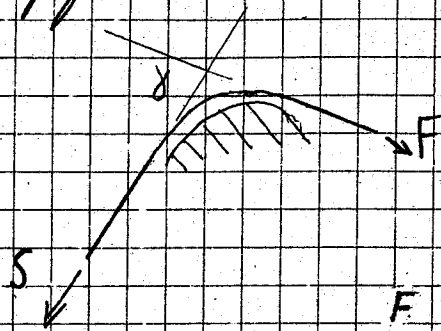


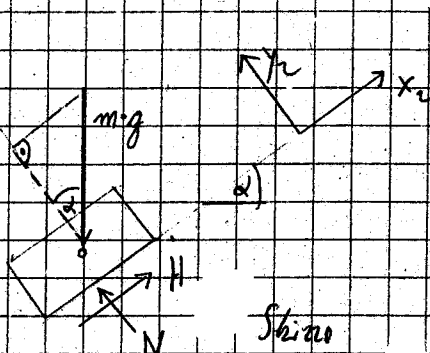
# Aufgabe 4



$$F_{\min} = S e^{-\mu_2 \gamma}$$

$$F_{\max} = S e^{\mu_2 \gamma}$$

a) ohne Seil

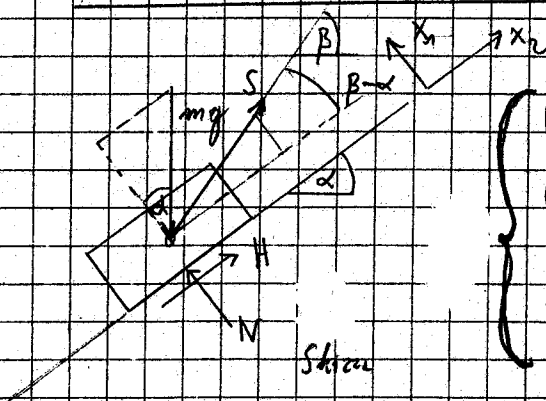


$$\begin{cases} \sum F_{x_1} = 0 = H - mg \sin \alpha & (G1) \\ \sum F_{x_2} = 0 = N - mg \cos \alpha & (G2) \\ H = N \mu_1 & (G3) \end{cases}$$

(G3), (G2) in (G1):

$$\mu_1 = \tan \alpha \quad \text{bzw.} \quad \alpha = \arctan \mu_1$$

b)  $F_{\min}$  (verhindert das Abrutschen)



$$\begin{cases} (G4) \sum F_{x_1} = 0 = S \cos(\beta - \alpha) + H - mg \sin \alpha \\ (G5) \sum F_{x_2} = 0 \\ \quad \quad \quad = N - mg \cos \alpha + S \sin(\beta - \alpha) \\ (G6) H = N \mu_1 \end{cases}$$

(G5) in (G6) in (G4):

$$0 = S \cos(\beta - \alpha) + \mu_1 (mg \cos \alpha - S \sin(\beta - \alpha)) - mg \sin \alpha$$

$$S = \frac{mg (\mu_1 \cos \alpha - \sin \alpha)}{\mu_1 \sin(\beta - \alpha) - \cos(\beta - \alpha)}$$

$$F_{\min} = \frac{\mu_1 \cos \alpha - \sin \alpha}{\mu_1 \sin(\beta - \alpha) - \cos(\beta - \alpha)} mg e^{-\mu_2 \gamma}$$

$F_{max}$  (bewegt den Klotz nach oben)

Frischmitt analog,  $H$  zeigt aber in die andere Richtung.

$$(G7) \sum F_x = 0 = S \cos(\beta - \alpha) - H - mg \sin \alpha$$

(G5) in (G6) in (G7):

$$0 = S \cos(\beta - \alpha) - \mu_n (mg \cos \alpha - S \sin(\beta - \alpha)) - mg \sin \alpha$$

$$S = \frac{\mu_n \cos \alpha + \sin \alpha}{\mu_n \sin(\beta - \alpha) + \cos(\beta - \alpha)} mg$$

$$F_{max} = \frac{\mu_n \cos \alpha + \sin \alpha}{\mu_n \sin(\beta - \alpha) + \cos(\beta - \alpha)} mg \cdot \mu_2$$

$$\underline{\underline{\sum = 10}}$$