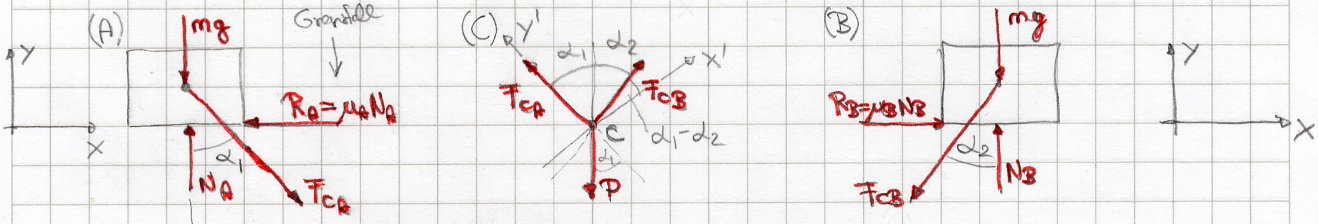
Aufgabe 10:



Gleichgewichte

$\xrightarrow{+}$: $F_{CA} \cdot \sin\alpha_1 - \mu_A N_A = 0$ (1)

$+\uparrow$: $N_A - mg - F_{CA}\cos\alpha_1 = 0$ (2)

x' : $F_{CB}\cos(\alpha_1-\alpha_2) - P\sin\alpha_1 = 0$ (3)

y' : $F_{CA} + F_{CB}\sin(\alpha_1-\alpha_2) - P\cos\alpha_1 = 0$ (4)

$\mu_B N_B - F_{CB}\sin\alpha_2 = 0$ (5)

$N_B - mg - F_{CB}\cos\alpha_2 = 0$ (6)

Idee: Bestimme F_{CA} & F_{CB} als Funktion von P und daraus dann welcher Block zuerst gleitet.

aus (3): $$F_{CB} = P\frac{\sin\alpha_1}{\cos(\alpha_1-\alpha_2)} = P\frac{2\cancel{\sqrt{2}}}{\cancel{\sqrt{2}}(\sqrt{3}+1)} = \frac{2}{\sqrt{3}+1}P$$

$\sin\alpha_1 = \sin 45° = \frac{1}{\sqrt{2}} = \cos 45°$

$\cos(\alpha_1-\alpha_2) = \cos 15° = \frac{\sqrt{3}+1}{2\sqrt{2}}$

$\sin(\alpha_1-\alpha_2) = \frac{\sqrt{3}-1}{2\sqrt{2}}$

in (4): $$F_{CA} + \frac{\sqrt{3}-1}{2\sqrt{2}}\,\frac{2}{\sqrt{3}+1}P - P\frac{1}{\sqrt{2}} = 0$$

$$F_{CA} = P\left[\frac{1}{\sqrt{2}} - \frac{\sqrt{3}-1}{\sqrt{2}(\sqrt{3}+1)}\right] = \frac{P}{\sqrt{2}}\left[\frac{\sqrt{3}+1-\sqrt{3}+1}{\sqrt{3}+1}\right]$$

$$F_{CA} = \frac{2}{\sqrt{6}+\sqrt{2}}P$$

Annahme: Block A beginnt zuerst zu gleiten ($\mu_A < \mu_B$; m gleich)

in (1): $$\frac{2}{\sqrt{6}+\sqrt{2}}P\frac{1}{\sqrt{2}} - \mu_A N_A = 0 \quad (1^*)$$

aus (2): $$N_A = mg + \frac{2}{\sqrt{6}+\sqrt{2}}P\frac{1}{\sqrt{2}}$$

in (1*): $$\frac{2}{\sqrt{12}+2}P - \mu_A mg - \mu_A\frac{2}{\sqrt{12}+2}P = 0$$

$$\frac{2}{\sqrt{12}+2}P(1-\mu_A) = \mu_A mg$$

$$P = \frac{\mu_A(\sqrt{12}+2)}{2(1-\mu_A)}mg = 40.2N$$, dann gilt: $F_{CB} = \frac{2}{\sqrt{3}+1}P = 29.43N$

$N_B = mg + \frac{1}{\sqrt{3}+1}P = 73.57N$

Probe: $R_{B\,max} = \mu_B N_B = 58.86N > P$ ✓

Block B ruht.