Midtsemesterprøve FYS008 Høst 2018

Oppgave 1

$v = 340 \frac{m}{s}$

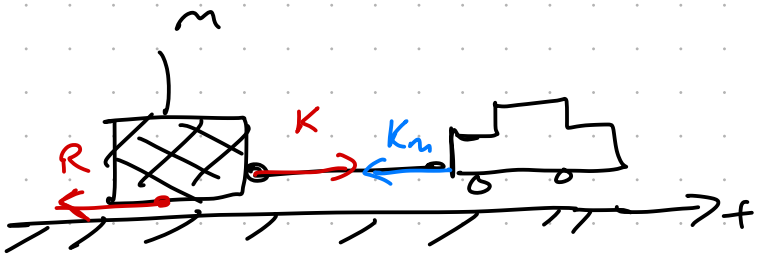
$s = v \cdot t$ $\quad t = 10\,s$

$s = 340 \frac{m}{s} \cdot 10\,s = 3400\,m$

$s = 3{,}4\,km$

Svar: 2) 3,4 km

Oppgave 2



$m = 5\,kg$

$K = 15\,N$

$R = -5\,N$

a) K_m : kraft fra kasse på bil

$K_m = -K = -15\,N$ (Newtons 3. lov)

kraft = motkraft

Svar: 1) -15 N

b) $s = s_0 + v_0 t + \frac{1}{2} a t^2$

$s_0 = 0$, $v_0 = 0$, $a = ?$

$\Sigma F = m \cdot a$ (Newtons 2. lov)

$a = \frac{\Sigma F}{m}$ $\quad \Sigma F = K - R$

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

$= \frac{1}{2} \cdot \frac{(15-5)N}{5\,kg} \cdot (10s)^2 = \frac{1}{2} \cdot \frac{10}{5} \cdot 100\,m$

$s = 100\,m$

Svar: 1) 100 m

Oppgave 3

$Z = X - Y$

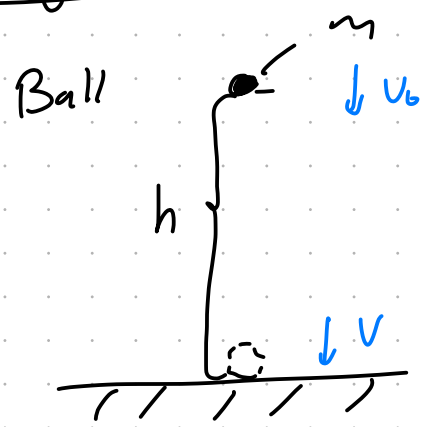
$= (123{,}0 - 1{,}2)\,cm = 121{,}8\,cm$

$\delta Z = \delta X + \delta Y = 0{,}5\,cm + 0{,}1\,cm = 0{,}6\,cm$

$Z = 121{,}8\,cm \pm 0{,}6\,cm$

Svar: 4) $(121{,}8 \pm 0{,}6)\,cm$

Oppgave 4



$m = 80\,g = 0{,}080\,kg$

$h = 1{,}00\,m$

$V_0 = 0$

$V = ?$

a) Bevaring mekanisk energi:

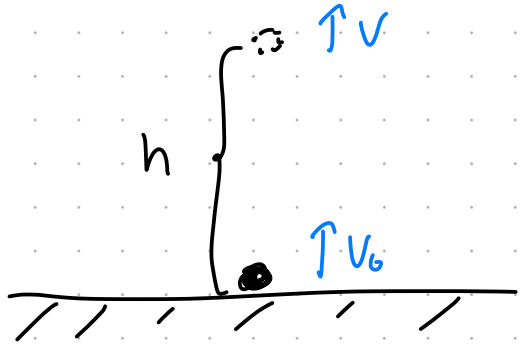
$$mgh = \frac{1}{2}mv^2$$

$$v = \sqrt{2gh} = \sqrt{2 \cdot 9{,}81 \frac{m}{s^2} \cdot 1{,}00\,m}$$

$$v = 4{,}43 \frac{m}{s}$$

Svar: 3) $4{,}43 \frac{m}{s}$

b)



