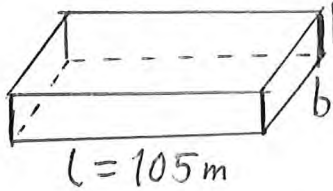
1.03 a) $v = 108\,\frac{m}{s} = 108\,\frac{\frac{1}{1000}\,km}{\frac{1}{60\cdot 60}\,h} = 108 \cdot \frac{3600}{1000}\,\frac{km}{h}$

$= 108 \cdot 3{,}600\,\frac{km}{h} = \underline{389\,\frac{km}{h}}$

$1\,km = 1000\,m$
$1\,h = 3600\,s$

b)



$Volum = l \cdot b \cdot h$

$= 105\,m \cdot 68\,m \cdot 2{,}250\,m$

$= 16065\,m^3 = \underline{1{,}6 \cdot 10^4\,m^3}$

$1\,m^3 = 10^3\,dm^3 = 10^3\,liter$ dvs. $Volum = 1{,}6 \cdot 10^4 \cdot 10^3\,liter$

$= \underline{1{,}6 \cdot 10^7\,liter}$

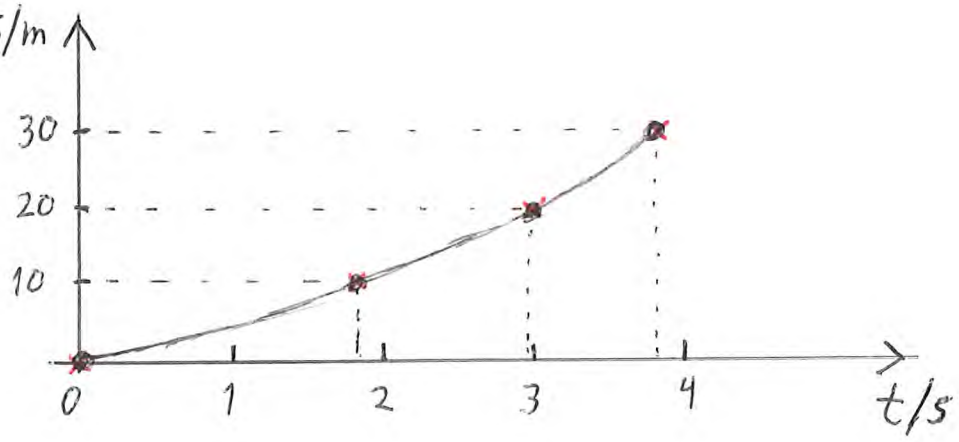
1.05

t/s	0	1,88	2,96	3,88
s/m	0	10	20	30

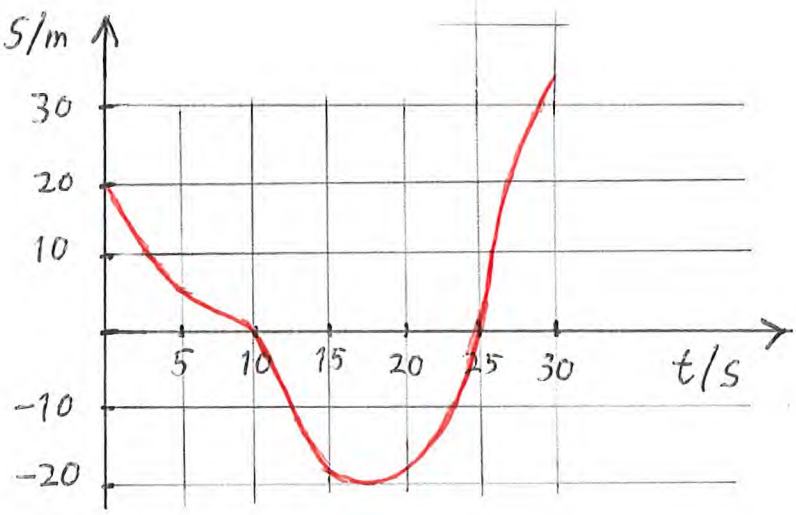
a) $t : [1{,}88\,s, 2{,}96\,s]$ $\quad \Delta s = 20\,m - 10\,m = \underline{10\,m}$

