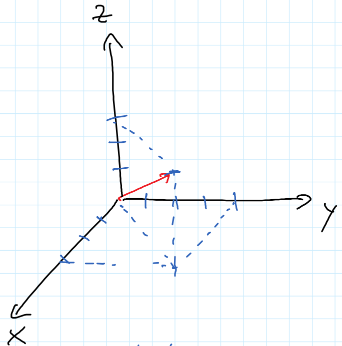
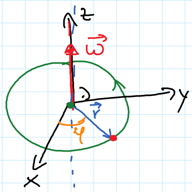


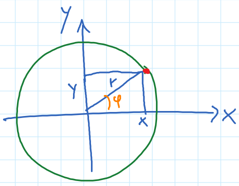
$$\vec{v} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$$



$$\vec{r} = \begin{pmatrix} r \cdot \cos \varphi \\ r \cdot \sin \varphi \end{pmatrix}$$

$$\boxed{\varphi = \omega \cdot t}$$

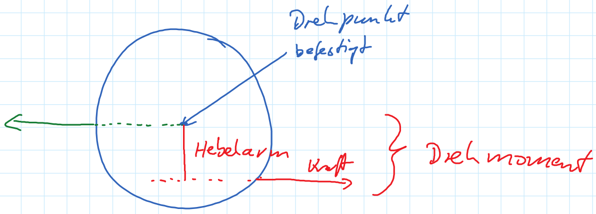
$$\omega = \frac{\Delta \varphi}{\Delta t}$$

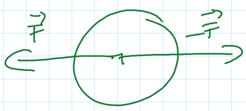


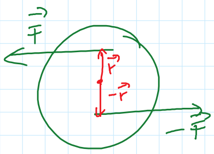
$$x = r \cdot \cos \varphi$$

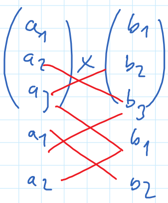
$$y = r \cdot \sin \varphi$$

lineare Bew.	Kreisbewegung
Weg x	Winkel φ
Geschw. $\vec{v}$	Winkelgeschw. $\vec{\omega}$
Kraft → Beschleunigung $\vec{a}$	Kraft → Drehmoment → Änderung der Winkelgeschw.





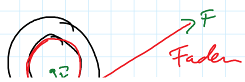


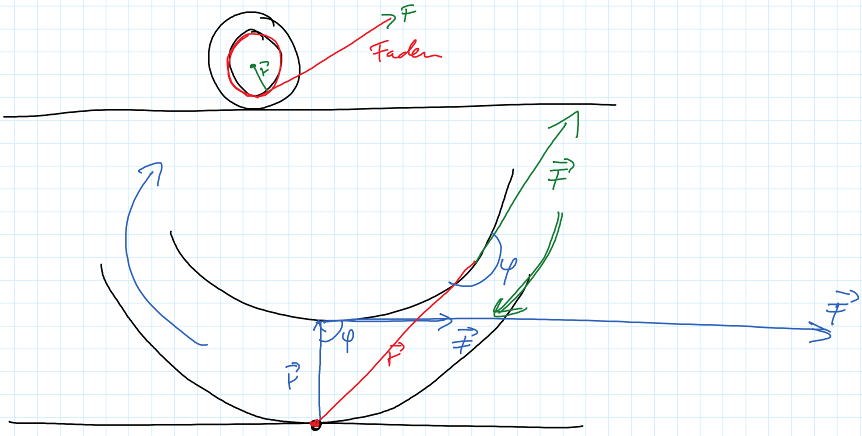


$$|\vec{a} \times \vec{b}| = |\vec{a}| \cdot |\vec{b}| \cdot \sin \varphi$$

Drehmoment $\vec{N} = \vec{r} \times \vec{F} = r \cdot F \cdot \sin \sphericalangle(r, F)$

Versuch: Garnrolle





Drehpunkt
= Auflagepunkt

folgsame Rolle

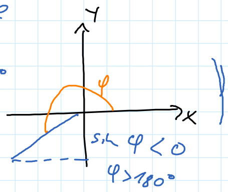
$\varphi \leq \pi \rightarrow \sin \varphi > 0$

Drehmoment > 0 in die Bildebene

störrische Rolle

$\varphi > \pi$ bzw. 180°

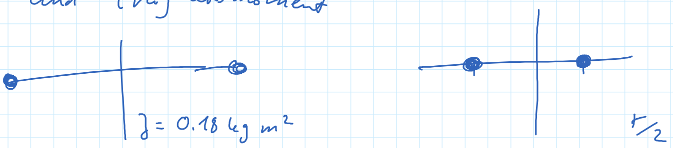
$\rightarrow \sin \varphi < 0$



Drehmom. < 0 → aus der Bildebene

Drehmoment und Trägheitsmoment

$J = r^2 \cdot m$

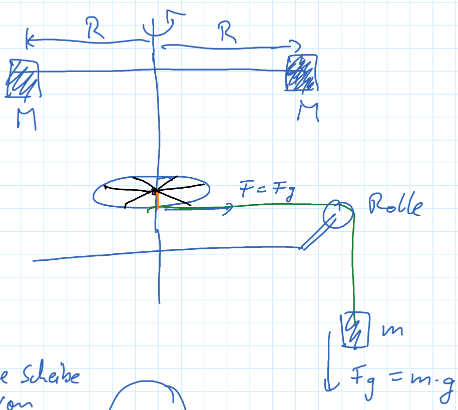


1. Umdrehung	12 sek	6 sek
2.	17 sek	9
3	21	11
4.	24	12 = t_4'
		:
		24 = t_{16}'

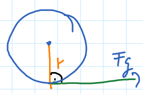
1. Teil
2. Teil

Offen: Repetitorium der Experimentalphysik

Versuch 7.1.



