S 74 Nr. 7 f.)

$f_a(x) = -ax - e^{-ax} + a$

$f_a'(x) = -a - e^{-ax} \cdot (-a) = a \cdot e^{-ax} - a = a(e^{-ax} - 1) = 0$
notw. Bed Extrema

für $a \neq 0$ muss $e^{-ax} - 1 = 0$ sein $\Rightarrow e^{-ax} = 1 \Rightarrow \underline{\underline{x_E = 0}}$

$f_a''(x) = a \cdot e^{-ax} \cdot (-a) = \underbrace{-a^2}_{<0} \cdot \underbrace{e^{-ax}}_{>0} < 0$ für alle $x \in D_f$

$\Rightarrow H(0 \mid \underbrace{-1+a}_{=0}) \Rightarrow \underline{\underline{a = 1}}$ für $a = 0$ ist $f_0(x) = -1$ konst.

S 74 Nr. 8 $f_k(x) = x \cdot e^{-kx}$; $k > 0$

$f_k'(x) = 1 \cdot e^{-kx} + x \cdot e^{-k \cdot x} \cdot (-k) = e^{-kx}(1 - kx)$

notw. Bed. Extrema $f_k'(x) = 0 = \underbrace{e^{-kx}}_{\neq 0} \underbrace{(1 - kx)}_{=0} \Rightarrow \underline{\underline{x_E = \frac{1}{k}}}$

$f_k''(x) = e^{-kx} \cdot (-k) \cdot (1 - kx) + e^{-kx} \cdot (-k)$

$f_k''(x) = (-k + k^2 x) \cdot e^{-kx} - k \cdot e^{-kx} = e^{-kx}(-k + k^2 x - k)$

$f_k''(x) = e^{-kx} \cdot (-2k + k^2 x)$ Hinreichende Bed $f_k''\left(\frac{1}{k}\right) = ?$

$f_k''\left(\frac{1}{k}\right) = e^{-k \cdot \frac{1}{k}}\left(-2k + k^2 \cdot \frac{1}{k}\right) = e^{-1} \cdot (-2k + k) = e^{-1} \cdot (-k) < 0$

$H\left(\frac{1}{k} \middle| \frac{1}{k} \cdot e^{-k \cdot \frac{1}{k}}\right) = \left(\frac{1}{k} \middle| \frac{e^{-1}}{k}\right) = \left(\frac{1}{k} \middle| \frac{1}{ek}\right)$

Wendepunkt: notw. Bed $f_k''(x) = 0 = \underbrace{e^{-kx}}_{\neq 0} \cdot (-2k + k^2 \cdot x) = 0$

$-2k + k^2 x = 0 \Rightarrow \underline{\underline{x_W = \frac{2k}{k^2} = \frac{2}{k}}}$

hinr. Bed: $f_k'''(x) = e^{-kx} \cdot (-k) \cdot (-2k + k^2 \cdot x) + e^{-kx} \cdot k^2$

$f_k'''(x) = e^{-kx}(2k^2 - k^3 x + k^2) = e^{-kx} \cdot (3k^2 - k^3 x)$

$f_k'''\left(\frac{2}{k}\right) = e^{-k \cdot \frac{2}{k}} \cdot \left(3k^2 - k^3 \cdot \frac{2}{k}\right) = e^{-2} \cdot (k^2) > 0 \Rightarrow W\left(\frac{2}{k} \middle| f_k\left(\frac{2}{k}\right)\right)$

$W\left(\frac{2}{k} \middle| \frac{2}{k} \cdot e^{-k \cdot \frac{2}{k}}\right) = \left(\frac{2}{k} \middle| \frac{2}{k} \cdot e^{-2}\right) = \left(\frac{2}{k} \middle| \frac{2}{k \cdot e^2}\right)$