$V_0 = 0{,}9 \cdot 4{,}43 \frac{m}{s} = 3{,}987 \frac{m}{s}$

$v = 0$

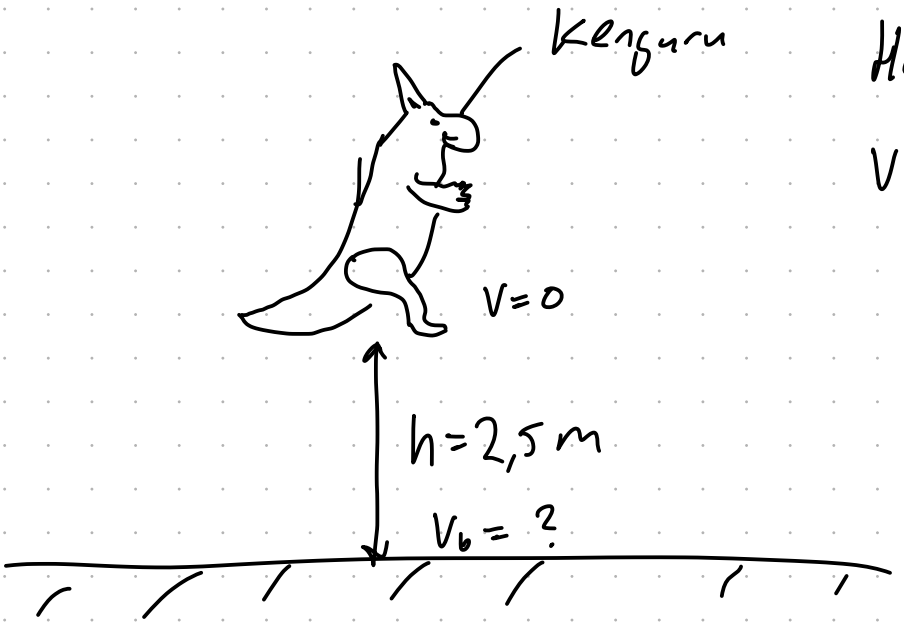
$h = ?$

$$\frac{1}{2}mv_0^2 = mgh$$

$$h = \frac{v_0^2}{2g} = \frac{\left(3{,}987 \frac{m}{s}\right)^2}{2 \cdot 9{,}81 \frac{m}{s^2}} = 0{,}81\,m$$

Svar: 2) 0,81 m

Oppgave 5



Hopper 2,5 m rett opp

v_0 = ?

Energibevaring: $\frac{1}{2}mv_b^2 = mgh$

$$v_b = \sqrt{2gh} = \sqrt{2 \cdot 9{,}81 \frac{m}{s^2} \cdot 2{,}5\,m}$$

$$= 7{,}0 \frac{m}{s}$$

Svar: 2) $7{,}0 \frac{m}{s}$

(kan også bruke tidløs formel)

$$v^2 - v_b^2 = 2a(s - s_0)$$

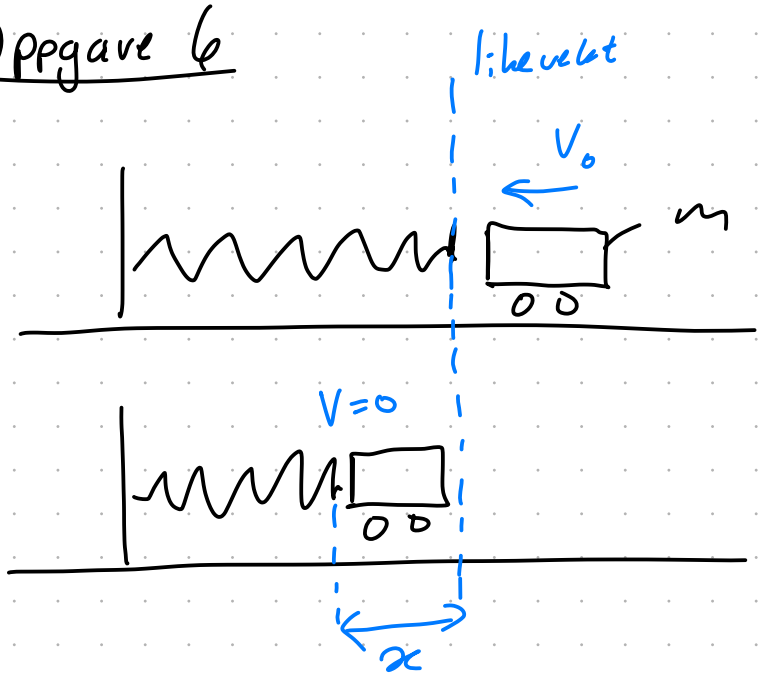
v: 0, v_b: 2, s_0: 0

$$-v_b^2 = 2as \quad \leftarrow \text{positiv retning opp}$$

$a = -g$

$$v_0 = \sqrt{2gs} \quad (s = h, \text{ dvs. samme ligning som over})$$

Oppgave 6



$m = 0{,}250\ kg$

$V_0 = 6{,}0\ \frac{m}{s}$

$k = 200\ \frac{N}{m}$

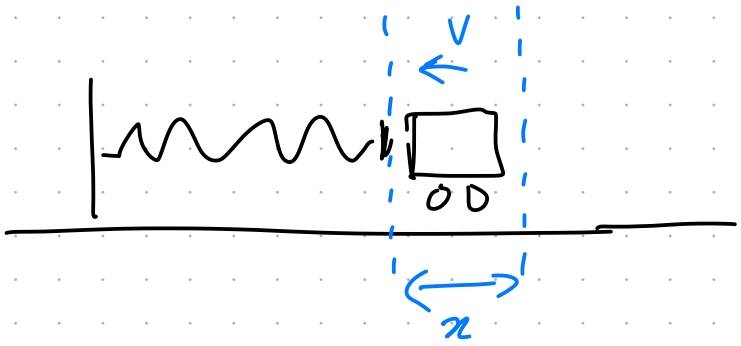
a) Energibevaring: $\frac{1}{2}mv_0^2 = \frac{1}{2}kx^2$

$$x = \sqrt{\frac{mv_0^2}{k}} = \sqrt{\frac{0{,}250\,kg \cdot \left(6{,}0\ \frac{m}{s}\right)^2}{200\ \frac{N}{m}}}$$

$$= \sqrt{\frac{9\ kg\frac{m^2}{s^2}}{200\ \frac{N}{m}}} = 0{,}21\ m$$

Svar: 4) $x = 0{,}21\ m$

b)



