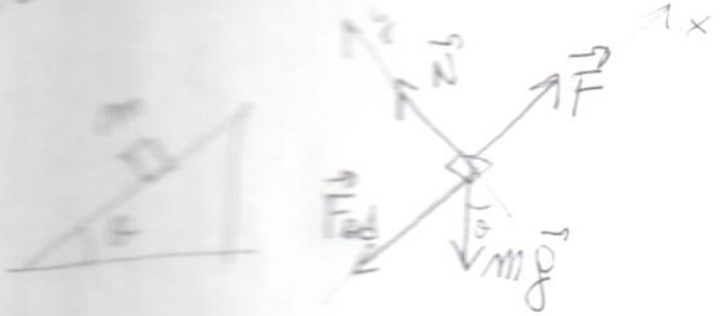
Esercizio

Calcolare la $\vec{F}$ necessaria a spingere un oggetto di peso $mg = 180\,N$ su un piano inclinato di $\vartheta = 30°$, sapendo che $\mu_d = 0{,}25$



$$\vec{F} + m\vec{g} + \vec{N} + \vec{F}_{ed} = m\vec{a}$$

$$\begin{cases} \hat{x}: & F - F_{ed} - mg\sin\vartheta = m a_x = 0 \\ \hat{y}: & N - mg\cos\vartheta = 0 \end{cases}$$

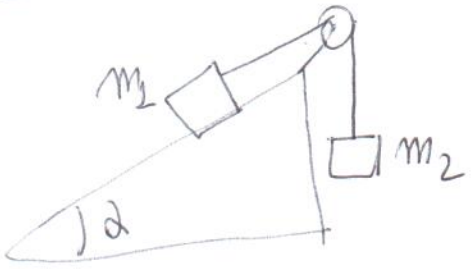
da cui $F_{ed} = \mu_d N$

$$\Rightarrow \begin{cases} F = mg\sin\vartheta + \mu_d mg\cos\vartheta = 129\,N \\ N = mg\cos\vartheta \end{cases}$$

← NON SERVE AI FINI DELL'ESERCIZIO

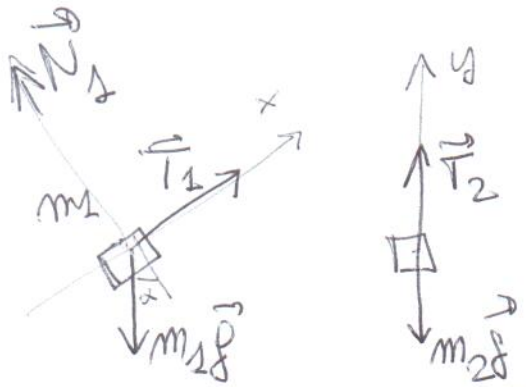
[illegible]

esercizio



$m_1 = 200\,g$.
$m_2 = 180\,g$
$\alpha = 30°$, no attriti.

calcolare le accelerazioni di m_1 e m_2 e la tensione del filo



$\vec{T}_1 + m_1\vec{g} = m_1\vec{a}_1$

$\hat{x}$ $T_1 - m_1 g \sin\alpha = m_1 a_{1x}$

$\vec{T}_2 + m_2\vec{g} = m\vec{a}_2$

$\hat{y}$: $T_2 - m_2 g = m a_{2y}$

so che $T_2 = T_1 = T$ $\Rightarrow$ $-a_{2y} = a_{1x} = a$ (porre g pos!!!)

$$\begin{cases} T - m_1 g \sin\alpha = m_1 a \\ T - m_2 g = -m_2 a \end{cases}$$

$a = \dfrac{-T + m_2 g}{m_2}$

$T = \dfrac{m_1}{m_2}(-T + m_2 g) + m_1 g \sin\alpha$

$= -\dfrac{m_1}{m_2} T + m_1 g + m_1 g \sin\alpha$

$T\left(1 + \dfrac{m_1}{m_2}\right) = m_1 g(\sin\alpha + 1)$

$T = m_2 m_1 / m_1 + m_2 (\sin\alpha + 1)$

$\Rightarrow a = g - \dfrac{T}{m_2} = g - \dfrac{m_1 g(1+\sin\alpha)}{m_2 + m_2}$

