II 3.4

a) $$H(p) = \frac{R_3}{R_3 + R_2 + \frac{R_1 \cdot \frac{1}{cp}}{R_1 + \frac{1}{cp}}} = \frac{R_3(1 + pCR_1)}{R_1 + R_2 + R_3 + pCR_1(R_2+R_3)}$$

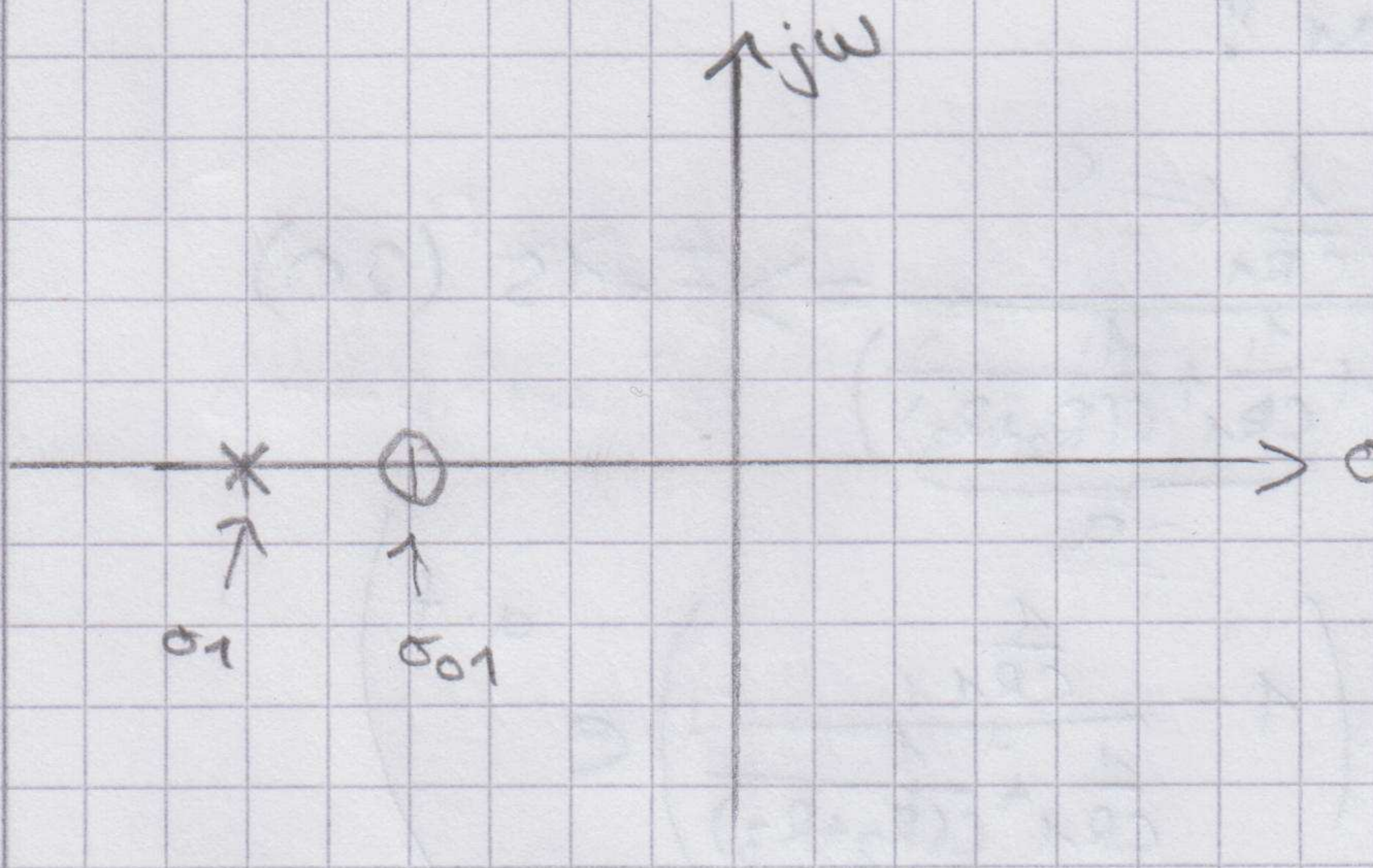
$$= \underbrace{\frac{R_3}{R_2+R_3}}_{K_P} \cdot \frac{p + \frac{1}{CR_1}}{p + \frac{1}{CR_1} + \frac{1}{C(R_2+R_3)}}$$

