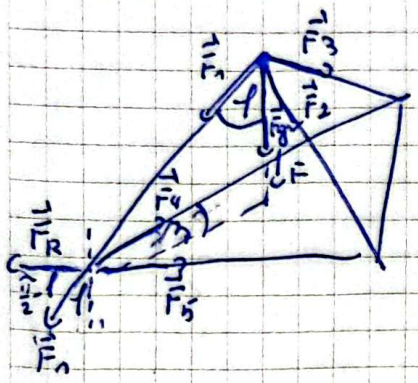
5. Stojalo v obliki tetraedra je sestavljeno iz šestih po 2 m dolgih kovinskih palic. Na vrh stojala prikrcljivo 100 N težko utež. Kolikšno silo moro prenesti vsaka od treh nožic in kolikšno vsaka od treh vodoravnih?



$$\vec{F}_g + \vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$$

$$F_g = 3 F_{proj} \qquad F_{proj} = F_1 \cos(\varphi)$$

$$F_1 = F_2 = F_3$$

$$F_R = F_1 \cos\left(\frac{\pi}{2} - \varphi\right) = F_1 \sin(\varphi)$$

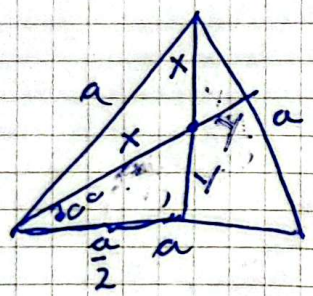
$$F_4 = F_5$$

$$F_R = 2 F_{proj_2} \qquad F_{proj_2} = F_4 \cos(\beta)$$

$$\underline{F_1 = \frac{F_g}{3\cos(\varphi)}}$$

$$F_4 = \frac{F_{proj_2}}{\cos(\beta)} = \frac{F_R}{2\cos(\beta)} = \frac{F_1 \sin(\varphi)}{2\cos(\beta)} =$$

$$= \frac{F_g \sin(\varphi)}{6\cos(\beta)\cos(\varphi)} = \underline{\frac{F_g \tan(\varphi)}{6\cos(\beta)}} = F_4$$

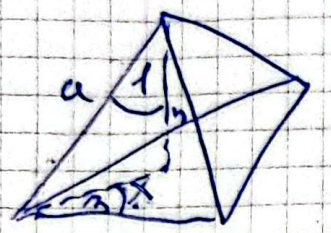


$$\cos(30^\circ) = \frac{\frac{a}{2}}{X} \Rightarrow X = \frac{a}{2\cos(30^\circ)}$$

$$\underline{X = \frac{a}{\sqrt{3}}}$$

$$\sin(30^\circ) = \frac{Y}{X} \Rightarrow Y = \sin(30^\circ) \cdot X =$$

$$= \sin(30^\circ) \cdot \frac{a}{2\cos(30^\circ)} = \frac{a}{2}\tan(30^\circ) = \underline{\frac{a}{2\sqrt{3}}}$$



$$h^2 = a^2 - x^2$$

$$h = \sqrt{a^2 - \frac{a^2}{3}} = a\sqrt{\frac{2}{3}}$$

$$\cos(\varphi) = \frac{h}{a} = \sqrt{\frac{2}{3}}$$

$$\beta = \frac{\pi}{6}$$

$$F_1 = \frac{F_g}{3\cos(\varphi)} = \frac{F_g}{\sqrt{6}}$$

$$F_4 = \frac{F_g \tan(\varphi)}{6\cos(\beta)} = \frac{F_g}{6}\frac{1}{\sqrt{2}}\frac{2}{\sqrt{3}} = \frac{F_g}{6}\sqrt{\frac{2}{3}} = F_1\sqrt{\frac{2}{18}}$$

$$\sin^2(\varphi) = 1 - \cos^2(\varphi)$$

$$= 1 - \frac{2}{3} = \frac{1}{3} \Rightarrow \sin(\varphi) = \frac{1}{\sqrt{3}}$$

$$\tan(\varphi) = \frac{\sin(\varphi)}{\cos(\varphi)} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\cos(\beta) = \frac{\sqrt{3}}{2}$$

