A 1

$f_t(x) = 4x \cdot e^{-tx} \qquad x \in \mathbb{R}\ ;\ t \in \mathbb{R}\setminus\{0\}$

$f'_t(x) = 4 \cdot e^{-tx} - 4x \cdot t e^{-tx} = 4e^{-tx}(1-tx)$

$f''_t(x) = -4te^{-tx}(+1-tx) - t \cdot 4e^{-tx} = -4te^{-tx}(2-tx)$

$f'''_t(x) = 4t^2e^{-tx}(2-tx) - t(-4te^{-tx}) = 4t^2e^{-tx}(3-tx)$

a) i) Nullstellen: $4x \cdot e^{-tx} = 0 \qquad N(0|0)$

ii) Extrema: notw. Bed. $4e^{-tx}(1-tx) = 0 \Rightarrow x = \frac{1}{t}$

hinr. Bed. $-4te^{-t \cdot \frac{1}{t}}(2 - t \cdot \frac{1}{t}) = -\frac{4t}{e}$

1. Fall: $t < 0 \qquad f''(\frac{1}{t}) > 0 \qquad TP(\frac{1}{t} | \frac{4}{te})$

2. Fall $t > 0 \qquad f''(\frac{1}{t}) < 0 \qquad HP(\frac{1}{t} | \frac{4}{t \cdot e})$

iii) Wendepunkte: notw. Bed: $-4t \cdot e^{-tx}(2-tx) = 0 \Rightarrow x = \frac{2}{t}$

hinr. Bed: $f'''_t(\frac{2}{t}) \neq 0$

$f'''_t(\frac{2}{t}) = \frac{4t^2}{e^2} \neq 0$

$WP(\frac{2}{t} | \frac{8}{e^2 t})$

iv) Schaubild: $f_{\frac{1}{2}}(x) = 4x \cdot e^{-\frac{x}{2}}$