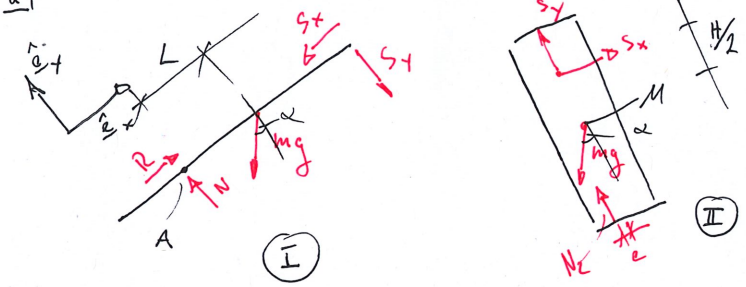
a)



① $_1^{MR}$ ① $_2^{MR}$ ① $_3^{MR}$ ① $_4^{MR}$ pro Fehler −1 Pkt.

b)

(*)

① $_5^{AR}$ ① $_6^{AR\ u.\ Zeichnung}$

$\sum \overline{F}_{i,x} \stackrel{!}{=} 0$: $R - S_x - mg\sin\alpha = 0$ (1)

$\sum \overline{F}_{i,y} \stackrel{!}{=} 0$: $N - S_y - mg\cos\alpha = 0$ (2)

$\sum M_{i,j} \stackrel{!}{=} 0$: $j = A$: $\frac{L}{2} mg\cos\alpha + S_y 2L = 0$ (3)

① $_7^{AR}$ ① $_8^{AR\ u.\ Zeichnung}$

$S_x - mg\sin\alpha = 0$ (4)

$N_2 + S_y - mg\cos\alpha = 0$ (5)

$j = M$: $\frac{H}{2} S_x + e N_2 = 0$ (6)

-1 Pkt. pro Fehler max 2 Pkt. pro Körper

c)

(3): $S_y = -\frac{mg}{4}\cos\alpha$ ✓ ① $_{11}^{AR\ u.\ Z.}$

(4): $S_x = mg\sin\alpha$ ✓ ① $_{12}^{AR\ u.\ Z.}$

(1): $R = S_x + mg\sin\alpha = 2mg\sin\alpha$ ✓ ① $_9^{AR}$

(2): $N = mg\cos\alpha + S_y = \frac{3mg}{4}\cos\alpha$ ✓ ① $_{10}^{AR}$

(5): $N_2 = mg\cos\alpha - S_y = \frac{5mg}{4}\cos\alpha$ ✓ ① $_{13}^{AR\ u.\ Z.}$

(6): $e = -\frac{\frac{H}{2} S_x}{N_2} = -\frac{mg\sin\alpha \frac{H}{2}}{\frac{5mg}{4}\cos\alpha} = -\frac{4}{5}\frac{H}{2}\tan\alpha = -\frac{4}{10} H\tan\alpha$ ✓ ① $_{14}^{AR\ u.\ Z.}$

d)

$|R| \le \mu_{0,1} |N|$ ① $_{15}^{AR}$

$\mu_{0,1} \ge \left|\frac{R}{N}\right| = \left|\frac{2mg\sin\alpha}{\frac{3}{4}mg\cos\alpha}\right| = \frac{8}{3}|\tan\alpha| \rightarrow \alpha \in (0; 90°) \rightarrow \mu_{0,1} \ge \frac{8}{3}\tan\alpha$ ① $_{16}^{AR}$ ✓ ① $_{17}^{AR}$

e)

