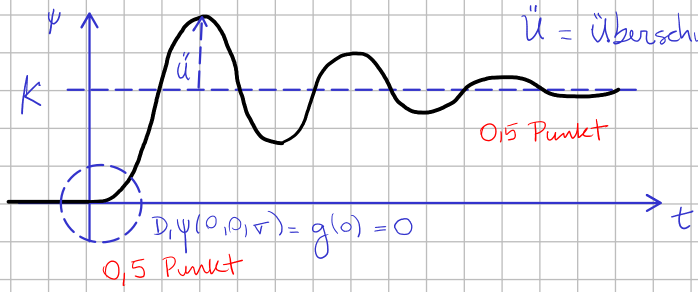
04.03.22, Victor Cheidde Chaim

⇒ $\boxed{\text{Probeklausuraufgaben} \\ \text{WT22-SRT}}$

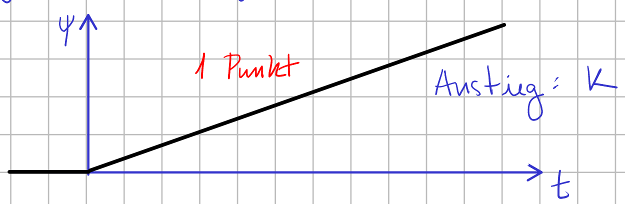
7. Aufgabenblatt

7.3) Sprungantwort: PT_2 System (Periodischer Fall)

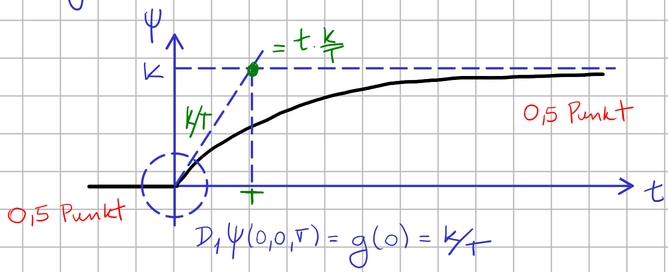
Ü = Überschwingen



7.4) Sprungantwort: Integrier-Glied



7.5) Sprungantwort: PT_1 - System ($T > 0$)



7.6) $H(s) = \dfrac{2}{s^2 + \gamma s + 9}$, Aperiodischer Fall: Pole $\in \mathbb{R}$ und Pole < 0

$s_{1,2} = \dfrac{-\gamma \pm \sqrt{\gamma^2 - 4.1.9}}{2}$, 1. Bedingung: $s_{1,2} \in \mathbb{R} \iff \gamma^2 - 36 \geq 0 \iff \gamma^2 \geq 36$ $\begin{cases} \gamma \geq 6 \\ \gamma \leq -6 \end{cases}$

2. Bedingung: $s_{1,2} < 0 \iff \gamma \geq 6$ // 1 Punkt

7.7) $\begin{cases} \dot{x} = 2x + 3u \\ y = 2x + 3u \end{cases} \Rightarrow A = 2,\ B = 3,\ C = 2,\ D = 3$

i) $\Phi(t) = \exp(At)$, $A = 2$, $\Phi(t) = \sum_{n=0}^{\infty} \frac{(2.t)^n}{n!} = e^{2t}$ // 1 Punkt

ii) $H(s) = C(s\,id - A)^{-1}B + D = 2(s-2)^{-1}.3 + 3 = \dfrac{6}{s-2} + 3 = \dfrac{6 + 3s - 6}{s-2} = \dfrac{3s}{s-2}$ // 1 Punkt

iii) $g(t) = \sigma(t) . C \exp(At) B + \delta(t) D = \sigma(t)\, 2 e^{2t} . 3 + \delta(t) . 3 = \sigma(t) 6 e^{2t} + \delta(t) 3$ 1 Punkt

iv) Anfangswert: $\psi(0,0,\sigma) = H(\infty) . u(0)$, $H(\infty) = \lim_{s\to\infty} \frac{3s}{s-2} \overset{\text{L'Hospital}}{=} \lim_{s\to\infty} \frac{3}{1} = 3$

$\psi(0,0,\sigma) = 3 . 1 = 3$ 0,5 Punkt

Endwert: $s_1 = 2$, das System ist nicht BIBO stabil!

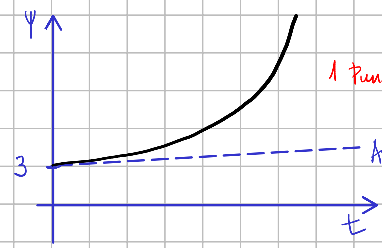
$\psi(\infty,0,\sigma) = H(0) u(\infty) \rightarrow$ kann nicht verwendet werden!

$\psi(\infty,0,\sigma) = (g * \sigma)(\infty) = \lim_{t\to\infty} (g*\sigma)(t)$

$$(g*\sigma)(t) = \int_{-\infty}^{\infty} \left(\sigma(\tau) 6 e^{2\tau} . \sigma(t-\tau) + \delta(\tau) 3 \sigma(t-\tau)\right) d\tau = \sigma(t) . 6 . \int_0^t e^{2\tau} d\tau + 3\sigma(t) \underbrace{\int_{-\infty}^{t} \delta(\tau) d\tau}_{=1} = \sigma(t) 3 \left(e^{2\tau}\Big|_0^t + 1\right) = 3\sigma(t) e^{2t}$$

$\psi(\infty,0,\sigma) = \lim_{t\to\infty} 3\sigma(t) e^{2t} \rightarrow \infty$ kein stationärer Endwert. 0,5 Punkt

Sprungantwort: 1 Punkt



Anstieg $(t=0) \rightarrow 6$

$D_1 \psi(0,0,\sigma) = 6 . e^{2.0} = 6$