$$\sigma_{01} = -\frac{1}{CR_1} = \underline{-6289} \quad ; \quad \sigma_1 = -\left(\frac{1}{CR_1} + \frac{1}{C(R_2+R_3)}\right) = \underline{-9434}$$

$$\tau_{01} = -\frac{1}{\sigma_{01}} = \underline{159\mu s} \qquad \tau_1 = -\frac{1}{\sigma_1} = \underline{106\mu s}$$

b) PN-Diagramm

$$\sigma_1 \approx \frac{3}{2} \cdot \sigma_{01}$$



c) $$f_{01} = -\frac{\sigma_{01}}{2\pi} = 1\,KHz \qquad f_1 = -\frac{\sigma_1}{2\pi} = 1{,}5\,KHz$$

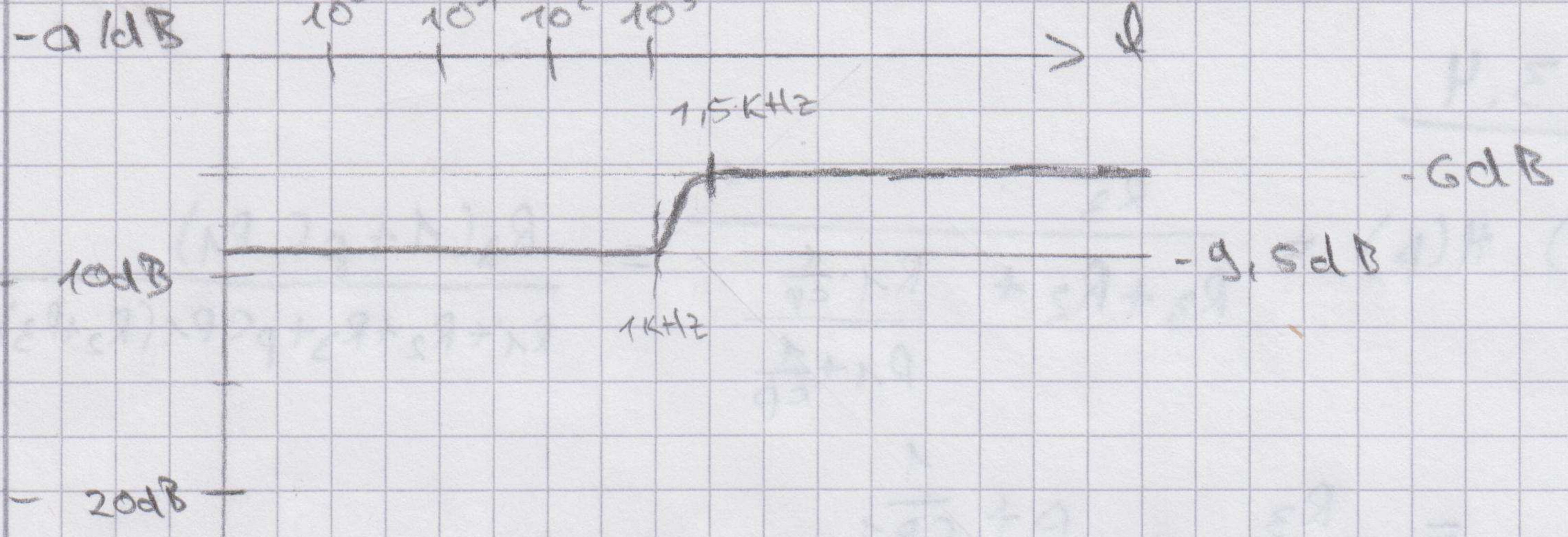
$$H(0) = \frac{1}{3} \rightarrow a = 20 \cdot \log\left(\frac{1}{3}\right) = -9{,}5\,dB$$