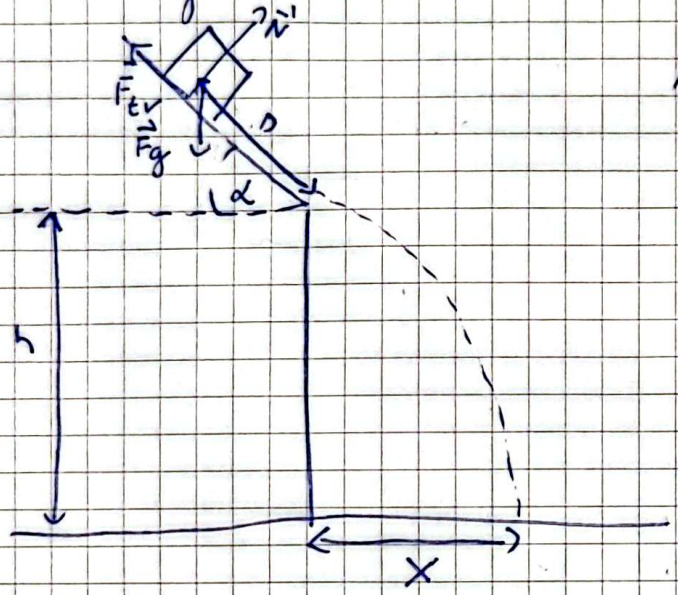
I kolokvij iz fizike za FRI 11. 12. 2024

2. Riba je na strehi z naklonom $\alpha = 30°$ odbožil zaboj z orodjem. Ker ni bil razljiv, je zaboj začel drseti in je s strehe padel na tla, kot je prikazano na sliki. Začetna lega zaboja je $s = 2m$ od roba strehe, koeficient trenja med streho in zabojem je $k_{tr} = 0,3$. Višina spodnje točke strehe je $h = 10m$

a) Izračunaj pospešek zaboja, medtem ko drsi po strehi

b) Izračunaj hitrost zaboja na robu strehe.

c) Izračunaj kako daleč od strehe pade zaboj na tla ($x = ?$)



$s = 2m$

$\alpha = 30°$

$k_t = 0,3$

$h = 10m$

a)

$$F_{tr} = k_{tr} \cdot N = k_{tr} \cdot mg \cdot \cos(\alpha)$$

$$N = mg\cos(\alpha)$$

$$F_d = mg\sin(\alpha)$$

$$a_s = \frac{F_d - F_{tr}}{m} = g\sin(\alpha) - g\,k_{tr}\cos(\alpha)$$

b)

$$a = \frac{dv}{dt}\frac{dv}{dv}$$

$$a \cdot dr = v\,dv$$

$$a\int_0^s dr = \int_0^v v\,dv$$

$$as = \frac{v^2}{2} \Rightarrow v_0 = \sqrt{2as} = \sqrt{2sg(\sin\alpha - k_{tv}\cos\alpha)}$$

c)

$$v_x = v_0 \cos\alpha$$

$$v_y = v_0 \sin\alpha$$

$$y = -\frac{gt^2}{2} - v_y t + h$$

vstavi $y = 0$ dobi ob kerem časa se nahaja na višini $y = 0$.

$$\frac{gt^2}{2} + v_y - h = 0$$

$$t_{1,2} = \frac{-v_y \pm \sqrt{v_y^2 + 2gh}}{g}$$

ker nam rabimo def. samo za + čas.

$$x = t_1 \cdot v_{0x}$$

$$= \frac{-v_y + \sqrt{v_y^2 + 2gh}}{g} \cdot \sqrt{2sg(\sin\alpha - k_{tv}\cos\alpha)}\cos\alpha$$

$$= \frac{-\sqrt{2sg(\sin\alpha - k_{tv}\cos\alpha)}\sin\alpha + \sqrt{2sg(\sin\alpha - k_{tv}\cos\alpha)\sin^2\alpha + 2gh}}{g} \cdot \sqrt{2sg(\sin\alpha - k_{tv}\cos\alpha}\cos\alpha$$