$t : [2{,}96\,s, 3{,}88\,s]$ $\quad \Delta s = 30\,m - 20\,m = \underline{10\,m}$

b)



1.06



a) $t = 0s$ $s = 20m$

$t = 10s$ $s = 0m$

$t = 20s$ $s = -18m$

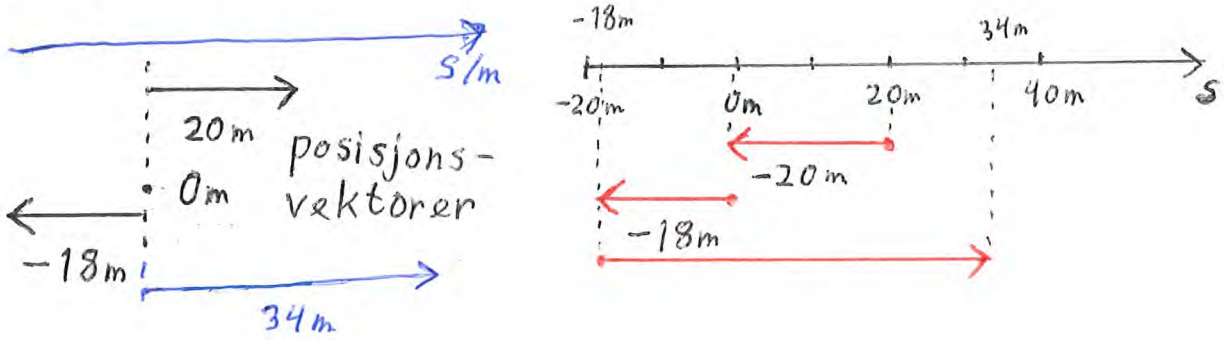
$t = 30s$ $s = 34m$

b) $t:[0, 10s]$ $\Delta s = 0m - 20m = \underline{-20m}$

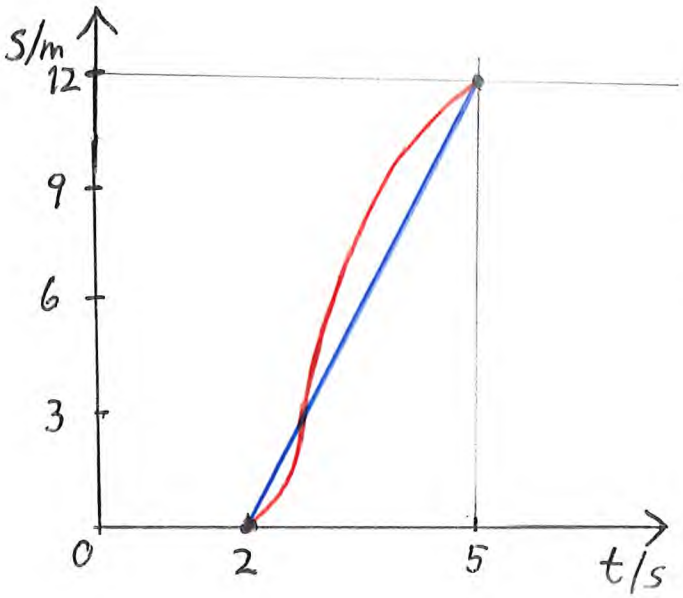
$t:[10s, 20s]$ $\Delta s = -18m - 0m = \underline{-18m}$

$t:[20s, 30s]$ $\Delta s = 34m - (-18m) = \underline{52m}$

c)



1.11

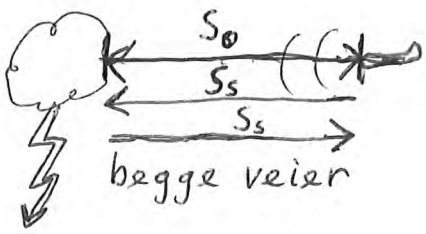


$\bar{v} = 4{,}0\ \frac{m}{s}$ fordi

$\bar{v} = \frac{\Delta s}{\Delta t} = \frac{12m - 0m}{5s - 2s} = 4{,}0\ \frac{m}{s}$

for begge grafer.