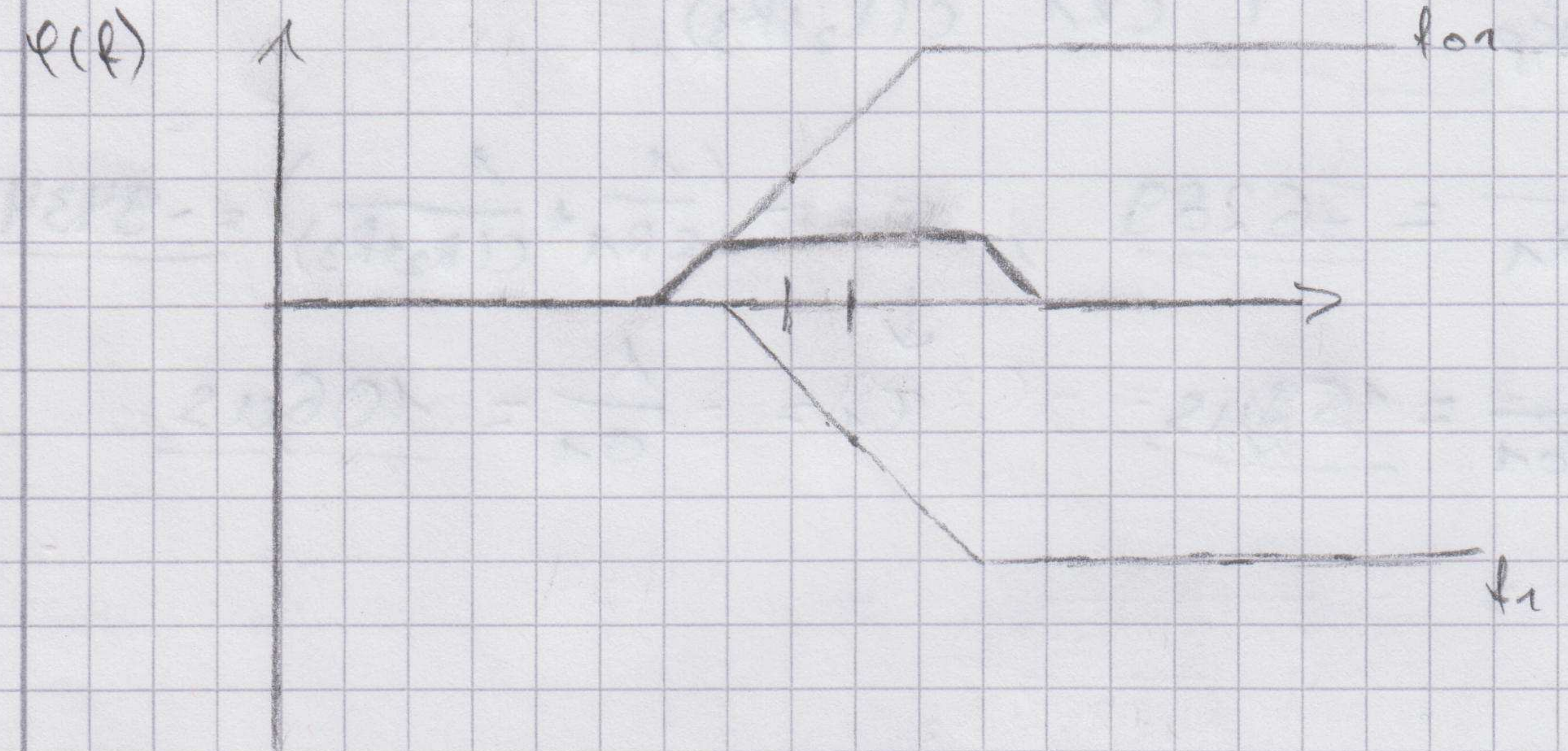
$$H(\infty) = K_p = \frac{1}{2} \rightarrow a = 20 \cdot \log\left(\frac{1}{2}\right) = -6\,dB$$

F-18

f_{01} knickt bei 1KHz nach oben ab

f_1 bei 1,5 KHz nach unten ab





nicht wirklich maßstabsgetreu, Verlauf ist aber erkennbar!

