## Lösung A1

a) $f'(x) = \frac{6x}{2+3x^2}$ $\quad f''(x) = \frac{6(3x^2-2)}{(2+3x^2)^2}$

b) $f'(x) = \frac{4x+1}{2x^2+x}$ $\quad f''(x) = -\frac{8x^2+4x+1}{x^2(2x+1)^2}$

c) $f'(x) = 2ln(4+x) + \frac{2x}{4+x}$ $\quad f''(x) = \frac{2(8+x)}{(4+x)^2}$

d) $f_t'(x) = \frac{2x}{x^2+t}$ $\quad f_t''(x) = -\frac{2(x^2-t)}{(x^2+t)^2}$

e) $f'(x) = \frac{3}{(3x+1)\cdot ln\,(3x+1)}$ $\quad f''^{(x)} = -\frac{9(ln(3x+1)+1)}{(3x+1)^2\,ln^2(3x+1)}$

## Lösung A2

a) $f'(x) = e^x \cdot cos(e^x+1)$
$f''(x) = -e^x(e^x \sin(e^x+1) - \cos(e^x+1))$

b) $f'(x) = e^x \cdot (sin(x) + cos(x))$ $\quad f''(x) = 2e^x \cdot cos\,(x)$

c) $f'(x) = 3e^{3x} \cdot sin(e^{2x}) + 2e^{5x} cos\,(e^{2x})$
$f''(x) = (9e^{3x} - 4e^{7x})\,sin(e^{2x}) + 16e^{5x} cos\,(e^{2x})$

d) $f'(x) = \frac{3e^{3x}}{2\sqrt{e^{3x}+1}}$ $\quad f''(x) = \frac{9e^{6x}+18e^{3x}}{4\cdot(e^{3x}+1)\cdot\sqrt{e^{3x}+1}}$

e) $f'(x) = -\frac{2x\cdot e^{-x}}{\sqrt{2x+1}}$ $\quad f''(x) = \frac{(4x^2-2)\cdot e^{-x}}{(2x+1)\cdot\sqrt{2x+1}}$

f) $f'(x) = \frac{cos\,(x)}{sin\,(x)}$ $\quad f''(x) = -\frac{cos^2(x)}{sin^2(x)} - 1$

## Lösung A3

a) $f'(x) = \frac{2x+3cos\,(x)}{x^2+3sin\,(x)}$ $\quad f''(x) = -\frac{(3x^2-6)\,sin(x)+12\,cos(x)+2x^2+9}{(3\,sin(x)+x^2)^2}$

b) $f'(x) = \frac{cos(ln(3x))}{x}$ $\quad f''(x) = -\frac{sin(ln(3x))+cos\,(ln(3x))}{x^2}$

c) $f'(x) = \frac{\sqrt{6}}{2x\cdot\sqrt{ln\,(x)}}$ $\quad f''(x) = \frac{\sqrt{6}\cdot(2\,ln(x)+1)}{4x^2 ln\,(x)\cdot\sqrt{ln\,(x)}}$

d) $f'(x) = \frac{1}{2x}$ $\quad f''(x) = -\frac{1}{2x^2}$

e) $f'(x) = \frac{12x+3}{4x^2+2x}$ $\quad f''(x) = -\frac{3(8x^2+4x+1)}{2x^2(2x+1)^2}$

## Lösung A4

a) $f'(x) = 2x$ $\quad f''(x) = 2$

b) $f'(a) = -2a$ $\quad f''(a) = -2$

c) $f'(y) = 0$ $\quad f''(y) = 0$

d) $f'(x) = -3xe^x \cdot (2xsin(2x) + (-x-2)\,cos(2x))$
$f''(x) = -3e^x(4x(x+2)\,sin(2x) + (3x^2-4x-2)\,cos(2x))$

e) $f(x) = \frac{\sqrt{1-\cos^2(x)}}{\sin\,(x)} = \frac{\sqrt{\sin^2(x)+\cos^2(x)-\cos^2(x)}}{\sin\,(x)} = \frac{\sqrt{\sin^2(x)}}{\sin\,(x)} = 1$
$f'(x) = 0$ $\quad f''(x) = 0$

f) $f'(x) = \frac{1}{cos^2(x)} = tan^2(x) + 1$ $\quad f''(x) = \frac{2\cdot sin(x)}{cos^3(x)} = 2tan\,(x) \cdot \frac{1}{cos^2(x)}$

g) $f'(x) = -e^{-x}(\sin(x) - \cos(x))$ $\quad f''(x) = -2e^{-x} \cdot \cos\,(x)$