$e = -\frac{4}{10}\tan\alpha H$ $|e| \le \frac{L}{2}$ ✓ ① $_{18}^{AR}$

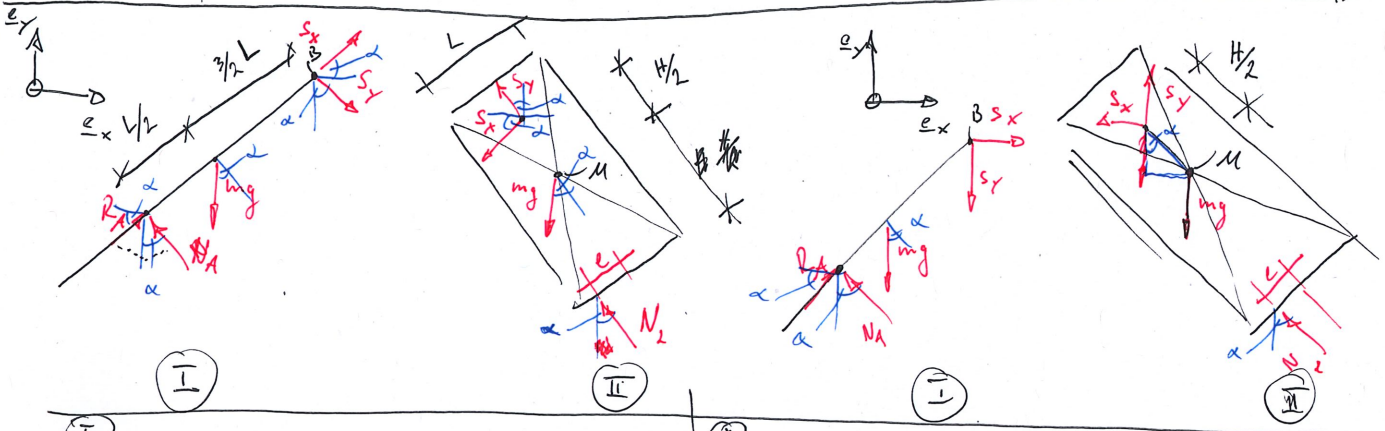
$\frac{4}{10}\tan\alpha H \le \frac{L}{2}$

$\frac{8}{10}\tan\alpha \le \frac{L}{H}$

$\frac{4}{5}\tan\alpha \le \frac{L}{H}$ ✓ ① $_{19}^{AR}$

(*) Berechnung mit anderem Koordinatensystem auf Zusatzblatt.

Klausur III: Reibung



I

$\sum \overline{F}_{i,x} \stackrel{!}{=} 0$: $R_A \cdot \cos\alpha - N_A \sin\alpha + S_x \cos\alpha + S_y \sin\alpha = 0$

$\sum \overline{F}_{i,y} \stackrel{!}{=} 0$: $R_A \sin\alpha + N_A \cos\alpha - S_y \cos\alpha + S_x \sin\alpha - mg = 0$

$\sum M_{ij} \stackrel{!}{=} 0$: $j = A$: $-mg \frac{L}{2} \cos\alpha - 2L\, S_y = 0$

$j = B$: $\cos\alpha \cdot mg \cdot \frac{3}{2} L - N_A \cdot 2L = 0$

II

$\sum \overline{F}_{i,x} \stackrel{!}{=} 0$: $-S_x \cos\alpha - S_y \sin\alpha - N_2 \sin\alpha = 0$

$\sum \overline{F}_{i,y} \stackrel{!}{=} 0$: $S_y \cos\alpha - S_x \sin\alpha - mg + N_2 \cos\alpha = 0$

$\sum M_{ij} \stackrel{!}{=} 0$: $j = M$ $S_x \cdot \frac{H}{2} - N_2 \cdot e = 0$.

$S_x = -mg \sin\alpha$

$S_y = -\frac{mg}{4} \cos\alpha$

I

$S_x + R_A \cos\alpha - N_A \sin\alpha = 0$

$N_A \cos\alpha + R_A \sin\alpha - S_y - mg = 0$

$j = A$: $-mg \frac{L}{2} \cos\alpha - S_y\, 2L \cos\alpha - S_x\, 2L \sin\alpha = 0$

$j = B$: $mg \frac{3}{2} L \cos\alpha - N_A 2L = 0$

II

$-S_x - N_2 \sin\alpha = 0$

$S_y + N_2 \cos\alpha - mg = 0$

$j = M$ $-N_2 \cdot e + S_x \cos\alpha \frac{H}{2} - S_y \sin\alpha \frac{H}{2} = 0$

