) = gt$

$\frac{dy}{dt} = gt \quad dy = g\,t\,dt \,/\int$

$y' = \frac{1}{2}gt^2 + C_2 \quad (C_2 = 0)$

$y(t) = \frac{1}{2}gt^2$

$\dot{y}(0,5) = -4{,}9\ m/s \qquad (*)$

$40{,}9\ m - y'(0,40) = 40{,}7\ m$

b) $(-40)$ krajnja − početna

$-40 = -\frac{1}{2}gt^2 - v_0 t$

$\frac{1}{2}gt^2 - v_0 t - 40 = 0$

$t_2 = 3{,}43\ s \quad t_2 = 3{,}43\ s$

c) $\dot{y}(t_2) = -g t_2 + v_0$

$\dot{y}(t_2) = -24{,}452\ m/s$

2.53) $a_x(t) = At - Bt^2 = \dot{x}(t) + a$

$A = 1{,}50\ m/s^3$

$B = 0{,}120\ m/s^3$

$t_0 = 0$

$\dot{x}(0) = 0, \ x(0) = 0$

a) $\dot{x}(t) = ?$ $\quad x(t) = ?$

b) $\dot{x}(t_2) = ?$ (max $\dot{x}$)

a) $\dot{x} = a_x(t)$

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

$dx = a\,dt$

$dx = dt\,(At - Bt^2) \,/\int$

$\dot{x} = \frac{1}{2}At^2 - \frac{1}{3}Bt^3 + C_1 \quad (C_1 = 0)$

$\dot{x}(t) = \frac{1}{2}At^2 - \frac{1}{3}Bt^3$

$\frac{dx}{dt} = \frac{1}{2}At^2 - \frac{1}{3}Bt^3$

$dx = dt\left(\frac{1}{2}At^2 - \frac{1}{3}Bt^3\right) \,/\int$

$x = \frac{1}{6}At^3 - \frac{1}{12}Bt^4 + C_2 \quad (C_2 = 0)$

$x(t) = \frac{1}{6}At^3 - \frac{1}{12}Bt^4$

$At > Bt^2 > 0$

$At - Bt^2 = 0$

$t_0 = 0, \ t_2 = 12{,}5\ s$

b) $\dot{x}(t_2) = 39{,}06\ m/s$

80) $h_1 = 46\ m$

$h_2 = 1{,}8\ m$

$v_0 = 1{,}2\ m/s$


a) $\dot{y} = \ddot{y}$

$y(t) = h_1 - h_2$

$y(t) = 44{,}2\ m$

$\frac{dy}{dt} = g$

$dy = g\,dt \,/\int$

$y = gt + C_1 \quad (C_1 = 0)$

$\frac{dy}{dt} = gt$

$dy = gt\,dt \,/\int$

$y = \frac{1}{2}gt^2 + C_2 \quad (C_2 = 0)$

$y(t) = \frac{1}{2}gt^2$

$y(t) = \frac{1}{2}gt^2$

$t = \sqrt{\frac{2y(t)}{g}}$

$t = 3\ s$

b) $\dot{x}(t) = v_x$

$\frac{dx}{dt} = v_x$

$dx = v_x dt \,/\int$

$x = v_x t + C_1 \quad (C_1 = 0)$

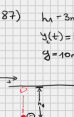
$x(t) = v_x t$

$x(t) = 2{,}6\ m$

2.87) $h_1 = 3\ m$

$y(t) = h_2$

$g = 10\ m/s^2$




a) $\dot{y}_0(0) = ?$

b) $t = ?$

c) $\dot{y}_0(0) = \frac{2}{3}\dot{y}(0), \ t_2 = ?$

$\dot{y}_0(t_2) = \dot{y}_0(t_2) = ?$

d) $\nearrow$

a) $y_c(t) = h_1$

$\dot{y}_c(t) = -v$

$\frac{dy}{dt} = -v$

$dy = -v\,dt \,/\int \quad y_c = -gt + C_1$

$\dot{y}_c(t) = -gt + \dot{y}_c(0) \quad (C_1 = y_0)$

$\frac{dy_c}{dt} = -gt + \dot{y}_c(0)$

$dy_c = dt\,(-gt + \dot{y}_c(0)) \,/\int$

$y_c = -\frac{1}{2}gt^2 + \dot{y}_c(0)t + C_2 \quad (C_2 = 0)$

$y_c(t) = -\frac{1}{2}gt^2 + \dot{y}_c(0)t$

$-gt + \dot{y}_c(0) = 0$

$y_c(t) = -\frac{1}{2}gt^2 + \dot{y}_c(0)t + y_c(t)$

$\dot{y}_c(0) = gt \quad t = \frac{\dot{y}_c(0)}{g}$

$y_c(t) = -\frac{1}{2}g\left(\frac{\dot{y}_c(0)}{g}\right)^2 + \dot{y}_c(t)\frac{\dot{y}_c(t)}{g}$

$y_c(t) = -\frac{1}{2}g\frac{\dot{y}_c(0)^2}{g^2} + \frac{\dot{y}_c(0)^2}{g} \Big/ 2$

$y_c(t)\,g = -\frac{1}{2}\dot{y}_c(0)^2 + \dot{y}_c(0)^2 \,/^{-2}$

$\dot{y}_c(0) = \sqrt{2\,y_c(t)\,g}$

$\dot{y}_c(0) = 7{,}744\ m/s$

b) $\dot{y}_c(0) = gt$

$t = \frac{\dot{y}_c(0)}{g}$

$t = 0{,}7744\ s$

c) $\dot{y}_p(0) = 5{,}46\ m/s$

$\dot{y}_p(t_2) = -gt_2 + \dot{y}_p(0)$

$\dot{y}_p(t_2) = 0 \quad \dot{y}_p' = -g$

$\frac{d\dot{y}_p(t)}{dt} = -gt + \dot{y}_p(0)$

$d\dot{y}_p(t) = dt\,(-gt + \dot{y}_p(0)) \,/\int$

$\dot{y}_p(t) = -\frac{1}{2}gt^2 + \dot{y}_p(0)t + C_3 \quad (C_3 = 0)$

$\dot{y}_p(t_2) = -\frac{1}{2}gt^2 + \dot{y}_p(0)t_2$

$\frac{d\dot{y}_c'}{dt_2} = -g$

$d\dot{y}_c' = -g\,dt_2 \,/\int$

$\dot{y}_c' = -gt_2 + C_4 \quad (C_4 = 0)$

$\dot{y}_c'(t_2) = -gt_2$

$\frac{dy_c'(t_2)}{dt_2} = -gt_2$

$dy_c'(t_2) = -gt_2\,dt_2 \,/\int$

$y_c'(t_2) = -\frac{1}{2}gt_2^2 + C_5 \quad (C_5 = h_1)$

$y_c'(t_2) = -\frac{1}{2}gt_2^2 + h_1$

$-\frac{1}{2}gt_2^2 + h_1 = -\frac{1}{2}gt_2^2 + \dot{y}_p(0)t_2$

$h_1 = \dot{y}_p(0)\,t_2$

$t_2 = \frac{h_1}{\dot{y}_p(0)}$

$t_2 = 0{,}58\ s$

d) $\dot{y}_c'(t_2) = 4{,}31\ m$