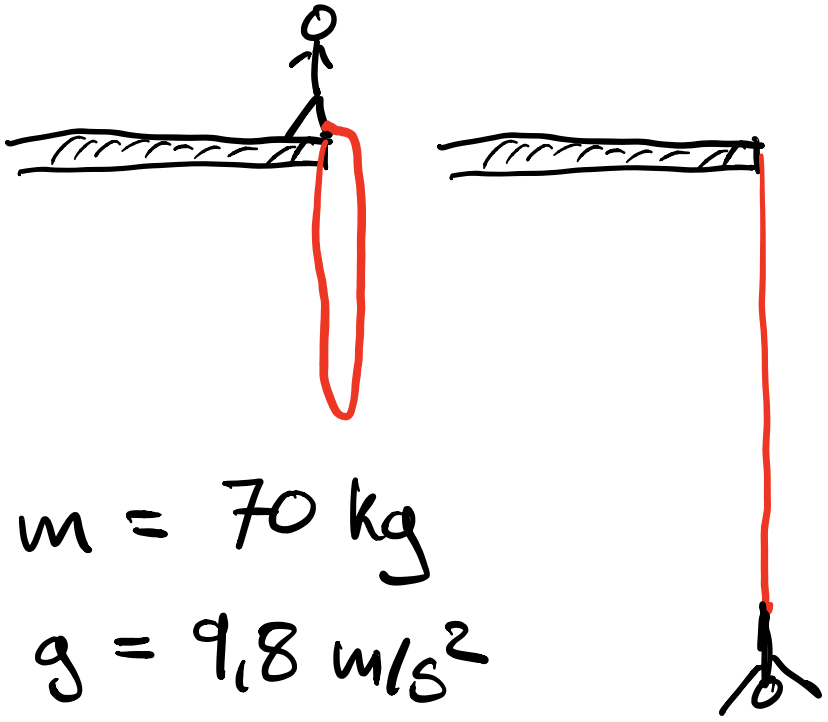
5.30 Modellere stikkhopp.



$m = 70\ kg$

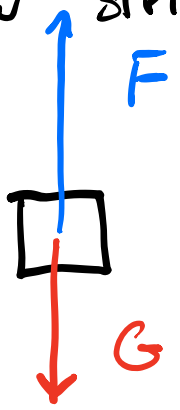
$g = 9{,}8\ m/s^2$

$K = 150\ N/m$

$d = 20\ m$ – lengden på strikk

$$F = \begin{cases} -k(x-d) - C_v \cdot v & x > d \\ 0 & x < d \end{cases}$$

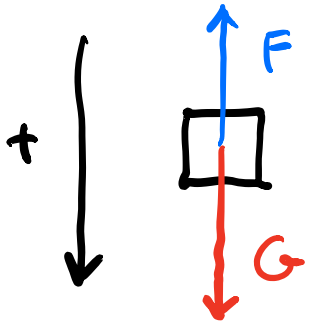
a) Tegn Fribegemediagram når strikken er strukket



$|F| > |G|$ - Første gang

$|F| = |G|$ - Når bevegelsen er ferdig.

b) Ved hvilken høyde henger personen når bevegelsen har stoppet?



$|G| = |F|$

N. 1. lov $\quad G + F = 0$

$v = 0$ når bevegelsen har stoppet.

$G = mg$

$$F = \begin{cases} -k(x-d) - C_v v & x > d \\ 0 & x < d \end{cases}$$

$d = 20\,m$

$m = 70\,kg$

$k = 150\,N/m$

$$G + F = 0$$

$$mg + -k(x-d) - c_0 \cdot 0 = 0$$

$$mg - kx + kd = 0 \quad | + kx$$

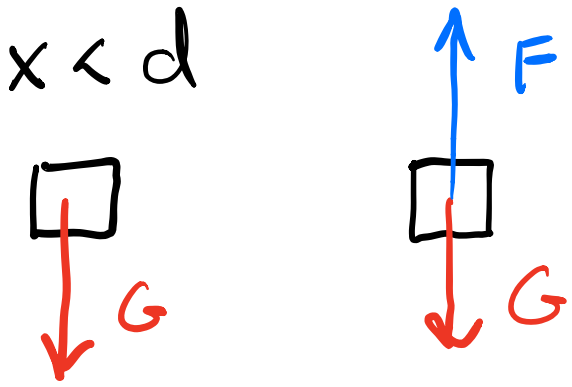
$$mg + kd = kx \quad | \cdot \frac{1}{k}$$

$$\boxed{\frac{mg}{k} + d = x}$$

$$x = \frac{70\,kg \cdot 9{,}8\,m/s^2}{150\,N/m} + 20\,m$$

$$x = 25\,m$$

c) Numerisk algoritme



N. 2. lov $\quad G + F = ma \quad | \cdot \frac{1}{m}$

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

$$v(t + \Delta t) = v(t) + a \cdot \Delta t$$

$$x(t + \Delta t) = x(t) + v(t + \Delta t) \cdot \Delta t$$

$G = mg$

if $x(t) > d$:

$F = -k(x[i-1] - d) - C_v \cdot v[i-1]$

else:

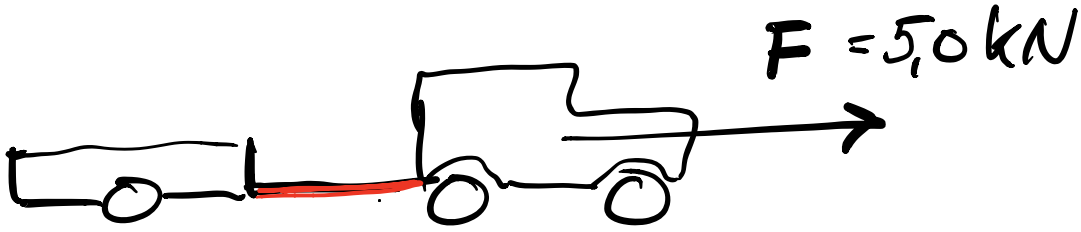
$F = 0$

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

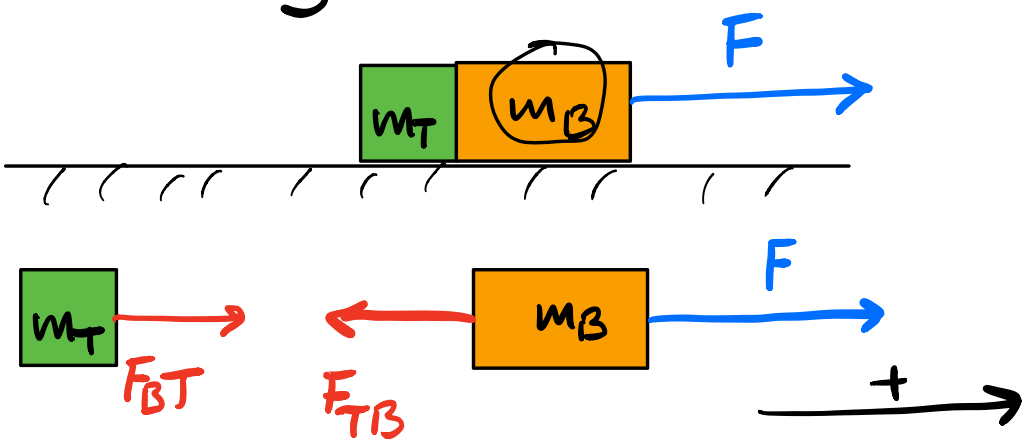
$$v[i] = v[i-1] + a \cdot \Delta t$$

$$x[i] = x[i-1] + v[i] \cdot \Delta t$$

Bil med tilhenger



$m_T = 300\ kg$ $\quad m_B = 1{,}5 \cdot 10^3\ kg$



$$|F_{BT}| = |F_{TB}| \quad , \quad F_{BT} = -F_{TB}$$

N. 2. lov
Bil:

$$F - |F_{TB}| = m_B \cdot a_B \quad (1)$$

N. 2. lov
Tilhenger:

$$|F_{BT}| = m_T \cdot a_T \quad (2)$$

$$a_B = a_T = a \quad (3)$$

(1) + (2)

$$F - m_T \cdot a = m_B \cdot a$$

$$F = m_B a + m_T \cdot a$$

$$F = (m_B + m_T)\, a$$

$$a = \frac{F}{m_B + m_T} = \frac{50\,kN}{1{,}5 \cdot 10^3\,kg + 300\,kg}$$

$$a = 2{,}8\,m/s^2$$

Hva er kraften mellom bil og tilhenger?

$|F_{BT}| = |F_{TB}|$

② $|F_{BT}| = m_T \cdot a$

$= 300\,kg \cdot 2{,}8\,m/s^2$

$\underline{\underline{|F_{BT}| = 8{,}3 \cdot 10^2\,N}}$