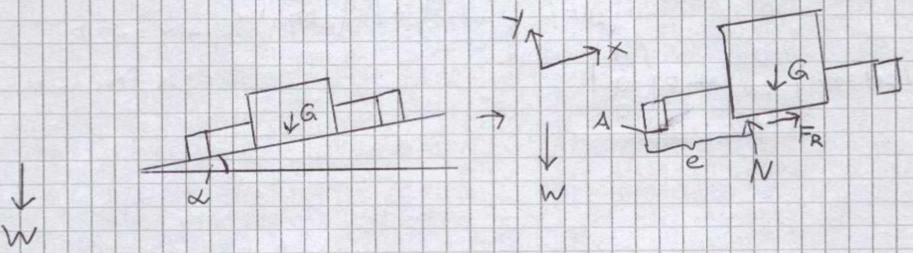
Lösungen (ohne Gewähr)

Mechanik 1 Klausur II 2005/06

1) a)



$\sum F_x = 0;\ F_R - G\sin\alpha - W\sin\alpha = 0 \rightarrow \underline{\underline{F_R = (G+W)\sin\alpha}}$

$\sum F_y = 0;\ N - G\cos\alpha - W\cos\alpha = 0 \rightarrow \underline{\underline{N = (G+W)\cos\alpha}}$

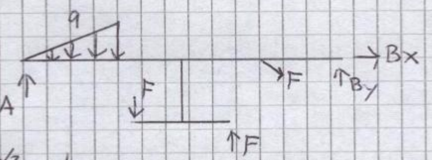
b) Kippen bei $e = 0$

$M_{A_z} = 0;\ N\cdot e - \frac{7}{2}a\cdot G\cdot\cos\alpha + \frac{3}{2}aG\sin\alpha + W\cdot a(4+\cos\alpha) = 0$

$\rightarrow \underline{\underline{W}} \leq \left(\frac{7}{2}G\cos\alpha - \frac{3}{2}G\sin\alpha\right) : (4+\cos\alpha) = \underline{\underline{\frac{G}{2(4+\cos\alpha)}(7\cos\alpha - 3\sin\alpha)}}$

2a) 3 Unbekannte, ebenes Problem → 3 lin. unabh. Gleichungen → $\underline{\underline{\text{statisch bestimmt}}}$

b)



① $\sum F_x = 0;\ B_x + \frac{F}{\sqrt{2}} = 0 \rightarrow \underline{\underline{B_x = -\frac{F}{\sqrt{2}}}}$

② $\sum F_y = 0;\ A + B_y + \cancel{F} - \cancel{F} - \frac{F}{\sqrt{2}} - R = 0$

$R = \frac{27\frac{F}{L}\frac{L/3}{L}\cdot\frac{L}{3}}{2} = \frac{3}{2}F$

③ $M_B = 0;\ \frac{L}{4}\frac{F}{\sqrt{2}} + \frac{L\cdot F}{4} - A\cdot L + R\frac{7}{9}L = 0$

③ $\rightarrow A = \frac{F}{4\sqrt{2}} + \frac{F}{4} + \frac{7}{6}F = \underline{\underline{\left(\frac{\sqrt{2}}{8} + \frac{17}{12}\right)F}}$

② $\rightarrow B_y = R + \frac{F}{\sqrt{2}} - A = \left(\frac{3}{2} + \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{8} - \frac{17}{12}\right)F = \underline{\underline{\left(\frac{3\sqrt{2}}{8} + \frac{1}{12}\right)F}}$

3 a) geg.: $\underline{v}_A = \begin{pmatrix} v \\ 0 \\ -2v \end{pmatrix};\ \underline{v}_B = \begin{pmatrix} v \\ -v \\ -\frac{3}{2}v \end{pmatrix};\ \underline{v}_C = \begin{pmatrix} v \\ 0 \\ -v \end{pmatrix};\ \underline{F}_1 = \begin{pmatrix} F \\ 0 \\ 0 \end{pmatrix};\ \underline{F}_2 = \begin{pmatrix} -F \\ 0 \\ 0 \end{pmatrix};$

$\underline{\omega}$ und $\underline{v}_\omega$ bestimmen mit $\underline{v}_A = \underline{v}_B + \underline{\omega}\times\underline{BA}$ oder v in x-Richtung überall gleich!

$\rightarrow \underline{v}_\omega = \begin{pmatrix} v \\ 0 \\ 0 \end{pmatrix}$; v_{Ay} und v_{Cy} sind 0 → $\underline{\omega}$ liegt in der Ebene $z=0$ mit Richtung $\underline{v}_\omega$

$\rightarrow \underline{\omega} = \begin{pmatrix} v/2R \\ 0 \\ 0 \end{pmatrix} \rightarrow g: \begin{pmatrix} 0 \\ 3R \\ 0 \end{pmatrix} + \lambda\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$

$\underline{F}_3 = \begin{pmatrix} F_{3x} \\ F_{3y} \\ F_{3z} \end{pmatrix}$ mit $\perp$ zu AC $\rightarrow \underline{F}_3 = \begin{pmatrix} F_{3x} \\ 0 \\ F_{3z} \end{pmatrix}$; kein Moment bezüglich Zentralachse

$\rightarrow \underline{F}_3 = \begin{pmatrix} F_{3x} \\ 0 \\ 0 \end{pmatrix}$; Leistung: $P = F_{3x}\cdot v = Fv \rightarrow \underline{\underline{\underline{F}_3 = \begin{pmatrix} F \\ 0 \\ 0 \end{pmatrix}}}$

b) $\underline{M}_M \cdot \underline{R} \overset{!}{=} 0 \rightarrow \begin{pmatrix} 0 \\ 0 \\ 2RF \end{pmatrix} \begin{pmatrix} F \\ 0 \\ 0 \end{pmatrix} = 0$ ✓.

c) $\underline{M}_Z = \underline{0} = \underline{M}_M + \underline{R} \times \underline{MZ} = \begin{pmatrix} 0 \\ 0 \\ 2RF \end{pmatrix} + \begin{pmatrix} F \\ 0 \\ 0 \end{pmatrix} \times \begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} 0 \\ -FZ \\ 2RF + FY \end{pmatrix}$ $\rightarrow Z = 0$

$\rightarrow Y = -2R$

X frei wählbar

$\rightarrow$ Zentralachse: $\underline{\underline{\begin{pmatrix} 0 \\ -2R \\ 0 \end{pmatrix} + t \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}}}$