2.319

$m_2 = 2 \cdot m_1$

$\Sigma F = ma$

$F = m_1 a_1$ og $a_1 = 8{,}0 \frac{m}{s^2}$

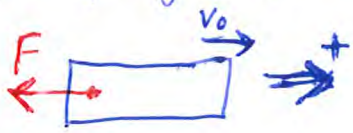
$a_1 = \frac{F}{m_1}$ og $a_2 = \frac{F}{m_2} = \frac{F}{2 \cdot m_1}$

$= \frac{F}{m_1} \cdot \frac{1}{2} = a_1 \cdot \frac{1}{2}$

$= \frac{a_1}{2} = 4{,}0 \frac{m}{s^2}$

2.322 $m = 3{,}0 kg$ $v_0 = 6{,}0 \frac{m}{s}$ $t = 2{,}4 s$ $v = 0$

a)



b) $v = v_0 + at$

$v - v_0 = at$

$a = \frac{v - v_2}{t}$

$a = \frac{0 - 6{,}0 \frac{m}{s}}{2{,}4 s} = -2{,}5 \frac{m}{s^2}$

c) $\Sigma F = ma$

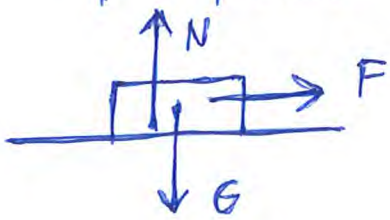
$F = ma$

$F = 3{,}0 kg \cdot (-2{,}5 \frac{m}{s^2}) = -7{,}5 N$ dvs. i negativ retning. $|F| = 7{,}5 N$

2.324+ $v_0 = 0$ $v = 10 \frac{km}{h} = 2{,}777 \frac{m}{s}$

$m = 1200 kg$

$F = 4 \cdot 200 N = 800 N$



$F = ma$

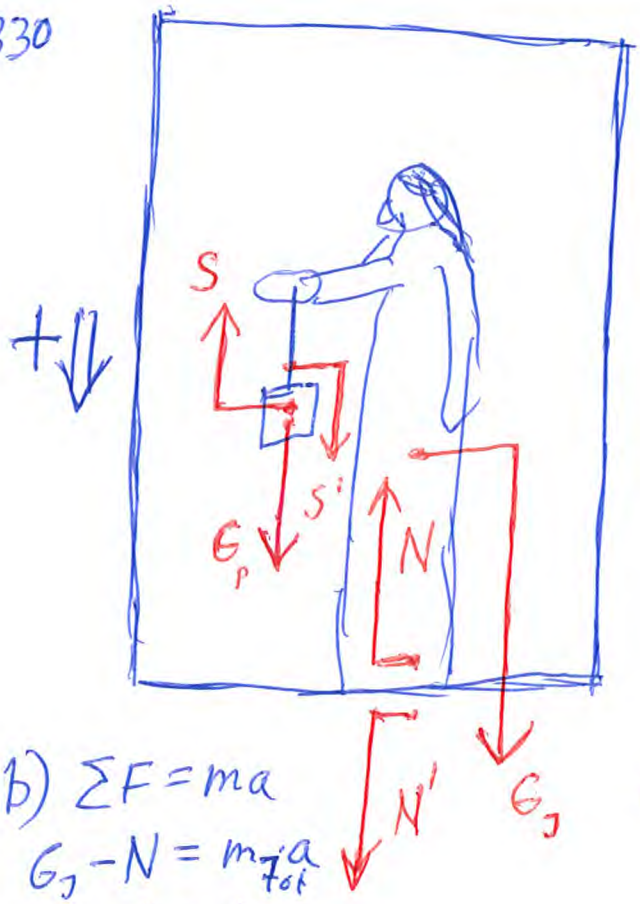
$a = \frac{F}{m} = \frac{800 N}{1200 kg} = 0{,}6666 \frac{m}{s^2}$