1.15 a)



$s_0 = v_c \cdot t$

$2s_s = v_c \cdot t$

$s_s = \frac{v_c \cdot t}{2}$

$= \frac{3{,}00 \cdot 10^8 \frac{m}{s} \cdot 80{,}01 \cdot 10\ s}{2}$

$12{,}0015 \cdot 10^3\ m = \underline{12{,}0\ km}$

b) $s_{s2} = \frac{v_c \cdot t_2}{2}$

$= \frac{3{,}00 \cdot 10^8 \frac{m}{s} \cdot 76{,}67 \cdot 10^{-6}\ s}{2}$

$= 11{,}5005 \cdot 10^3\ m$

$v_f = \frac{\Delta s_f}{\Delta t_f} = \frac{(12{,}0015 - 11{,}5005) \cdot 10^3\ m}{2{,}000\ s}$

$= \underline{251 \frac{m}{s}}$ $\left(250{,}5 \frac{m}{s}\right)$

1.18 $\Delta s = 10{,}0\ mm = 10{,}0 \cdot 10^{-3}\ m$

$\Delta t_A = 3{,}8\ ms = 3{,}8 \cdot 10^{-3}\ s$

$\Delta t_B = 2{,}6\ ms = 2{,}6 \cdot 10^{-3}\ s$

$\Delta t_{AB} = 0{,}34\ s$

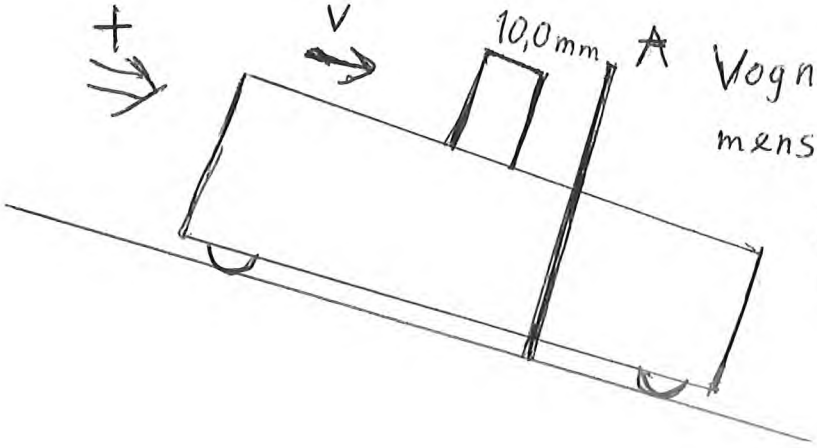
$v_A = \frac{\Delta s}{\Delta t_A} = \frac{10{,}0 \cdot 10^{-3}\ m}{3{,}8 \cdot 10^{-3}\ s}$

$= 2{,}631 \frac{m}{s}$

$v_B = \frac{\Delta s}{\Delta t_2} = \frac{10{,}0 \cdot 10^{-3}\ m}{2{,}6 \cdot 10^{-3}\ s} = 3{,}846 \frac{m}{s}$

$a = \frac{\Delta v}{\Delta t_{AB}} = \frac{v_B - v_A}{\Delta t_{AB}} = \frac{3{,}846 \frac{m}{s} - 2{,}631 \frac{m}{s}}{0{,}34 s} = \underline{3{,}6 \frac{m}{s^2}}$

$(3{,}57)$



Vogna flytter seg 10,0 mm mens flagget sperrer for fotocellen i A (og like langt i B)

1.20

a) Der streken er horisontal er $a = 0$

$[0, 5{,}0s]$ $[15{,}0s, 20{,}0s]$ $[25{,}0s, 35{,}0s]$

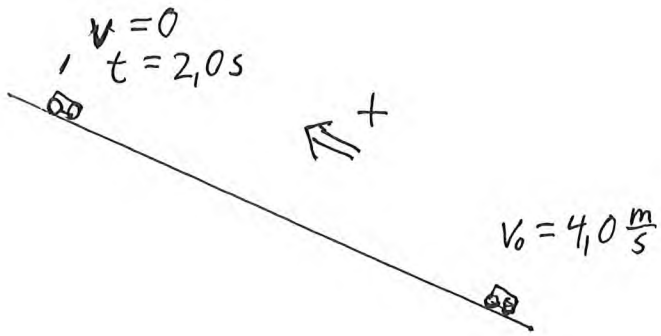
b) $[0, 5{,}0s]$ $a = \frac{\Delta v}{\Delta t} = \frac{-20\frac{m}{s} - (-20\frac{m}{s})}{5{,}0s} = \frac{0\frac{m}{s}}{5{,}0s} = \underline{0\frac{m}{s^2}}$

