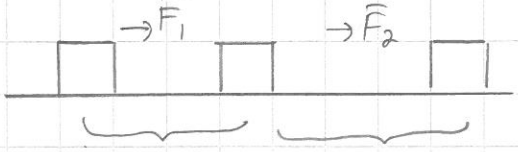
11.10



$F_1 = 50N$, $F_2 = 20N$

$t: 0s \ldots 5s$ $\quad t: 5s \ldots 14s$

$s_1 = 10m - 0m = 10m$

$s_2 = 28m - 10m = 18m$

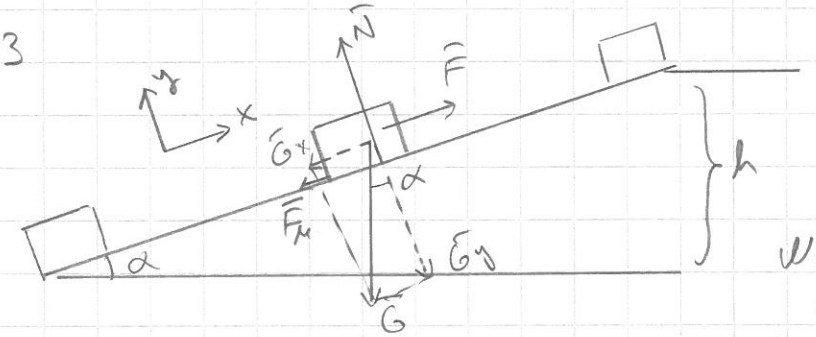
Tehty työ:

$W = W_1 + W_2$

$= F_1 s_1 + F_2 s_2$

$= 50N \cdot 10m + 20N \cdot 18m = \underline{860\ J}$

11.13



$m = 72kg$

$h = 1{,}5m$

$\mu = 0{,}38$

$\alpha = 17°$

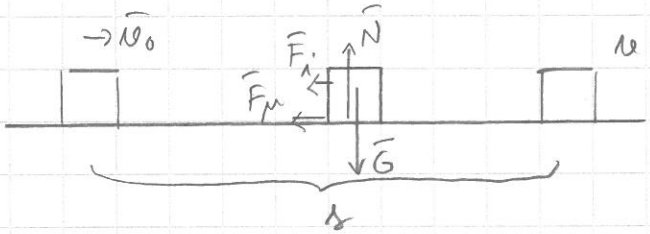
Vaunu on vakio $\Rightarrow \bar{a} = \bar{0}$

$\Rightarrow \sum \bar{F} = \bar{G} + \bar{N} + \bar{F} + \bar{F}_\mu = \bar{0}$

jaetaan liikemäärän yhtälö komponenteille

$$\begin{cases} \sum F_x = F - F_\mu - G_x = F - \mu N - G \sin\alpha = 0 \\ \sum F_y = N - G_y = N - G\cos\alpha = 0 \end{cases}$$

12.11



$v_0 = 48 \frac{km}{h}$ $\quad m = 1450kg$

$s = 12m$

Oletus $\bar{F}_\mu = \bar{0}$

a) Työperiaate: Jäitään tekemä työ = auton liike-energian muutos

$W_\mu = \Delta E_k$

$\Leftrightarrow -F_\mu s = 0 - \frac{1}{2} m v_0^2 \quad | : (-s)$

$\Leftrightarrow F_\mu = \frac{\frac{1}{2} m v_0^2}{s} = \frac{\frac{1}{2} \cdot 1450kg \cdot \left(\frac{48}{3{,}6} \frac{m}{s}\right)^2}{12m} \approx 10\,740{,}7N$

$\approx \underline{11\,8kN}$

b) $\mu = 0{,}17$

Oletetaan, että auto liukuu jarrutuksessa jolloin kitka on liukukitkaa: $F_\mu = \mu N = \mu G = \mu mg$

Työperiaate: $W_\mu = \Delta E_k$

$\Leftrightarrow -F_\mu s = 0 - \frac{1}{2} m v_0^2$

$\Leftrightarrow \mu mg s = \frac{1}{2} m v_0^2 \quad | \cdot \frac{2}{m} \quad | \sqrt{\ }$

$\Leftrightarrow v_0 = \pm \sqrt{2\mu g s} = \sqrt{2 \cdot 0{,}17 \cdot 9{,}81 \frac{m}{s^2} \cdot 12m} \approx 6{,}3265 \frac{m}{s} \approx \underline{23 \frac{km}{h}}$