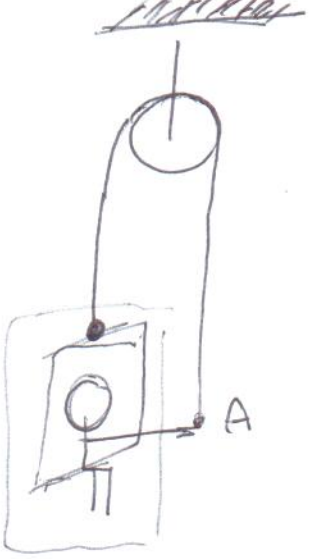
$= \dfrac{g m_2 + g m_1 - g m_1 - g m_1 \sin\alpha}{m_2 + m_2}$

$= \dfrac{g}{(m_2 + m_2)}(m_2 - m_1 \sin\alpha)$

$= 2.1\ m/s^2$ $\quad a > 0$!!

$\Rightarrow T = \dfrac{m_2 m_1}{(m_2 + m_1)} g(1 + \sin\alpha)$

$= 1,4\ N$



esercizio

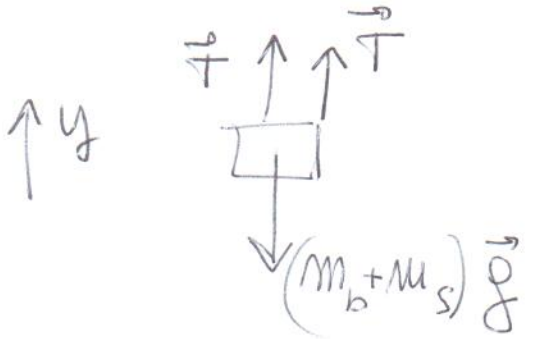
conosco $m_{bumbo}\,g = 320\,N$

$m_{sedile}\,g = 160\,N$

$F = 250\,N$ esercitata dal bambino sulla fune

trovare accelerazione del sistema sedile + bambino e la reazione normale esercitata dal sedile sul bambino

(1) considero il sistema bambino + sedile $m_{TOT} = m_b + m_s$



$\vec{F}_{TOT} = m_{TOT}\,\vec{a}$

$2\vec{T} + m_{TOT}\,\vec{g} = m_{TOT}\,\vec{a}$

$\hat{y}: \; 2T - m_{TOT}\,g = m_{TOT}\,a$

$\Rightarrow a = \dfrac{2T - m_{TOT}\,g}{m_{TOT}}$

conosco T perché ce lo dice A

$\vec{F} + \vec{T} = 0$ ($m_{fune} = 0$) $\Rightarrow F = T$ lungo $\hat{y}$

$\Rightarrow a = \dfrac{2F - m_{TOT}\,g}{m_{TOT}} = 0{,}41\ m/s^2$

(2)