$[5{,}0s, 15s]$ $a = \frac{\Delta v}{\Delta t} = \frac{0\frac{m}{s} - (-20\frac{m}{s})}{15s - 5{,}0s} = \frac{20\frac{m}{s}}{10s} = \underline{2{,}0\frac{m}{s^2}}$

$[35s, 40s]$ $a = \frac{\Delta v}{\Delta t} = \frac{0\frac{m}{s} - 40\frac{m}{s}}{40s - 35s} = \frac{-40\frac{m}{s}}{5s} = \underline{-8\frac{m}{s}}$

c) a er positiv fordi akselerasjonvektoren peker i positiv retning.
Negativ a ville bety at fanten ekte i negativ retning, noe den ikke gjør her.

1.21

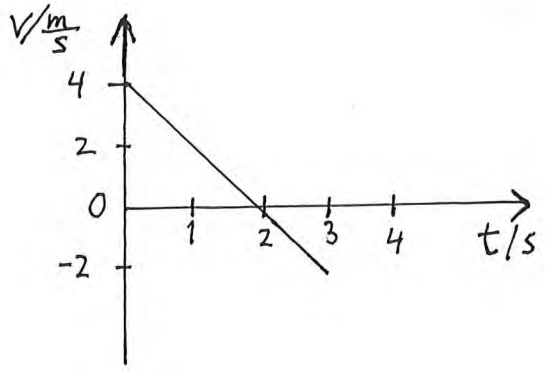


a) $v = 0$ idet vogna snur

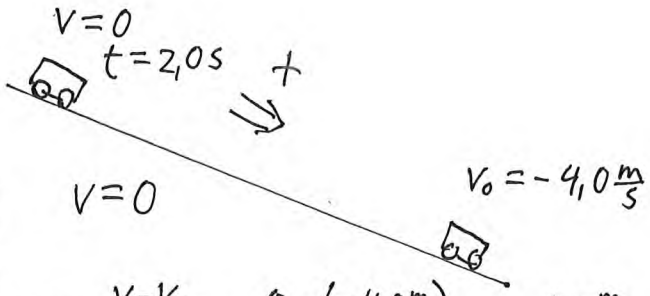
b) $a = \frac{\Delta v}{t} = \frac{v - v_0}{t} = \frac{0 - 4{,}0\ \frac{m}{s}}{2{,}0\ s} = \frac{-4{,}0\ \frac{m}{s}}{2{,}0\ s} = \underline{-2{,}0\ \frac{m}{s^2}}$

c) $t = 3{,}0\ s$ $\quad v = v_0 + at = 4{,}0\ \frac{m}{s} + (-2{,}0\ \frac{m}{s^2}) \cdot 3{,}0\ s$

$= 4{,}0\ \frac{m}{s} - 6{,}0\ \frac{m}{s} = \underline{-2{,}0\ \frac{m}{s}}$



d)

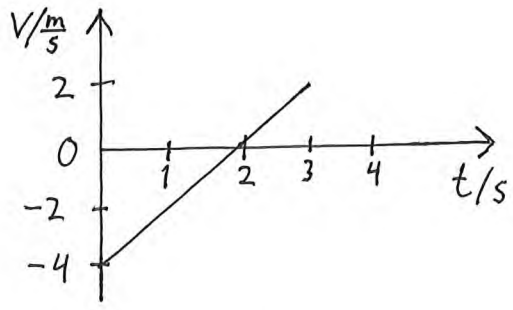


a) $v = 0$

b) $a = \frac{v - v_0}{t} = \frac{0 - (-4{,}0\ \frac{m}{s})}{2{,}0\ s} = \frac{4{,}0\ \frac{m}{s}}{2{,}0\ s} = \underline{2{,}0\ \frac{m}{s^2}}$

