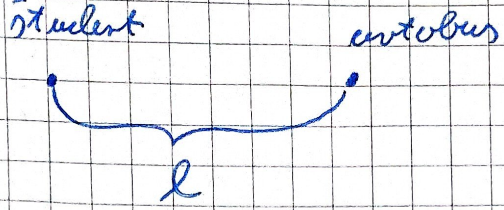
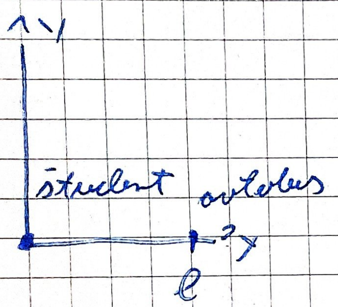
avtobus in študent bo teče za njim



r - razdalija med študentom in avtobusom

Postavimo središče koordinatnega sistema na mesto študenta ob času 0.



$$r = b - vt + \frac{at^2}{2}$$

zanima nas kdaj ima r vrednost 0. Ampak mi želimo da bo imela samo eno ničlo. To pomeni, da bo študent najprej ujel avtobus. Drugače ga bi ujel, potem ga bi ta prehitel in potem ga bi študent spet ujel.

$$b - vt + \frac{at^2}{2}$$

To bo res ko bo $D = b^2 - 4ac = 0$. Saj je r kvadratna funkcija

$$v^2 - 4\frac{a}{2}\cdot l = 0$$

$$v^2 = 2al$$

$$\underline{\underline{v = \sqrt{2al}}}$$

$$A = \int_{r_1}^{r_2} \vec{F} \cdot d\vec{r}$$

$d\vec{r} = \vec{e} \cdot |d\vec{r}|$

r_1 začetna točka na tiru.

r_2 končna točka na tiru

$d\vec{r} = \vec{e} \cdot ds \qquad ds = |d\vec{r}|$

$s = s(\vec{r})$

$$A = \int_0^s F \cos\varphi \, ds$$

$\vec{F} \cdot \vec{e} = F \cos\varphi \qquad |\vec{e}| = 1$

$\vec{F} = \vec{F}(s) \qquad \vec{e} = \vec{e}(s)$

sila. enotski vektor premika

ko smo v točki r_1 je prepotovana pot telesa 0, ko smo pa v točki r_2 pa je prepotovana pot telesa s

v točki r_1 začnemo merit pot

$$\int_c^t f(t)\,dt$$

ko računamo neki integral ko t fiksen ostane, za izračun integrala se pa mora spreminjati, da lahko izračunamo $f(t)$ v točkah na intervalu od c do t. Zato

$\int_c^t f(t')\,dt'$. Tak t' ob računu integrala ni fiksen in lahko zavzame vrednosti z intervala c do t.

5. teden vaje 6. naloga voziček in človek

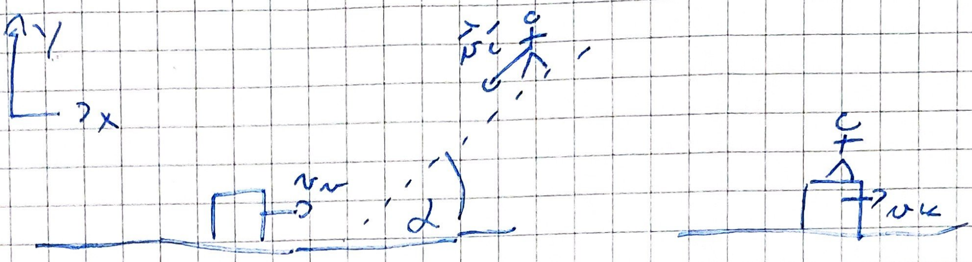
$m_v = 200\,kg$

$v_v = 1\,\frac{m}{s}$

$\alpha = 30^\circ$

$m_č = 80\,kg$

$v_č = 4\,\frac{m}{s}$



$v_k = ?$

$\int F_y dt = ?$

F_Y nima X komponente, zato bo $\Delta G_x = 0$, $\Delta G_y = \int F_y dt$

$$\Delta \vec{G} = \int \vec{F}_y dt$$

$$(\Delta G_x, \Delta G_y) = \int (0, F_y) dt$$

skupna masa

$m_s = m_č + m_v$

$$\Delta G_x = 0$$
$$\Downarrow$$
$$G_{xz} = G_{xk}$$

$$m_v v_v - m_č v_č \cos\alpha = m_s v_k$$

$$v_k = \frac{m_v v_v - m_č v_č \cos\alpha}{m_s}$$

na koncu nimamo hitrosti v smeri Y, zato

$G_{yk} = 0$

$G_{yz} = -m_č v_č \sin\alpha$

v negativno smer baze

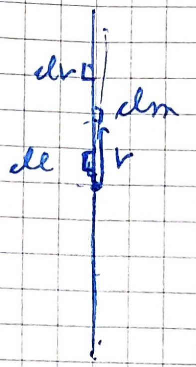
$$\Delta G_y = \int F_y dt$$

$$G_{yk} - G_{yz} = \int F_y dt$$

$$-(-m_č v_č \sin\alpha) = \int F_y dt$$

$$\int F_y dt = m_č v_č \sin\alpha$$

Izpeljava vztrajnostnega momenta za palico



$$J = \int r^2 \, dm =$$

$$\frac{dm}{dl} = \frac{m}{l}$$ enakomerno porazdeljena masa

$$dm = \frac{m}{l} \, dl$$

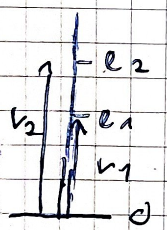
$$dr = dl$$

iz središča gledamo 2 enaka kosa palice

$$\int r^2 \, dm = \int r^2 \frac{m}{l} \, dl = 2\frac{m}{l}\int_0^{\frac{l}{2}} r^2 \, dr =$$

$$= 2\frac{m}{l} \frac{r^3}{3}\Big|_0^{\frac{l}{2}} = 2\frac{m}{l} \cdot \frac{l^3}{8} \cdot \frac{1}{3} = \frac{1}{12} m l^2$$