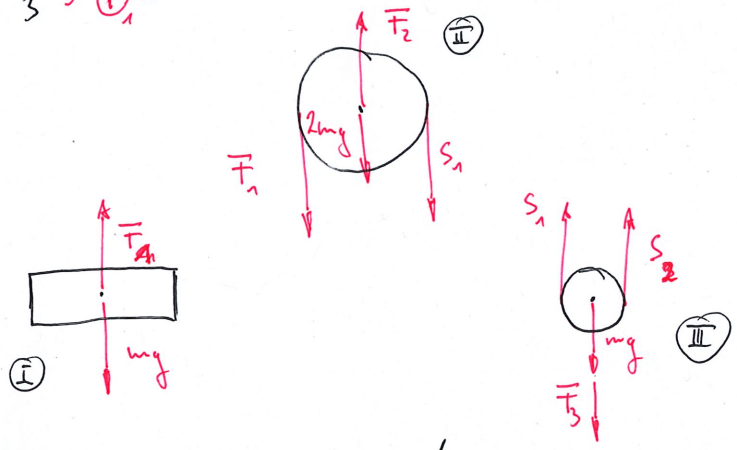
$S_x = -\frac{5}{4} mg \cos\alpha \sin\alpha$

$S_y = mg \left(\sin^2\alpha - \frac{1}{4} \cos^2\alpha \right)$

R_A, N_A und N_2 müssen so eingezeichnet sein, wie oben.
Das heißt, dass die Beträge gleich sind, wie bei einem gedrehten Koordinatensystem

a) 3 ✓ (1)$_1$ AR

b)



(1)$_2$ AR, (1)$_3$ AR, (1)$_4$ AR, (1)$_5$ AR, (1)$_6$ AR, (1)$_7$ AR — pro Fehler −1 Pkt.

c) III $\quad \dot{x}_3 = \dot{\rho}_3 2r \rightarrow \dot{\rho}_3 = \frac{1}{2r}\dot{x}_3$ ✓ (1)$_8$ AR

II $\quad \dot{x}_2 + 3r\dot{\rho}_2 = 4r\dot{\rho}_3$

$\dot{\rho}_2 = \frac{1}{3r}(2\dot{x}_3 - \dot{x}_2)$ (1)$_{10}$ AR ✓ (1)$_9$ AR

d) $\overline{F}_3 = -c_3 x_3$ ✓ (1)$_{12}$ AR

$\overline{F}_2 = c_2 x_2$ (1)$_{13}$ AR

$\overline{F}_1 = c_1\left[x_1 - (x_2 - \rho_2 3r)\right] = c_1\left[x_1 - x_2 + 3r\rho_2\right] =$ $\quad 3r\frac{1}{3r}(2x_3 - x_2)$

$= c_1\left[x_1 - 2x_2 + 2x_3\right]$ ✓ (1)$_{14}$ AR ✓ (1)$_{11}$ AR

e) $m\ddot{x}_3 = mg + \overline{F}_3 - S_1 - S_2$ (1) ✓ (1)$_{17}$ AR u. Z.

$m\ddot{x}_1 = mg - \overline{F}_1$ (2) ✓ (1)$_{15}$ AR u. Z.

$2m\ddot{x}_2 = 2mg + \overline{F}_1 + S_1 - \overline{F}_2$ (3) ✓ (1)$_{16}$ AR u. Z.

f) (3) $\quad S_1 = 2m(\ddot{x}_2 - g) + \overline{F}_2 - \overline{F}_1$ (1)$_{18}$ AR u. Z.

(1) $\quad S_2 = m(g - \ddot{x}_3) + \overline{F}_3 - 2m(\ddot{x}_2 - g) - \overline{F}_2 + \overline{F}_1$ (1)$_{19}$ AR u. Z.

ODER: keine Rotationsträgheiten $\rightarrow S_1 = S_2 = \overline{F}_1$