$v = v_0 + at$

$v - v_0 = at$

$t = \frac{v - v_0}{a} = \frac{2{,}777 \frac{m}{s} - 0}{0{,}6666} = 4{,}2 s$

2.330



$\downarrow a = 0{,}50 \frac{m}{s^2}$

$m_p = 2{,}0\,kg$

$m_J = 40\,kg$

a) $\Sigma F = ma$

$G_p - S = m_p \cdot a$

$m_p \cdot g - S = m_p \cdot a$

$m_p(g - a) = S$

$S' = S = 2{,}0kg \cdot (9{,}81 - 0{,}50)\frac{m}{s^2}$

$= 18{,}62N \simeq \underline{19\,N}$

b) $\Sigma F = ma$

$G_J - N = m_J \cdot a$

$m_J(g - a) = N$

$N = 42kg \cdot (9{,}81 - 0{,}50)\frac{m}{s^2} = \underline{0{,}39\,kN}$

2.332 $m = 300kg$ $v_0 = 0$ $t = 8{,}0s$ $F = 650N$

a) $a = ?$

$\Sigma F = ma$

$\frac{F}{m} = a$

$a = \frac{650N}{300kg} = 2{,}1666 \frac{m}{s^2} = \underline{2{,}17 \frac{m}{s^2}}$

b) $v = ?$

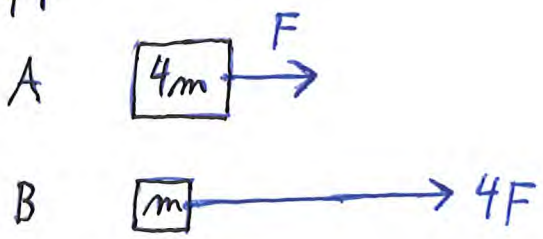
$v = v_0 + at = 0 + 2{,}1666 \frac{m}{s^2} \cdot 8{,}0s = 17{,}33 \frac{m}{s} = \underline{17 \frac{m}{s}}$

c) $s = ?$

$s = v_0 t + \frac{1}{2}at^2 = \frac{1}{2}at^2 = \frac{1}{2} \cdot \left(2{,}1666 \frac{m}{s^2}\right) \cdot (8{,}0s)^2$

$= 69{,}33m \simeq \underline{69m}$

2.334+



a) Likt. A: $\Sigma F = Ma_A$ $\quad$ B: $\Sigma F = Ma_B$ $\quad$ $\frac{a_B}{a_A} = \frac{\frac{4F}{m}}{\frac{F}{4m}} = 16$

$F = 4m \cdot a_A$ $\quad$ $4F = m \cdot a_B$

$a_A = \frac{F}{4m}$ $\quad$ $a_B = \frac{4F}{m}$

Aks. til B er 16 ganger større enn aks. til A

$v = \cancel{v_0^0} + at$

$v = at$ gir da at $v_B = 16 v_A$ dvs 3.

b) v når de har beveget seg samme lengde s.

$2as = v^2 - v_0^2$ og $v_0 = 0$

$2as = v^2$

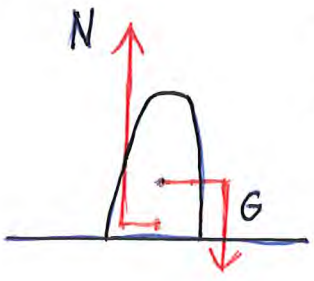
$v = \sqrt{2as} = \sqrt{2s} \cdot \sqrt{a}$

dvs $v_A = \sqrt{2s} \cdot \sqrt{a_A}$ og $v_B = \sqrt{2s} \cdot \sqrt{a_B}$

$$\frac{v_B}{v_A} = \frac{\sqrt{2s} \cdot \sqrt{a_B}}{\sqrt{2s} \cdot \sqrt{a_A}} = \sqrt{\frac{a_B}{a_A}} = \sqrt{16} = 4$$

dvs $v_B = 4 \cdot v_A$ dvs 2.

