G2d, 9.5.12: Eta, M, D

(1) $E_{pot} = mgh = 1000kg \cdot 9.81 N/kg \cdot 700m$

$= 6'867'000 J = 6.867 MJ$

$= 1.9075 kWh$

$\eta = \frac{E_{zweite}}{E_{zugef.}} = \frac{E_{Nutz}}{E_{zugef}} = \frac{E_{pot}}{E_{elektrisch}}$

$\frac{6'867'000 J}{7'304'400 J.} = \frac{1.9075 kWh}{2.029 kWh} \approx 0.94012$

$\approx \underline{94.01\%}$

b) $\eta_{tot} = \eta^2 = (0.94012)^2 = 0.8838$

$= \underline{88.38\%}$

c) $\eta_{tot} = 88.38\%$ ausgeschlossen

(2) F pro Feder: $= F_G = mg = 75kg \cdot 9.81 N/kg$

$D = \frac{F}{x} = \frac{75 \cdot 9.81 N}{0.04m} = 18'393.75 N/m$

$75 \cdot 9.81 = 735.75 N$ / $73'575$

$4 \cdot 75 \cdot 9.81 = 2'943 N$

$\approx \underline{18.393 kN/m}$

oder: $F_{tot} = 4 \cdot 75 \cdot 9.81 N$

$D_{tot} = D + D + D + D = 4D = \frac{4 \cdot 75 \cdot 9.81 N}{0.04m}$

$\Rightarrow D = 18.393 kN/m$

(3) $D_{ges} = 12.5\ N/m = \left(\frac{1}{D_1} + \frac{1}{D_2} + \frac{1}{D_3}\right)^{-1}$

~~$D_2 = 5x$ / $D_1 = \#x$~~

$D_1 = 5x$ / $D_2 = x$ / $D_3 = \frac{5}{2}x$

$$\frac{1}{5x} + \frac{1}{x} + \frac{1}{\frac{5}{2}x} = \frac{1}{12.5} \quad / \cdot 10x$$

$$2 + 10 + 4 = \frac{10}{12.5}x \quad / \cdot 12.5$$

$$16 \cdot 12.5 = 10x$$

$$200 = 10x$$

$$20 = x = D_2$$

$$D_1 = 100,\ D_3 = 50$$

$D_1 = 100\ N/m$ / $D_2 = 20\ N/m$ / $D_3 = 50\ N/m$

(4) 1:4 unterteilen:

5 Teile à $\frac{180\,cm}{5} = 36\,cm$

36cm / 144cm

OR:

$$F \cdot x = 4F \cdot (1.8 - x) \quad / : F$$

$$x = 4(1.8 - x)$$

$$x = 7.2 - 4x$$

$$5x = 7.2$$

$$x = 1.44m\ ;\ 1.8 - x = 0.36m$$

(5) "Pfeiler links" als Drehpunkt:

8m vor/nach Pfeiler → KGL, weglassen

↪ 16m → 48m ≙ 32m = $\frac{2}{3}$m

Schwerpunkt 24m von Pfeiler entfernt:

$M_1 = \frac{2}{3} mg \cdot 24m$

Laster:

Schwerpunkt 31m von 1. Pfeiler entfernt:

$M_2 = 40'000\,kg \cdot g \cdot 31m$

$F_{G,\,2.\,Pfeiler} = \frac{M_1 + M_2}{28m}$

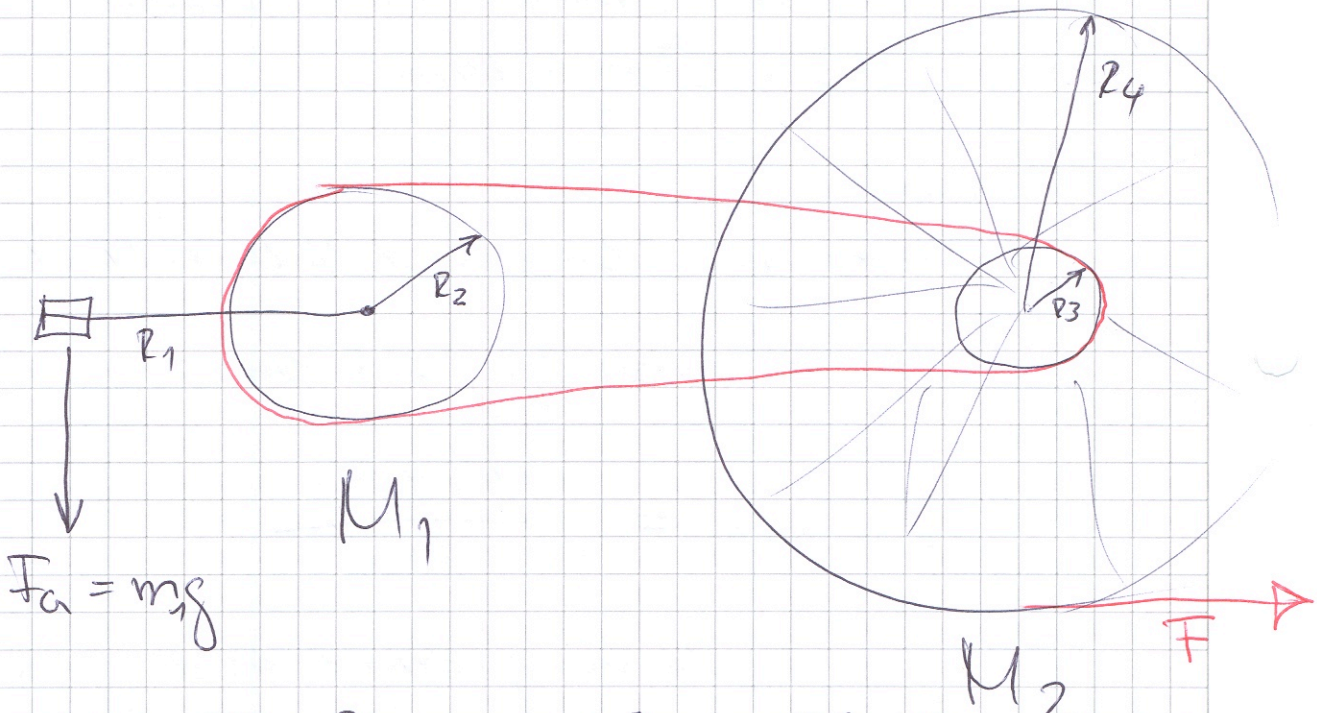
$= \frac{\frac{2}{3} \cdot 36'000 \cdot g \cdot 24m + 40'000\,g \cdot 31m}{28m}$

$= 2'452'500N \triangleq \underline{2.453\,MN}$

(6) $m_1 = 75\,kg$, $m_2 = 10\,kg$

$R_1 = 0.2\,m$ / $R_2 = 0.1\,m$ / $R_3 = 0.05\,m$

$R_4 = 0.35\,m$



$M_1 = F_G \cdot R_1 = m_1 g R_1 = 147.15\,Nm$

$M_1 : M_2 = R_2 : R_3 = 2:1$ $\quad \left(F_{Kette} = \frac{M_1}{R_2} = 1471.5\,N\right)$

$$M_2 = \frac{M_1 R_3}{R_2} = \frac{m_1 g R_1 R_3}{R_2} = 73.575\,Nm$$

$$F = \frac{M_2}{R_4} = \frac{m_1 g R_1 R_3}{R_2 \cdot R_4} = \underline{\underline{210.21\,N}}$$

$$F = F_{Hang} = (m_1 + m_2) g \cdot \sin\alpha$$

$$\arcsin\left(\frac{F}{(m_1+m_2)g}\right) = \alpha = \arcsin\frac{m_1 R_1 R_3}{(m_1+m_2) R_2 R_4}$$

(7) $\frac{1}{x} + \frac{1}{x+15} = \frac{1}{4} \quad / \cdot 4x(x+15)$

$$\frac{4x(x+15)}{x} + \frac{4x(x+15)}{(x+15)} = \frac{4x(x+15)}{4}$$

$$4(x+15) + 4x = x(x+15)$$

$$4x + 60 + 4x = x^2 + 15x$$

$$0 = x^2 + 7x - 60$$

$$0 = (x-5)(x+12)$$

$$x_1 = 5 \quad / \quad x_2 = -12$$

5 N/m / 20 N/m

Test $\frac{1}{5} + \frac{1}{20} = \frac{5}{20} \rightarrow \frac{20}{5} = 4$