## Lösung A1

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

b) $f'(x)=\frac{a(x-1)}{\sqrt{ax^2-2ax}}$ $f''(x)=-\frac{a^2}{(ax^2-2ax)\cdot\sqrt{ax^2-2ax}}$

c) $f'(x)=\frac{2}{\sqrt{x}}+1$ $f''(x)=-\frac{1}{x\sqrt{x}}$

d) $f'(x)=\frac{4(x^2+2)}{\sqrt{x^2+4}}$ $f''(x)=\frac{4x^3+24x}{(x^2+4)\cdot\sqrt{x^2+4}}$

e) $f'(x)=\frac{x(3x^2-8)}{\sqrt{x^2-4}}$ $f''(x)=\frac{6x^4-36x^2+32}{(x^2-4)\cdot\sqrt{x^2-4}}$

f) $f'(x)=\frac{4x}{5\sqrt[5]{(2x^2+5)^4}}$ $f''(x)=-\frac{24x^2-100}{25\cdot(2x^2+5)\cdot\sqrt[5]{(2x^2+5)^4}}$

## Lösung A2

a) $f'(x)=-\frac{3e^x}{(e^x+1)^2}$ $f''(x)=\frac{3e^x\cdot(e^x-1)}{(e^x+1)^3}$

b) $f'(x)=-\frac{e^{3x}\cdot(3x-1)-2}{(2+e^{3x})^2}$ $f''(x)=\frac{3e^{3x}\cdot((3x-2)e^{3x}-4)}{(2+e^{3x})^3}$

c) $f'(x)=\frac{xe^x(2e^x+x+2)}{(e^x+1)^2}$ $f''(x)=\frac{x\left(2e^{2x}+e^x\left(-x^2+4x+4\right)+x^2+4x+2\right)}{(e^x+1)^3}$

d) $f'(x)=\frac{2e^{2x}(e^x-1)}{(2e^x-1)^2}$ $f''(x)=\frac{2e^{2x}(2e^{2x}-3e^x+2)}{(2e^x-1)^3}$

e) $f'(x)=\frac{e^{-x}(e^{2x}-2e^x-1)}{(1+e^x)^2}$ $f''(x)=\frac{e^{-x}(e^{3x}-5e^{2x}-3e^x-1)}{(1+e^x)^3}$

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

## Lösung A3

a) $f'(x)=-\frac{2cos(x)}{\left(1+sin(x)\right)^2}$ $f''(x)=\frac{2(\sin^2(x)+sin(x)+2\cos^2(x))}{\left(1+sin(x)\right)^3}$

b) $f'(x)=\frac{4}{(1+x^2)\cdot\sqrt{1+x^2}}$ $f''(x)=-\frac{12x}{(1+x^2)^2\cdot\sqrt{1+x^2}}$

c) $f'(x)=-\frac{5}{(2x+5)\cdot\sqrt{2x+5}}$ $f''(x)=\frac{15}{(2x+5)^2\cdot\sqrt{2x+5}}$

d) $f'(x)=-\frac{2}{x^2-1}$ $f'(x)=\frac{4x}{(x^2-1)^2}$

e) $f'(x)=\frac{2x(ln(ax)-1)-1}{x(2x+1)^2}$ $f''(x)=\frac{4x(x(2ln(ax)-3)-2)-1}{x^2(2x+1)^3}$

## Lösung A4

a) $f'(x)=2x\cdot(sin(2x)+xcos(2x))$
$f''(x)=(2+4x^2)\cdot sin(2x)+8x\cdot cos(2x)$

b) $f'(x)=\frac{4x(x-3)}{(x-1)^2\cdot(x+3)^2}$ $f''(x)=\frac{4(2x^3-9x^2-9)}{(x-1)^3\cdot(x+3)^3}$

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

d) $f'(x)=e^x\cdot(sin(x)+cos(x))$ $f''(x)=2e^x\cdot cos(x)$

e) $f'(x)=n\cdot a^{nx}\cdot ln(a)$ $f''(x)=n^2\cdot a^{nx}\cdot ln^2(a)$

f) $f'(x)=x^4\cdot(5ln(x)+1)$ $f''(x)=x^3\cdot(20ln(x)+9)$

g) $f'(x)=\frac{1}{(x-1)^2}$ $f''(x)=-\frac{2}{(x-1)^3}$

h) $f'(x)=\frac{x^2(2x-3)}{(x-1)^2}$ $f''(x)=\frac{2x(x^2-3x+3)}{(x-1)^3}$

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