2.338+



$\Sigma F = ma$

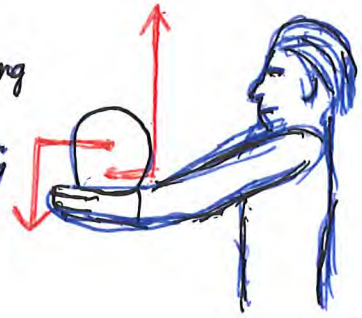
$N - G = ma$

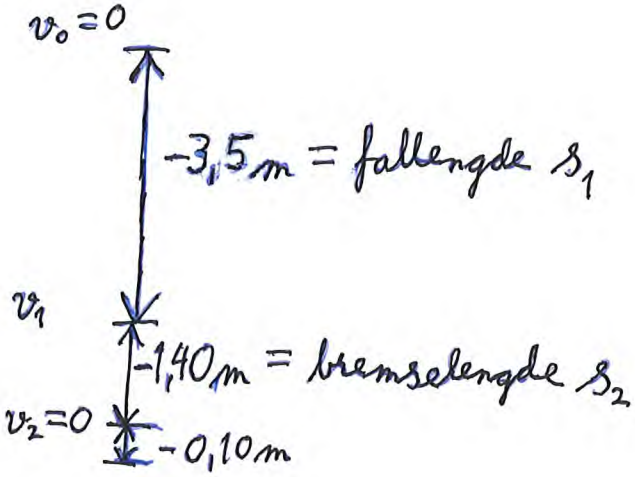
$N = m(a+g)$

$N = 40kg \cdot (5{,}0 + 9{,}81)\frac{m}{s^2} = 0{,}59kN$

2.340+

a) ↑ + (Valgt retning med som positiv vil gi samme slutsvar)





$$2gs_1 = v_1^2 - v_0^2$$

$$v_1 = \pm\sqrt{2gs_1} = -\sqrt{2(-9{,}81)(-3{,}5)}\,\frac{m}{s} = -8{,}29\,\frac{m}{s}$$

$$2as_2 = v_2^2 - v_1^2$$

$$a = \frac{-v_1^2}{2s_2} = \frac{-(8{,}29\,\frac{m}{s})^2}{2(-1{,}40\,m)} = +24{,}5\,\frac{m}{s^2}$$

$$\Sigma F = ma$$

$$F - G = ma$$

OBS ↑ $F = m(a+g) = 10{,}0\,kg \cdot (+24{,}5 + 9{,}81)\,\frac{m}{s^2} = 0{,}34\,kN$