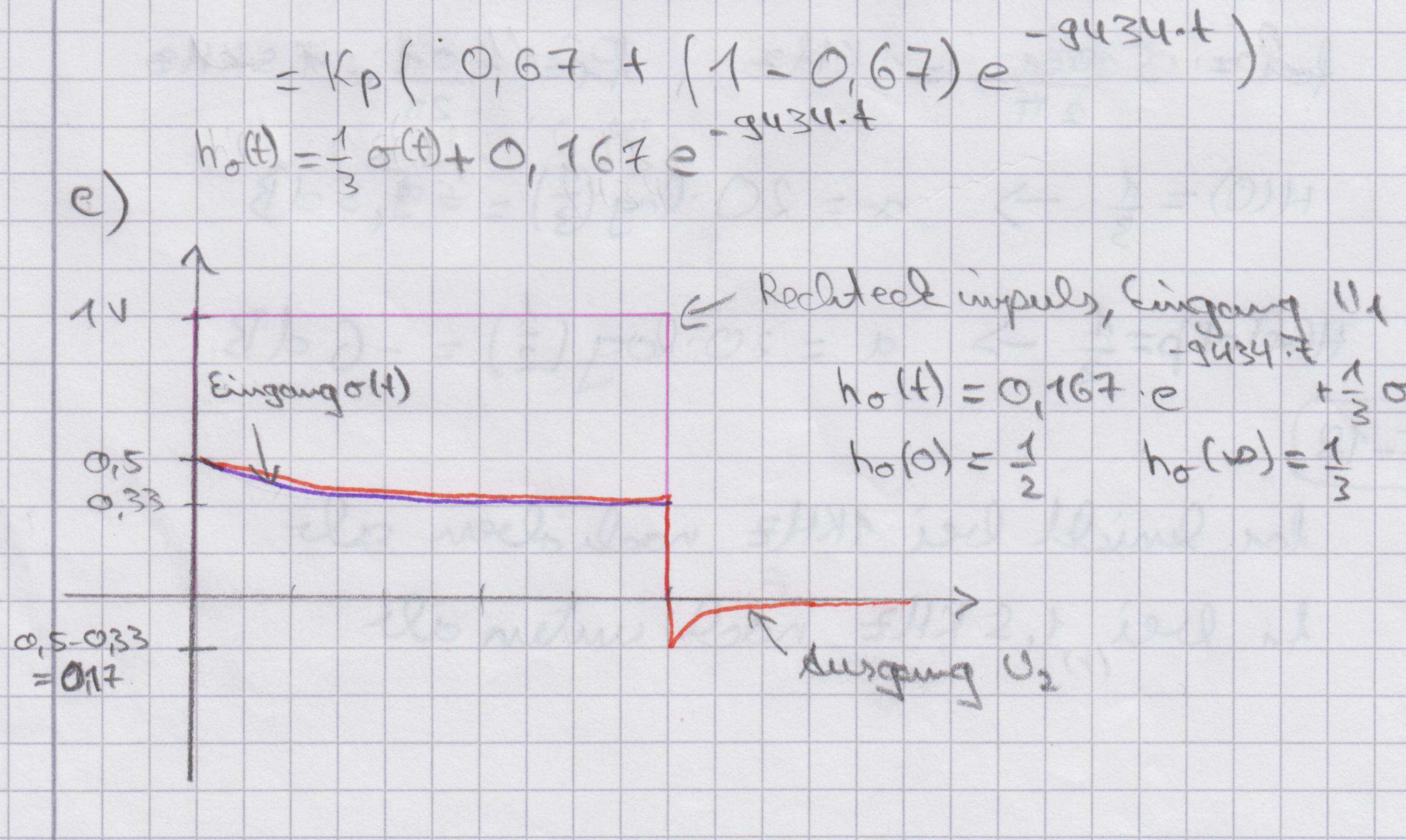
d) $\frac{1}{p}\cdot H(p) = \frac{R_3}{R_3+R_2}\cdot \frac{p+\overbrace{\frac{1}{CR_1}}^{c}}{p\cdot\left(p+\underbrace{\frac{1}{CR_1}+\frac{1}{C(R_2+R_3)}}_{-a}\right)} \Rightarrow$ F-15 (20)

$$h_\sigma(t) = K_p\cdot\left(\frac{\frac{1}{CR_1}}{\frac{1}{CR_1}+\frac{1}{C(R_2+R_3)}} + \left(1-\frac{\frac{1}{CR_1}}{\frac{1}{CR_1}+\frac{1}{C(R_2+R_3)}}\right)e^{a\cdot t}\right)$$

$$= K_p\left(0{,}67 + (1-0{,}67)\,e^{-9434\cdot t}\right)$$

$$h_\sigma(t) = \frac{1}{3}\sigma(t) + 0{,}167\,e^{-9434\cdot t}$$

e)



$h_\sigma(t) = 0{,}167\cdot e^{-9434\cdot t} + \frac{1}{3}\sigma(t)$

$h_\sigma(0) = \frac{1}{2}$ $\quad h_\sigma(\infty) = \frac{1}{3}$