Lösung A1

$f_1(x) = x^3 + x^{-3}$	$f_1{}'(x) = 3x^2 - 3x^{-4}$
$f_2(x) = x^3 + \sqrt[3]{x^2} + \frac{1}{x^3}$	$f_2{}'(x) = 3x^2 + \frac{3}{2}\sqrt{x} - \frac{3}{x^4}$
$f_3(x) = (2x-4)^3$	$f_3{}'(x) = 24x^2 - 96x + 96 = 24(x^2 - 4x + 4)$
$f_4(x) = x^3(1-\sqrt{x})$	$f_4{}'(x) = 3x^2 - \frac{7}{2}x^2 \cdot \sqrt{x} = x^2\left(3 - 3{,}5\sqrt{x}\right)$
$f_5(x) = \frac{\pi}{2}(x^4 - 4x^2 + 5)$	$f_5{}'(x) = \frac{\pi}{2}(4x^3 - 8x) = 2\pi(x^3 - 2x)$
$f_6(x) = \frac{x - 8x^2}{8}$	$f_6{}'(x) = \frac{1}{8} - 2x$
$f_7(x) = \frac{2}{5}x^5 - \frac{2}{3}x^3 + 2x$	$f_7{}'(x) = 2x^4 - 2x^2 + 2$

Lösung A2

a) $f(x) = 3x^2 + \frac{1}{x} \longrightarrow f'(x) = 6x - \frac{1}{x^2} \longrightarrow f''(x) = 6 + \frac{2}{x^3} \longrightarrow f'''(x) = -\frac{6}{x^4}$

b) $f(x) = \sqrt[3]{x} - \frac{3}{x} \longrightarrow f'(x) = \frac{1}{3\sqrt[3]{x^2}} + \frac{3}{x^2} \longrightarrow f''(x) = -\frac{2}{9x\sqrt[3]{x^2}} - \frac{6}{x^3} \longrightarrow f'''(x) = \frac{10}{27x^2\sqrt[3]{x^2}} + \frac{18}{x^4}$

c) $f(x) = (x+2)^2 + (x-4)^2 \longrightarrow f'^{(x)} = 4x - 4 \longrightarrow f''(x) = 4 \longrightarrow f'''(x) = 0$

d) $f(x) = 4x^{\frac{1}{4}} + 2x \longrightarrow f'(x) = x^{-\frac{3}{4}} + 2 \longrightarrow f''(x) = -\frac{3}{4}x^{-\frac{7}{4}} \longrightarrow f'''(x) = \frac{21}{16}x^{-\frac{11}{4}}$

Lösung A3

$f_1(x) = (x-2)(x-1)(x+1)(x+2) = (x^2-4)(x^2-1) = x^4 - 5x^2 + 4$
$f_1{}'(x) = 4x^3 - 10x$

$f_2(x) = x^2(1-2x)(4-x) = x^2(4 - 9x + 2x^2) = 2x^4 - 9x^3 + 4$
$f_2{}'(x) = 8x^3 - 27x^2$

$f_3(x) = \left(\sqrt{x} - 1\right)^2\left(\sqrt{x} + 1\right)^2 = (x-1)^2 = x^2 - 2x + 1$
$f_3{}'(x) = 2x - 2$

$f_4(x) = (2 - x^2)^3 = 6 - 12x^2 + 6x^4 - x^6$
$f_4{}'(x) = -6x^5 + 24x^3 - 24x = -6x(x^4 - 3x^2 + 3)$

$f_5(x) = \sqrt{x} \cdot (1-x)^2 = \sqrt{x} - 2x \cdot \sqrt{x} + x^2 \cdot \sqrt{x}$
$f_5{}'(x) = \frac{1}{2\sqrt{x}} - 3\sqrt{x} + \frac{5}{2}x \cdot \sqrt{x}$

$f_6(x) = \left(\frac{1}{x} + \frac{1}{x^2}\right) \cdot (3 + x^2 - x^3) = \frac{3}{x} + x - x^2 + \frac{3}{x^2} + 1 - x = \frac{3}{x^2} + \frac{3}{x} - x^2 + 1$
$f_6{}'(x) = -\frac{6}{x^3} - \frac{3}{x^2} - 2x$

$f_7(x) = x^{-\frac{1}{2}} \cdot (2 + \frac{1}{x} - \frac{1}{x^2}) = 2x^{-\frac{1}{2}} + x^{-\frac{3}{2}} - x^{-\frac{4}{2}}$
$f_7{}'(x) = -x^{-\frac{3}{2}} - \frac{3}{2}x^{-\frac{5}{2}} + \frac{4}{2}x^{-3}$