kleine Scheibe von oben

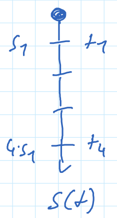


Drehmoment $\vec{N} = \vec{r} \times \vec{F} = r \cdot F \cdot 1$ ($\sin 90°$)

$t_4 = 2 \cdot t_1$

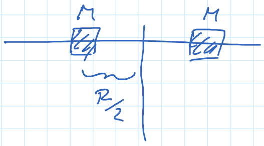
Winkel $\varphi_4 = 4 \cdot \varphi_1$ (4x360°, 1x360°) $\Big\}$ $\varphi(t) \propto t^2$

vgl. freier Fall



$s(t) \propto t^2$ gleichmässige Beschleunigung

2. Teil: $R \mapsto R/2$



def: $J = M \cdot R^2$

$M \downarrow 2M$, $R^2 \downarrow \frac{R^2}{4}$

$\Rightarrow J_{2.Teil} = \frac{1}{4} J_{1.Teil}$ d. Versuch

Trägheitsmoment nur noch $\frac{1}{4}$

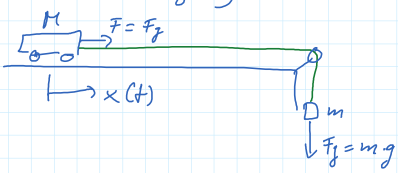
neue t_4' (4 U) = t_1 (1 U) vorher

$\Rightarrow \varphi(t) \propto \frac{1}{J}$

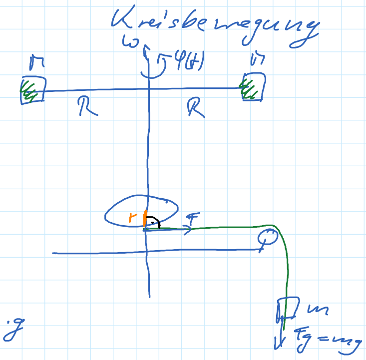
$\Rightarrow$ Bewegungsgl. d. Rotation $\varphi(t) = \frac{1}{2} \frac{N}{J} \cdot t^2 = \frac{1}{2} \alpha t^2$ (Winkel-beschl. α)

Die gleichmäßig beschleunigte

Linearbewegung



Kreisbewegung



$F = F_g = m \cdot g$

Masse M — Trägheitsmoment $J = M R^2$ (3.220)

(hier: $2M \cdot R^2$ weil 2 Massen!)

Kraft $\vec{F} = \dot{\vec{p}} = M \cdot \dot{\vec{v}} = M \cdot \vec{a}$ — Drehmoment $\vec{N} = \dot{\vec{L}} = J \cdot \dot{\vec{\omega}} = J \cdot \vec{\alpha}$

$\vec{N} = \vec{r} \times \vec{F}$ (3.228)

$N = r \cdot F \cdot \sin \sphericalangle(\vec{r}, \vec{F})$ (hier: 90°)

$\Rightarrow N = r \cdot F$

Impuls $\vec{p}(t) = M \cdot \vec{v}(t)$ — Drehimpuls $\vec{L}(t) = J \cdot \vec{\omega}(t)$ (3.225)

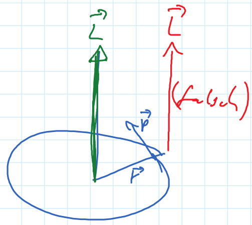
Beschleunig. $\vec{a}(t) = \frac{\vec{F}(t)}{M}$ — Winkelbeschl. $\vec{\alpha}(t) = \frac{\vec{N}(t)}{J}$ (3.227)

Geschwindigk. $v(t) = a \cdot t + v_0$ — Winkelgeschw. $\omega(t) = \alpha \cdot t + \omega_0$ (3.213)

Strecke $x(t) = \frac{1}{2} a t^2 + v_0 \cdot t + x_0$ Winkel: $\varphi(t) = \frac{1}{2} \alpha t^2 + \omega_0 \cdot t + \varphi_0$

(3.214)

Korrekt hier Buch



Impulserhaltung $\vec{F} = 0$

$\vec{F} = \dot{\vec{p}} \longrightarrow \vec{p} = \text{const}$

Kräftefrei → Impuls ändert sich nicht

Drehimpulserhaltung $\vec{N} = 0$ (kein Drehmom.)

$\vec{N} = \dot{\vec{L}} \Longrightarrow \vec{L} = \text{const}$

Drehimpuls erhalten falls kein Drehmoment

Energie $E_{kin} = \frac{1}{2} M v^2$ Rotenergie: $E_{rot} = \frac{1}{2} J \omega^2$