$V = \frac{1}{2} v_0$

$x = ?$

Energibevaring:

$$\frac{1}{2} k x^2 = \frac{1}{2} m v_0^2 - \frac{1}{2} m v^2$$

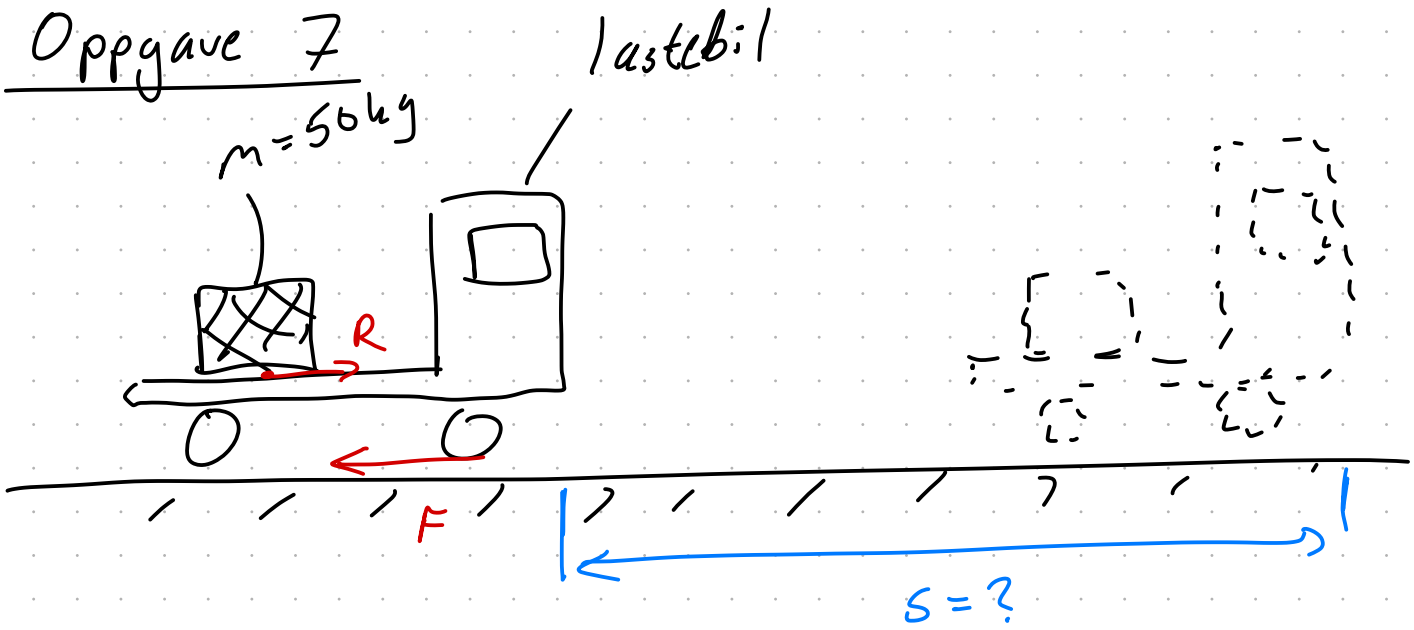
$$x = \sqrt{\frac{m}{k}\left(v_0^2 - v^2\right)} = \sqrt{\frac{m}{k}\left(v_0^2 - \frac{1}{4} v_0^2\right)}$$

$$= \sqrt{\frac{m}{k} \frac{3}{4} v_0^2} = \sqrt{\frac{m v_0^2}{k}} \cdot \sqrt{\frac{3}{4}}$$

$$= 0{,}18 \text{ m}$$

Svar: 1) $x = 0{,}18$ m

Oppgave 7



Bremser uten at kassen glir.
Den kraftigste oppbremsingen bilen kan ha må ha kraft mindre eller lik friksjonskraften R til kasse når den glir.

$$R = \mu N = \mu mg$$

Akselerasjonen til bilen er gitt ved bremsekraften F.

$$F = m \cdot a$$
$$\sum F = F + R \Rightarrow F = -R$$
$$m \cdot a = -\mu m g$$
$$a = -\mu g$$

Stekning får vi fra tidløs formel

$$v^2 - v_0^2 = 2a(s - s_0)$$

$v = 0$, $s_0 = 0$

$$-v_0^2 = 2as = -2\mu g s$$

$$s = \frac{v_0^2}{2\mu g} = \frac{\left(\frac{50}{3.6}\frac{m}{s}\right)^2}{2 \cdot 0{,}5 \cdot 9{,}81 \frac{m}{s^2}}$$

$$s = 19{,}7\ m$$

Svar: 4) 20 m