↑ OBS ↑ OBS

b) $v_1 = v_0 + gt_1$

$$v_1 - v_0 = gt_1$$

$$t_1 = \frac{v_1 - v_0}{g} = \frac{-8{,}29 - 0}{-9{,}81}\,s = 0{,}845\,s$$

$$v_2 = v_1 + at_2$$

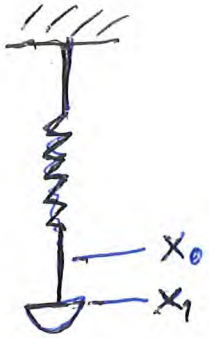
$$0 = v_1 + at_2$$

$$-v_1 = at_2$$

$$t_2 = \frac{-v_1}{a} = \frac{-(-8{,}29)}{24{,}5}\,s = 0{,}338\,s$$

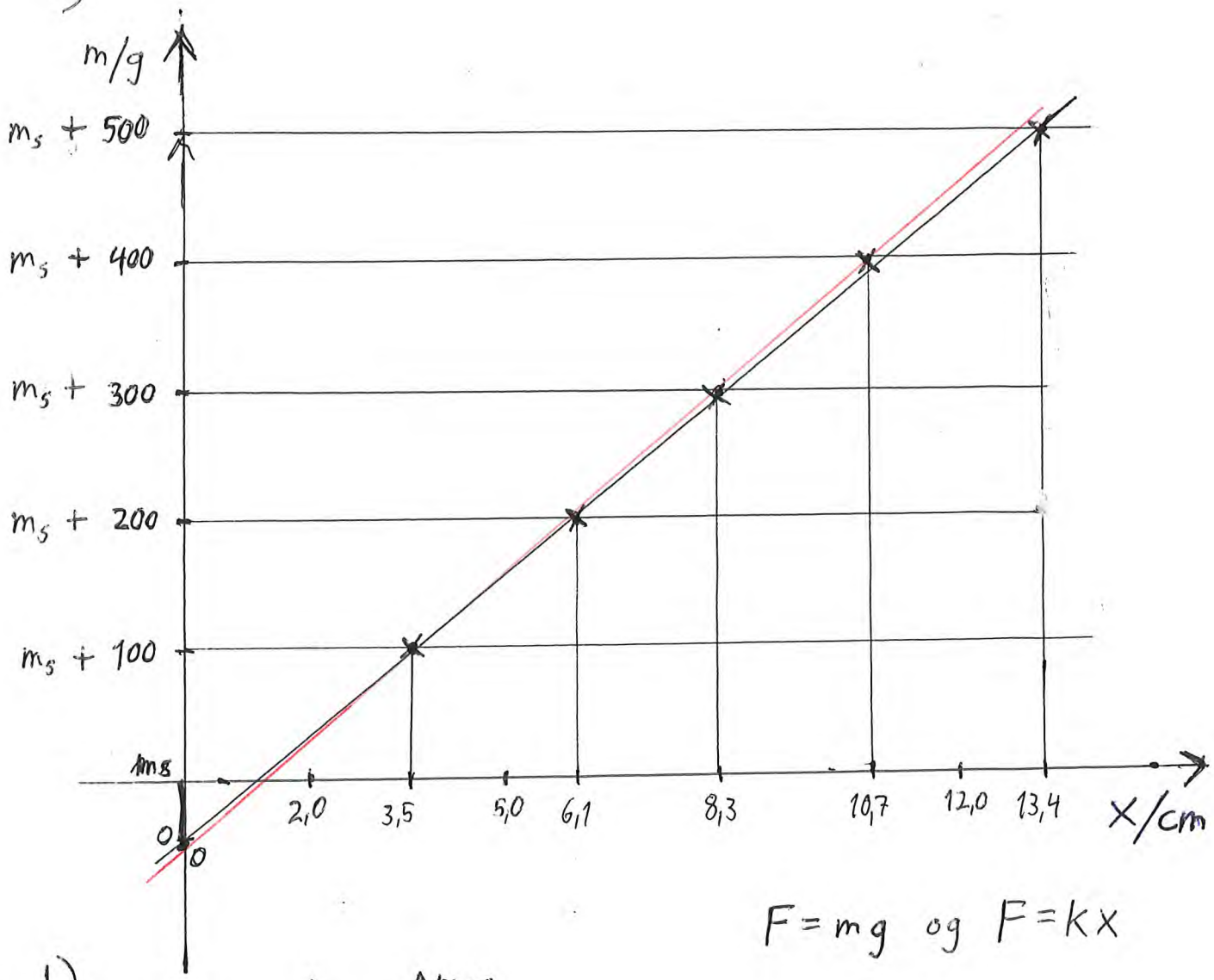
$$t = t_1 + t_2 = 1{,}183\,s \approx 1{,}2\,s$$

2.344



Skåla strekker noe i fjæra. Total masse blir dermed lik masse av skål pluss lodd.

a)



$F = mg$ og $F = kx$

b)

$$k = \frac{\Delta m \cdot g}{x}$$

$$k_1 = \frac{(0{,}500 - 0{,}100)\,kg \cdot 9{,}81\,\frac{N}{kg}}{(0{,}134 - 0{,}035)\,m} = 39{,}63\,\frac{N}{m} \simeq \underline{40\,\frac{N}{m}}$$

$$\left(k_2 = \frac{(0{,}400 - 0{,}100)\,kg \cdot 9{,}81\,\frac{N}{kg}}{(0{,}107 - 0{,}035)\,m} = 40{,}87\,\frac{N}{m} \simeq \underline{41\,\frac{N}{m}} \right)$$

$\underline{m_s \approx 50\,gram}$ i følge grafaksen.