$m_{bimbo}\,\hat{y}: \; N + T - m_b\,g = m_b\,a$

$\Rightarrow N = m_b\,a + m_b\,g - T$

→ segue

$$N = m_b a + m_b g - T$$

$$\overset{!}{=} m_b \left(\frac{2F - m_{tot} g}{m_{tot}} \right) + m_b g - T$$

$$= \frac{m_b}{m_{tot}} 2F - \cancel{m_b g} + \cancel{m_b g} - T$$

$$= \frac{m_b}{m_{tot}} 2F - T \qquad F = T$$

$$\overset{!}{=} \left(\frac{2m_b}{m_{tot}} - 1 \right) T$$

$$\overset{!}{=} \left(\frac{2m_b - m_b - m_s}{m_{tot}} \right) T$$

$$\overset{!}{=} \frac{m_b - m_s}{m_b + m_s} T$$

$$\overset{!}{=} \frac{320 - 160}{320 + 160} \cdot 250 = 83{,}3 \text{ N}$$

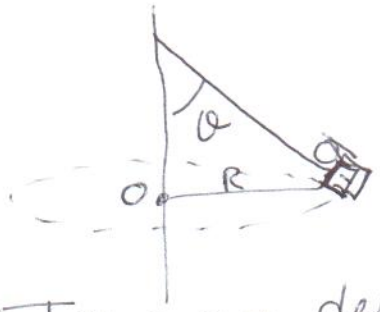
$N \geq 0 \Rightarrow m_b \geq m_s$

se $m_b = m_s = m \Rightarrow a = \frac{2T - 2mg}{2m}$

$$\overset{!}{=} \frac{T}{m} - g$$

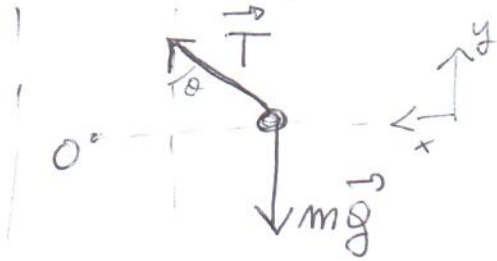
Calcinculo una giostra per bambini è costituita da un seggiolino attorcato ad un filo appeso ad un estremo ad un polo girevole.

Quando è in movimento, il bambino + seggiolino descrivono una circonferenza di raggio $R = 8\,m$, con velocità $v = 36\,km/h \hat{=} 10\,m/s$. Trovare ϑ e Tensione del filo



vista dell'alto:

vista di profilo



$m_{TOT} = \text{bimbo} + \text{seggiolino} = 50\,kg$

$$\begin{cases} \hat{x}: & T\sin\vartheta = m a_c \hat{=} m\frac{v^2}{R} \\ \hat{y}: & T\cos\vartheta - mg = 0 \end{cases} \Rightarrow \begin{cases} T\sin\vartheta = \frac{mv^2}{R} \\ T\cos\vartheta = mg \end{cases}$$

$$\Rightarrow \tan\vartheta = \frac{v^2}{Rg} \quad \Rightarrow \vartheta = \arctan\left(\frac{v^2}{Rg}\right) = 51{,}9°$$

$$\Rightarrow T = \frac{mg}{\cos\vartheta} \hat{=} mg\sqrt{1+\frac{v^4}{R^2g^2}}$$

$$\cos\vartheta = \sqrt{\frac{1}{1+\tan^2\vartheta}}$$

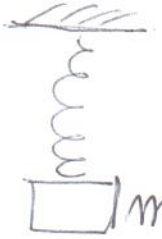
$$\frac{1}{\cos\vartheta} = \sqrt{1+\tan^2\vartheta} \hat{=} \sqrt{1+\frac{v^4}{R^2g^2}}$$

$$\hat{=} 50 \times 9{,}8\sqrt{1+\frac{10^4}{64(9{,}8)^2}}$$

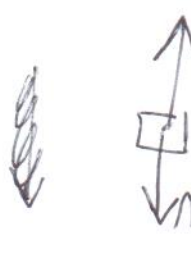
$$\simeq 500\sqrt{1+\frac{10^4}{6{,}4\,10^2}} \simeq 500 \times 1{,}5 = 750\,N$$

$$\hat{=} 734\,N$$

esercizio molla appesa al soffitto ($m_{molla} = 0$)



$k = 1 \cdot 10^4$ N/m / $m = 5$ kg calcolare Δl



calcolare Δl ($\Delta l > 0$)

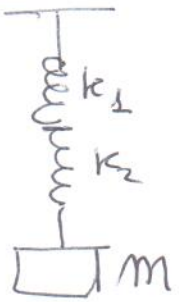
$\vec{F}_{el} + m\vec{g} = 0$: $\hat{y}$ $F_{el_y} - mg = 0$

$k\Delta l - mg = 0$

$k\Delta l = mg$ $\Delta l = mg/k$

$= 4.9$ mm

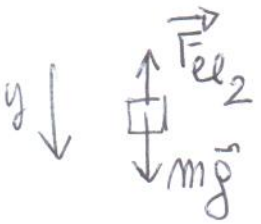
Cambiamo la vita: 2 molle in serie

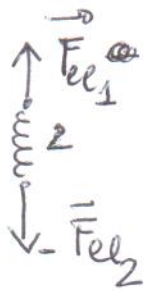


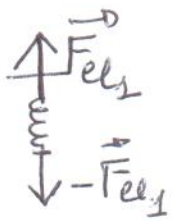
molla 1: k_1 Δl_1

= 2 k_2 Δl_2

trovare Δl e k equivalente







$\hat{y}$: $mg - k_2\Delta l_2 = 0$ $mg = k_2\Delta l_2$ $\Delta l_2 = mg/k_2$

$k_2\Delta l_2 - k_1\Delta l_1 = 0$ $k_2\Delta l_2 = k_1\Delta l_1$ $\Rightarrow$ $\Delta l_1 = \frac{k_2\Delta l_2}{k_1}$