$dr = dl$, kar še pogledamo

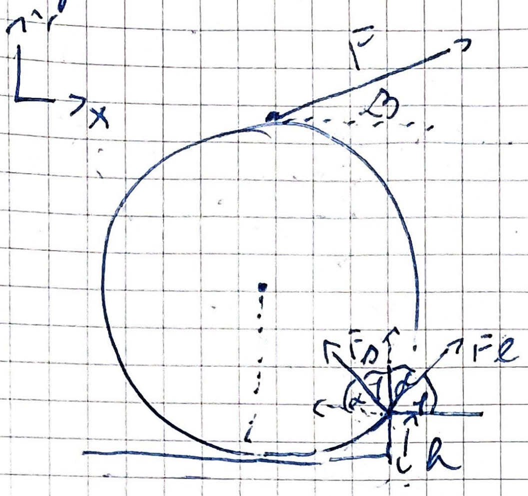


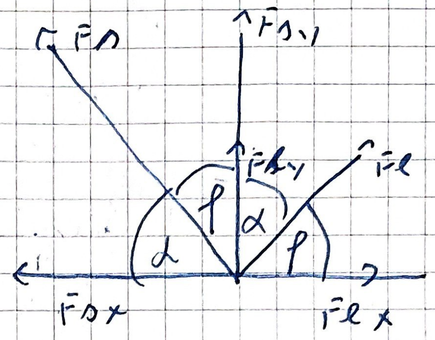
$$l_2 - l_1 = dl$$
$$\parallel$$
$$r_2 - r_1 = dr$$

Vzamemo l_1, l_2, r_1, r_2 z zelo malo razliko, da dobimo dr, ne Δr

To naredimo lahko za poljubna l_1 in l_2 na palici, zato bo veljalo $dl = dr$.

Vajl in stopnička F = ?, da se odkotali naprej





Zapišemo vsoto sil in navorov. Oba morata biti enaka 0, potem smo na meji, da se začne dvigovati in vrteti

$$\Sigma F = 0$$

$$y: F_{sy} - F_g + F \sin\beta + F_{l_y} = 0$$

$$x: -F_{sx} + F_{l_x} + F \cos\beta = 0$$

$$F_{sy} - F_g + F \sin\alpha + F \cos\alpha = 0$$

$$F_{sx} + F_{l_x} + F\cos\alpha = 0$$

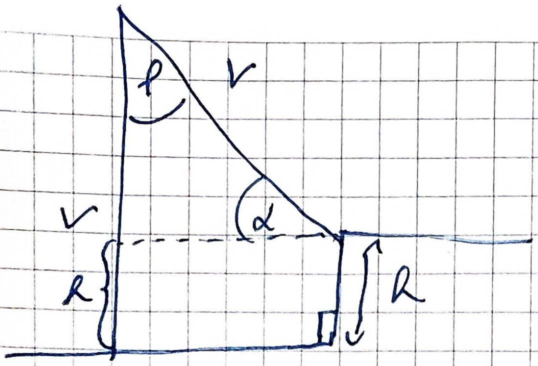
$$\Sigma M = 0$$

$$M_F - M_l = 0$$

$$M_F = -M_l$$

$$F \cos\beta \cancel{x} = F_l \cancel{x}$$

$$F\cos\beta = F_l$$



$\alpha = \frac{\pi}{2} - \varphi$

$\cos \varphi = \dfrac{r-h}{r}$ $\qquad \varphi = \arccos \dfrac{r-h}{r}$ $\qquad \cos\alpha = \sin\varphi$

$F_{sy} - F_g + F \sin\beta + F_{ly} = 0$

$F_s \cos\varphi - F_g + F \sin\beta + F_l \underbrace{\cos\alpha}_{= \sin\varphi} = 0$ (1)

$-F_{sx} + F_{lx} + F \cos\beta = 0$ $\qquad F \cos\beta = F_l$ (2)

$-F_s \cos\alpha + F_l \cos\varphi + F \cos\beta = 0$

$-F_s \sin\varphi + F_l \cos\varphi + F \cos\beta = 0$ (3)

F_s, F_l, F so neznanke. Imamo sistem 3 enačb za 3 neznanke znamo rešit

(2) vstavimo v (1) in (3)

$$F_s \cos\varphi - F_g + F\sin\beta + F\cos\beta\sin\varphi = 0$$

$$-F_s\sin\varphi + F\cos\beta + F\cos\beta\cos\varphi = 0$$

$$F_s\sin\varphi = F\cos\beta(1+\cos\varphi)$$

$$F_s = \frac{F\cos\beta(1+\cos\varphi)}{\sin\varphi}$$

$$\frac{F\cos\beta(1+\cos\varphi)}{\sin\varphi} + F\sin\beta + F\cos\beta\sin\varphi = F_g$$

$$F\left(\frac{\cos\beta(1+\cos\varphi)}{\sin\varphi} + \sin\beta + \cos\beta\sin\varphi\right) = F_g$$

$$\cos\varphi = \frac{r-h}{r} = 1-\frac{h}{r}$$

$$F = \frac{mg}{\frac{\cos\beta\left(2-\frac{h}{r}\right)}{\sin\left(\arccos\left(1-\frac{h}{r}\right)\right)} + \sin\beta + \cos\beta\sin\left(\arccos\left(1-\frac{h}{r}\right)\right)}$$