($\simeq \underline{55\,gram}$ i følge rød tilpasningslinje)

2.345  $k = 280\,\frac{N}{m}$ $m = 0{,}180\,kg$ $x_0 = 1{,}5 \cdot 10^{-2}\,m$

a) $\Sigma F = ma$

$kx = ma$

$a = \frac{kx}{m} = \frac{280\,\frac{N}{m} \cdot 1{,}5 \cdot 10^{-2}\,m}{0{,}180\,kg} = 23{,}33\,\frac{m}{s^2} = \underline{23\,\frac{m}{s^2}}$

b) $x = 1{,}2 \cdot 10^{-2}\,m$

$a = \frac{kx}{m} = \frac{280\,\frac{N}{m} \cdot 1{,}2 \cdot 10^{-2}\,m}{0{,}180\,kg} = 18{,}66\,\frac{m}{s^2} = \underline{19\,\frac{m}{s^2}}$

2.346. $m = 1{,}20\,kg$ $k = 75\,\frac{N}{m}$ $\mu = 0$

$F = kx = 75\,\frac{N}{m} \cdot 0{,}100\,m = 7{,}50\,N$

a) $\Sigma F = ma$

$kx = ma$

$a = \frac{kx}{m} = \frac{7{,}50\,N}{1{,}20\,kg} = \underline{6{,}25\,\frac{m}{s^2}} = \underline{6{,}3\,\frac{m}{s^2}}$

b) $\Sigma F = 0$ $\underline{a = 0}$

c) $x = 0{,}100\,m$

$\Sigma F = ma$

$a = \frac{kx}{m} = \frac{75\,\frac{N}{m} \cdot 0{,}100\,m}{2{,}00\,kg} = 3{,}75\,\frac{m}{s^2}$

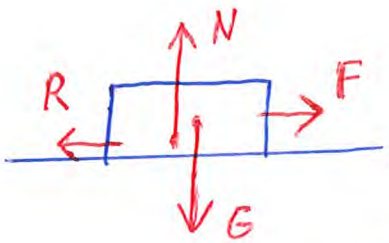
$\Sigma F = ma = 0{,}80\,kg \cdot 3{,}75\,\frac{m}{s^2} = \underline{3{,}0\,N}$

2.348 $G = 4{,}6\,N$

$v = konst.$

$F = 3{,}0\,N$

$\mu = ?$

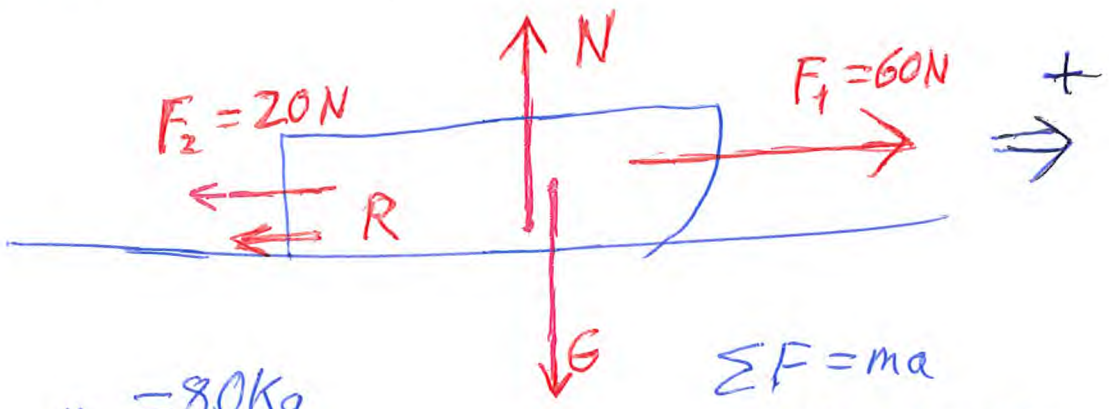


$y: \Sigma F = 0$ $\quad N = G$

$x: \Sigma F = 0$ $\quad R = F$

$\mu = \frac{R}{N} = \frac{F}{G} = \frac{3{,}0\,N}{4{,}6\,N} = \underline{0{,}65}$