$= mg/k_1$

oss che:

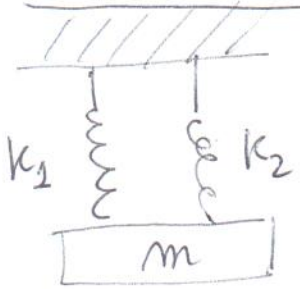
$\Delta l = \Delta l_1 + \Delta l_2$

$= mg\left(\frac{1}{k_1} + \frac{1}{k_2}\right)$

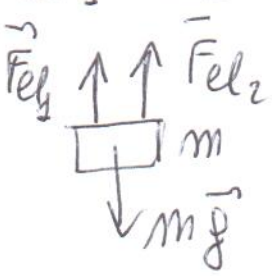
oss che: uno con una molla over $\Delta l = mg/k$

$\Rightarrow \frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2}$ k equivalente

2 molle in parallelo



$\Delta l_1 = \Delta l_2 = \Delta l$



$\downarrow y$

NON FATTO IN AULA.

$$mg - k_1\Delta l_1 - k_2\Delta l_2 = 0$$

$$mg = \Delta l (k_1 + k_1) \Rightarrow \Delta l = \frac{mg}{(k_1 + k_2)}$$

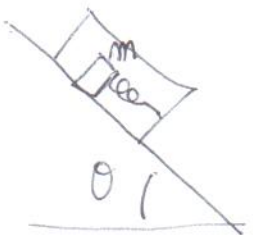
con una molla sola avrei $\Delta l = \frac{mg}{k}$

$$\Rightarrow k_1 + k_2 = k$$

k equivalente di 2 molle in parallelo

[illegible]

esercizio 2,26 pag 330 Mazzoldi



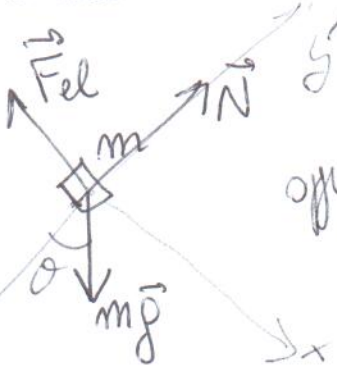
$m = 0{,}38\ kg \quad \theta = 30° \quad K = 5{,}5\ N/m$

il corpo scende con $\vec{a}$ costante e la molla non oscilla

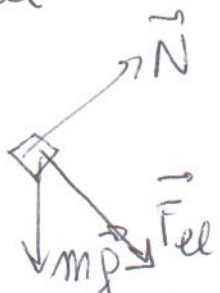
trovare Δl = deformazione della molla

$a_1 = 6\ m/s^2$ e $a_2 = 3\ m/s^2$

non oscilla $\Rightarrow$ m scende con la stessa $\vec{a}$ del corpo



oppure



molla allungata

molla compressa

$\vec{F}_{tot} = M\vec{a}$

$\hat{x}: \; mg\sin\theta + F_{el_x} = ma_x$

F_{el_x} = componente x della $\vec{F}_{el}$ non sappiamo se > 0 o < 0 vediamo il problema a trovare le risposte

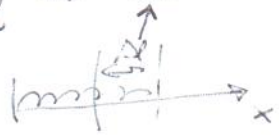
$F_{el_x} = m(a_x - g\sin\theta)$

$K\Delta l_x = m(a_x - g\sin\theta)$

$\Delta l_x = \frac{m}{K}(a_x - g\sin\theta)$

$= \begin{cases} +7{,}6\,10^{-2}\ m \ (a_1) & \text{molla allungata} \\ -0{,}131\ m \ (a_2) & \text{molla compressa} \end{cases}$

Ricordo: $\vec{F}_{el} = -K\Delta l\,\vec{i}$



$|\vec{F}_{el}| = K|\Delta l|$