c) $t = 3{,}0\ s$

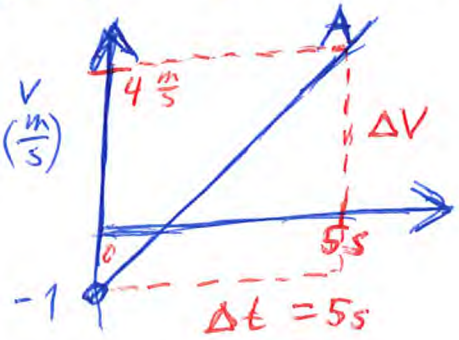
$v = v_0 + at = -4{,}0\ \frac{m}{s} + 2{,}0\ \frac{m}{s^2} \cdot 3{,}0\ s = -4{,}0\ \frac{m}{s} + 6{,}0\ \frac{m}{s} = \underline{2{,}0\ \frac{m}{s}}$



1.23 a) A og C

b) $s = v_0 t + \frac{1}{2} a t^2$ (2)

A:



$v_0 = -1 \frac{m}{s}$

$a = \frac{\Delta v}{\Delta t}$

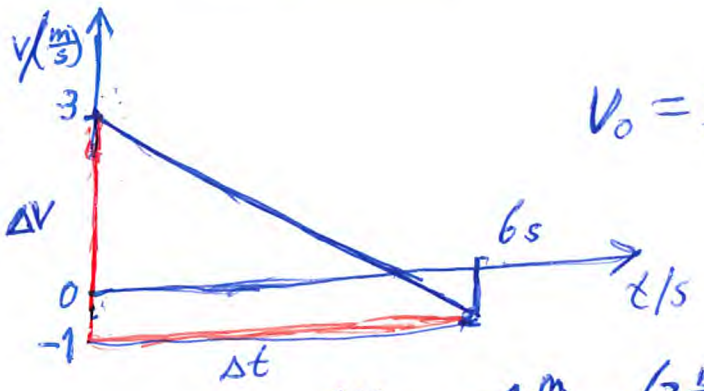
$a = \frac{4 \frac{m}{s} - (-1) \frac{m}{s}}{5s - 0s}$

$a = \frac{5 \frac{m}{s}}{5s} = 1 \frac{m}{s^2}$

$s = (-1 \frac{m}{s}) \cdot t + \frac{1}{2} \cdot 1 \frac{m}{s^2} \cdot t^2$

$s = -1{,}0 \frac{m}{s} \cdot t + 0{,}5 \frac{m}{s^2} \cdot t^2$

C:



$v_0 = 3{,}0 \frac{m}{s}$

$a = \frac{\Delta v}{\Delta t} = \frac{-1{,}0 \frac{m}{s} - (3{,}0 \frac{m}{s})}{6s - 0s} = \frac{-4{,}0 \frac{m}{s}}{6{,}0s}$

$= -0{,}67 \frac{m}{s^2}$

$s = 3{,}0 \frac{m}{s} \cdot t + \frac{1}{2} (-0{,}67 \frac{m}{s^2}) \cdot t^2$

$s = 3{,}0 \frac{m}{s} \cdot t - 0{,}33 \frac{m}{s^2} \cdot t^2$

1.24 $a = 4{,}00\ \frac{m}{s^2}$ $t_1 = 2{,}50\ s$

a) $v = v_0 + at$ $a = \frac{v - v_0}{t} = \frac{\Delta v}{t}$

$v = 0 + 4{,}00\ \frac{m}{s^2} \cdot 2{,}50\ s = \underline{10{,}0\ \frac{m}{s}}$

b) $s = \frac{v_0 + v}{2} \cdot t = \frac{0 + 10{,}0\ \frac{m}{s}}{2} \cdot 2{,}50\ s = \underline{12{,}5\ m}$

$s = v_0 t + \frac{1}{2} a t^2$

$2as = v^2 - v_0^2 \Rightarrow s = \frac{v^2 - v_0^2}{2a}$

c) $t_1 = 2{,}50\ s$ $s_1 = 12{,}5\ m$ $s = 100\ m$

$t_2 = ?$ $s_2 = s - s_1 = 100\ m - 12{,}5\ m = 87{,}5\ m$

$v = 10{,}0\ \frac{m}{s}$

$s_2 = v \cdot t_2$

$\frac{s_2}{v} = t_2$

$t_2 = \frac{s_2}{v} = \frac{87{,}5\ m}{10{,}0\ \frac{m}{s}} = 8{,}75\ s$

$t = t_1 + t_2 = 2{,}50\ s + 8{,}75\ s = \underline{11{,}25\ s}$

$= \underline{11{,}3\ s}$

d) Antar samme akselerasjon som forrige over lenger tid så toppfarten blir $12{,}0\ \frac{m}{s}$.