2.349



$m = 8{,}0kg$

$a = 4{,}5 \frac{m}{s^2}$

$\Sigma F = ma$

$F_1 - F_2 - R = ma$

$60N - 20N - R = 8{,}0kg \cdot 4{,}5 \frac{m}{s^2}$

$40N - R = 36N$

$R = 40N - 36N$

$\underline{R = 4N}$

2.350+ $a = -1{,}0 \frac{m}{s^2}$

$m_1 = 60kg$

$m_2 = 20kg$

$\Sigma F = ma$

$-R = ma$

$-\mu mg = ma$

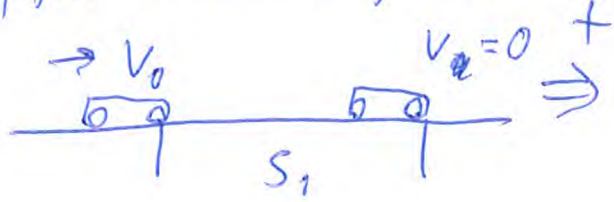
$-\mu g = a$

$\mu = \frac{a}{-g} = \frac{-1{,}0 \frac{m}{s^2}}{-9{,}81 \frac{m}{s^2}} = \underline{\underline{0{,}10}}$

2.351 $v_0 = 110 \frac{km}{h} = 30{,}555 \frac{m}{s}$ $s = 106\,m$

$s_0 = 31\,m$ pg.a. reaksjonstid

$s_1 = 75\,m$ pg.a. bremsingen



a) $2as_1 = v^2 - v_0^2$

$a = \frac{-v_0^2}{2s_1}$

$a = \frac{-(30{,}555 \frac{m}{s})^2}{2 \cdot 75\,m} = -6{,}224 \frac{m}{s^2}$

$s_0 = v_0 \cdot t_0$

$t_0 = \frac{s_0}{v_0} = \frac{31\,m}{30{,}555 \frac{m}{s}} = 1{,}01\,s$

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

$v = v_0 + at$

$v - v_0 = at_2$

$t_2 = \frac{v - v_0}{a}$

$t_2 = \frac{-30{,}555 \frac{m}{s}}{-6{,}224 \frac{m}{s^2}}$

$t_2 = 4{,}909\,s$

$t = 1{,}01\,s + 4{,}909\,s$

$= 5{,}91\,s$

b) $v_0 = 80 \frac{km}{h}$

μ som før

samme reaksjonstid.

$t_0 = 1{,}01\,s$

$s_0 = v_0 \cdot t_0$

$= \frac{80}{3{,}6} \frac{m}{s} \cdot 1{,}01\,s$

$= 22{,}44\,m$

$\sum F = ma$

$-R = ma$

$-\mu N = ma$

$-\mu G = ma$

$-\mu g = a$

$\mu = \frac{a}{-g} = \frac{-6{,}224}{-9{,}81} = 0{,}634$

$2as_1 = v^2 - v_0^2$

$s_1 = \frac{-v_0^2}{2a}$

$= \frac{-(22{,}22 \frac{m}{s})^2}{2 \cdot (-6{,}224 \frac{m}{s^2})} = 39{,}66\,m$

$v = v_0 + at_1$

$t_1 = \frac{v - v_0}{a} = \frac{0 - 22{,}22}{-6{,}224}\,s = 3{,}57\,s$

$s = s_0 + s_1 = 22{,}44 + 39{,}66\,m = 62{,}1\,m = \underline{62\,m}$

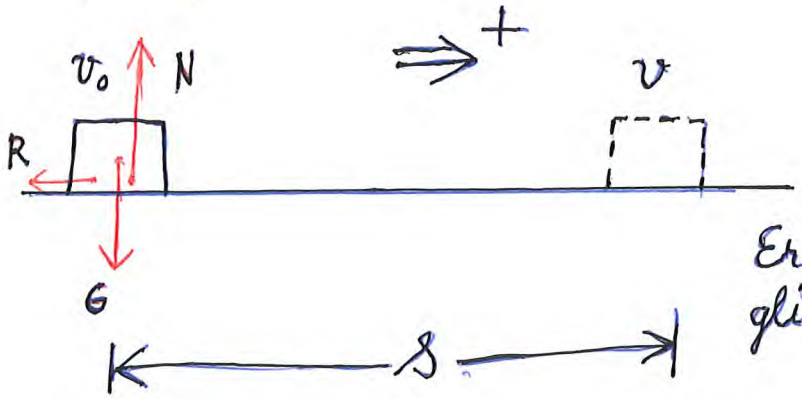
$t = t_0 + t_1$

$= 4{,}58\,s = \underline{4{,}6\,s}$

2.352+

$v_0 = 50\frac{km}{h} = \underline{13{,}9\frac{m}{s}}$ $\quad \mu = 0{,}50$

$v = 0$



Er på grensen til glidefriksjon

$R \approx R_{gli}$

$\Sigma F = ma$

$-R = ma$

$-\mu mg = ma$

$\underline{a = -\mu g}$

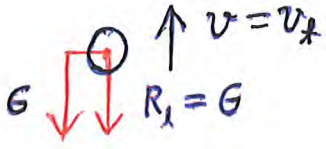
$2as = v^2 - v_0^2$

$2as = -v_0^2$

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

$$s = \frac{-v_0^2}{2\cdot(-\mu g)} = \frac{-(13{,}9\frac{m}{s})^2}{-2\cdot 0{,}50\cdot 9{,}81\frac{m}{s^2}} = 19{,}695\,m \approx \underline{\underline{20\,m}}$$

2.355+



$\Sigma F = ma$

$-G - R_l = ma$

$-G - G = ma$

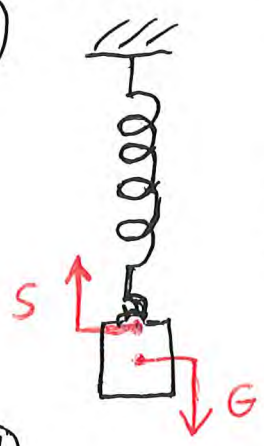
$-2G = ma$

$-2mg = ma$

$\underline{a = -2g}$ dvs 4) større enn

2.358 a) Motkraften til F er kraften F' som virker tilbake på legeme A fra legeme B.

b) Når en kraft F_A virker på legeme A fra legeme B, vil en motsatt rettet og like stor kraft, F_B, virke tilbake på legeme B fra legeme A.

c) 

Motkraften til G virker på Jordas sentrum.

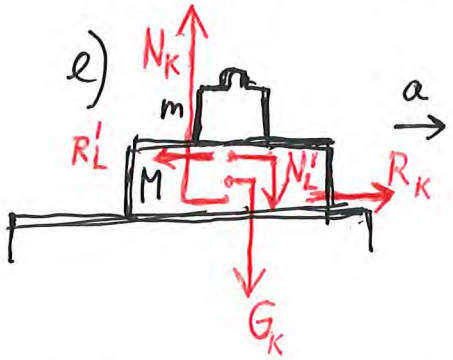
Motkraften til S virker på kroken som fjæra er en del av.

d) $\Sigma F = 0$ for loddet når det henger i ro i følge Newtons 1. lov.

$\Downarrow$

$S = G$

Motkraften til S virker på fjæra i følge Newtons 3. lov, og hvis fjæra skal være i ro må krafta fra taket på fjæra være like stor og motsatt rettet i følge Newtons 1. lov. Dermed blir krafta på taket lik $S = \underline{G}$

e) 

$a = 1{,}5\ \frac{m}{s^2}$ $M = 0{,}50\,kg$ $m = 0{,}20\,kg$

$G_K = Mg = 0{,}50\,kg \cdot 9{,}81\ \frac{N}{kg} = \underline{4{,}9\,N}$ (4,905)

$N_L' = G_L = mg = 0{,}20\,kg \cdot 9{,}81\ \frac{N}{kg} = \underline{2{,}0\,N}$ (1,962)

$N_K = G_K + N_L' = (4{,}905 + 1{,}962)\,N = \underline{6{,}9\,N}$ (6,867)

$\Sigma F = Ma$

$R_K - R_L' = Ma$

$R_K = R_L' + Ma$

$R_K = 0{,}30\,N + 0{,}50\,kg \cdot 1{,}5\ \frac{m}{s^2} = \underline{1{,}1\,N}$ (1,05)

$\Sigma F = ma$

$R_L = ma = 0{,}20\,kg \cdot 1{,}5\ \frac{m}{s^2} = 0{,}30\,N \Rightarrow R_L' = \underline{0{,}30\,N}$

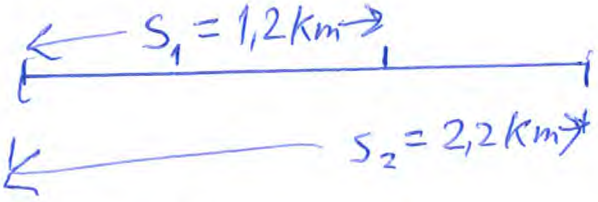
Kreftene virker i retningene tegninga viser.