$v = at_1 \Rightarrow t_1 = \frac{v}{a} = \frac{12{,}0\ \frac{m}{s}}{4{,}00\ \frac{m}{s^2}} = 3{,}00\ s$

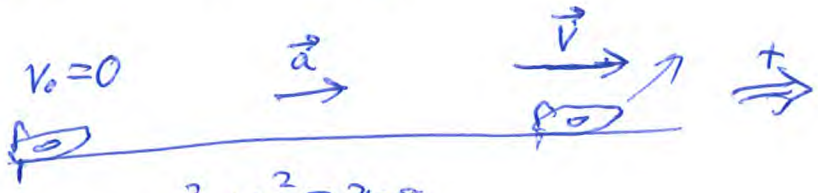
$s_1 = \frac{v_0 + v}{2} \cdot t_1 = \frac{0 + 12{,}0\ \frac{m}{s}}{2} \cdot 3{,}00\ s = 18{,}0\ m$

$s_2 = 100\ m - 18{,}0\ m = 82{,}0\ m$

$s_2 = v \cdot t_2 \Rightarrow t_2 = \frac{s_2}{v} = \frac{82{,}0\ m}{12{,}0\ \frac{m}{s}} = 6{,}83\ s$

$t = t_1 + t_2 = 3{,}0\ s + 6{,}83\ s = \underline{9{,}83\ s}$

1.25 $a = 3{,}0\ \frac{m}{s^2}$ $V = 30\ \frac{m}{s}$ $s = ?$

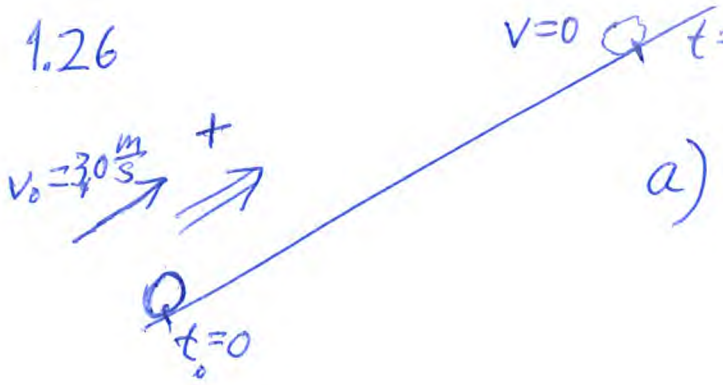


$V^2 - V_0^2 = 2as$

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

$s = \frac{V^2}{2a} = \frac{(30\ \frac{m}{s})^2}{2 \cdot 3{,}0\ \frac{m}{s^2}} = 150\,m = \underline{0{,}15\,km}$

1.26



a) $a = \frac{\Delta V}{\Delta t} = \frac{V - V_0}{t - t_0}$

$= \frac{0 - 3{,}0\ \frac{m}{s}}{1{,}2s - 0s} = \frac{-3{,}0\ \frac{m}{s}}{1{,}2s}$

$= \underline{-2{,}5\ \frac{m}{s^2}}$

b) $s = ?$

$s = \frac{(V_0 + V)}{2} \cdot t$

$s = \frac{(3{,}0\ \frac{m}{s} + 0)}{2} \cdot 1{,}2s = \underline{1{,}8\,m}$

c) $t = 0{,}40s$

$s = V_0 t + \frac{1}{2} a t^2$

$s = 3{,}0\ \frac{m}{s} \cdot 0{,}40s + \frac{1}{2}(-2{,}5\ \frac{m}{s^2}) \cdot (0{,}40s)^2$