2.359

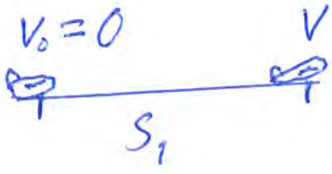
$V = 60\frac{m}{s}$

$F_L = 10 \cdot 10^3 N$

$m = 30 \cdot 10^3 kg$



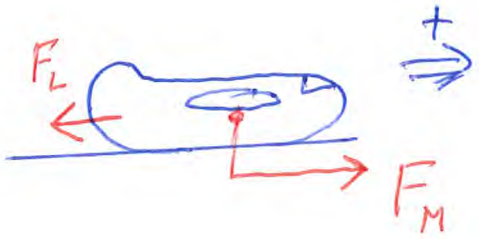
a)



$2as_1 = V^2 - V_0^2$

$a = \frac{V^2}{2s_1} = \frac{(60\frac{m}{s})^2}{2 \cdot 1200m} = 1{,}5\frac{m}{s^2}$

b)



$\Sigma F = ma = 30 \cdot 10^3 kg \cdot 1{,}5\frac{m}{s^2}$

$= 45 \cdot 10^3 N = 45kN$

c) $\Sigma F = ma$

$F_M - F_L = ma$

$F_M = ma + F_L$

$F_M = 45 \cdot 10^3 N + 10 \cdot 10^3 N = 55 \cdot 10^3 N = 55kN$

d) $2a_2 s_2 = V^2 - V_0^2 \quad V = 0$

$a_2 = \frac{-V_0^2}{2s_2} = \frac{-(60\frac{m}{s})^2}{2 \cdot 2200m} = -0{,}8181\frac{m}{s^2}$

$\Sigma F = m_2 a_2$

$-F_L + R = m_2 a_2$

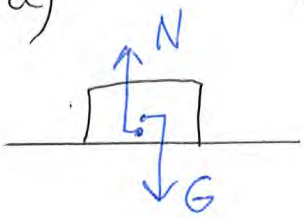
$R = m_2 a_2 + F_L$

$R = 25 \cdot 10^3 kg \cdot (-0{,}8181\frac{m}{s^2}) + 10 \cdot 10^3 N$

$= -10kN$

2.364 $m = 8{,}0\,kg$

a) $\Sigma F = 0$



b) $v = 2{,}0\,\frac{m}{s}$ konst

$\Sigma F = 0$

$F_1 - R = 0$

$F_1 = R$

$R = 15N$

c) $R = 15N$

1. $\Sigma F = ma$

$R = 15N$

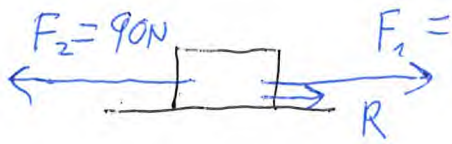
$F_1 - R = ma$

$a = \frac{F_1 - R}{m} = \frac{80N - 15N}{8{,}0kg} = 8{,}125\,\frac{m}{s^2}$

$v = \cancel{v_0} + at$

$v = at = 8{,}125\,\frac{m}{s^2} \cdot 3{,}0s = \underline{24\,\frac{m}{s}}$

2.



$F_1 + R - F_2 = ma$

$80N - 15N - 90N = ma$

$-25N$

$F_1 + R > F_2$

$\Downarrow$

Legemet er i ro!

$v = 0$

3.

$F_1 + R - F_2 = ma$

$80N + 15N - 120N = ma$

$-25N = 8{,}0kg \cdot a$

$a = \frac{-25}{8{,}0}\,\frac{m}{s^2} = -3{,}125\,\frac{m}{s^2}$

$v = at = -3{,}125\,\frac{m}{s^2} \cdot 3{,}0s$

$= \underline{-9{,}4\,\frac{m}{s}}$