$= \underline{1{,}0\,m}$

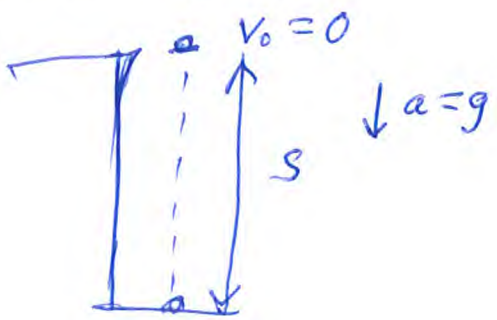
$t = 2{,}4s$ $s = 3{,}0\ \frac{m}{s} \cdot 2{,}4s + \frac{1}{2} \cdot (-2{,}5\ \frac{m}{s^2}) \cdot (2{,}4s)^2$

$= \underline{0\,m}$ er posisjon!

banelengde = ?

$1{,}8m + 1{,}8\,m = \underline{3{,}6m}$

1.27 $t = 3{,}8\,s$ $\quad s = ?$



$$s = \cancel{v_0 t} + \frac{1}{2} a t^2$$

$$s = \frac{1}{2} \cdot 9{,}81 \frac{m}{s^2} \cdot (3{,}8\,s)^2$$

$$= 70{,}82\,m \quad \underline{= 71\,m}$$

1.28 $s = 10\,m$

$v = ?$

$a = 9{,}81 \frac{m}{s^2}$

$v_0 = 0$

$$v^2 - v_0^2 = 2as$$

$$v^2 = 2as$$

$$v = \sqrt{2as}$$

$$v = \sqrt{2 \cdot 9{,}81 \frac{m}{s^2} \cdot 10\,m}$$

$$\underline{v = 14 \frac{m}{s}}$$

$s = 3{,}5\,m$

$$v^2 - v_0^2 = 2as$$

$$v^2 = 2as + v_0^2$$

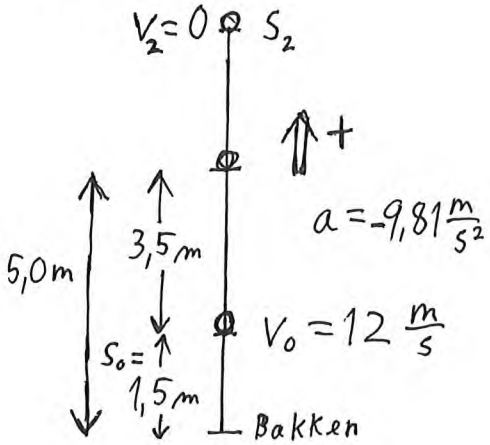
$$v = \pm\sqrt{2as + v_0^2}$$

$$v = \pm\sqrt{2 \cdot (-9{,}81 \frac{m}{s^2}) \cdot 3{,}5\,m + (12{,}0 \frac{m}{s})^2}$$

$$v = \pm 8{,}7 \frac{m}{s}$$

$\uparrow +$

1.29



a) $V_2^2 - V_0^2 = 2aS_2$ og $V_2 = 0$

$$-V_0^2 = 2aS_2$$

$$\frac{-V_0^2}{2a} = S_2$$

$$S_2 = \frac{-\left(12 \frac{m}{s}\right)^2}{2 \cdot \left(-9{,}81 \frac{m}{s^2}\right)} = 7{,}339\,m$$

$$S_{tot} = S_0 + S_2 = 1{,}5\,m + 7{,}339\,m = 8{,}839\,m = \underline{8{,}8\,m}$$

b) $S = 3{,}5\,m$ $\left(5{,}0\,m - 1{,}5\,m = 3{,}5\,m\right)$

$$V^2 - V_0^2 = 2aS$$

$$V^2 = 2aS + V_0^2$$

$$V = \pm\sqrt{2aS + V_0^2}$$

$$V = \pm\sqrt{2 \cdot \left(-9{,}81 \frac{m}{s^2}\right) \cdot 3{,}5\,m + \left(12 \frac{m}{s}\right)^2} = \pm 8{,}679 \frac{m}{s} = \underline{\pm 8{,}7 \frac{m}{s}}$$

Ballen passerer høyden både på vei opp og ned.