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Nr. 4) a) $f(x) = 6x^5 + 10x^4 - 20x^3$

$f'(x) = 30x^4 + 40x^3 - 60x^2$

not. Bed. $f''(x) = 120x^3 + 120x^2 - 120x = 120 \cdot x(x^2 + x - 1) = 0$

$\Rightarrow \underline{x_1 = 0} \vee x_{2,3} = \frac{-1 \pm \sqrt{1^2 - 4 \cdot 1(-1)}}{2 \cdot 1}$; $x_2 = \underline{\frac{-1-\sqrt{5}}{2}}$

$x_3 = \underline{\frac{-1+\sqrt{5}}{2}}$ Auf hinr. Bed verzichtet

b) $f(x) = x^4 \cdot e^x$; $f'(x) = 4x^3 \cdot e^x + x^4 \cdot e^x = e^x \cdot (4x^3 + x^4)$

$f''(x) = e^x \cdot (4x^3 + x^4) + e^x \cdot (12x^2 + 4x^3) = \underbrace{e^x}_{\neq 0} \cdot (x^4 + 4x^3 + 12x^2 + 4x^3)$

$x^2(x^2 + 8x + 12) = 0 \Rightarrow \underline{x_1 = 0} \vee x_{2,3} = \frac{-8 \pm \sqrt{64 - 4 \cdot 1 \cdot 12}}{2}$

$\underline{x_2 = \frac{-8-4}{2} = -6} \vee \underline{x_3 = \frac{-8+4}{2} = -2}$ Auf hinr. Bed verzichtet

c) $f(x) = (x^2 - 2) \cdot e^x$; $f'(x) = 2x \cdot e^x + (x^2 - 2) \cdot e^x$

$f'(x) = e^x \cdot (x^2 + 2x - 2)$; $f''(x) = e^x \cdot (x^2 + 2x - 2) + e^x(2x + 2)$

$f''(x) = e^x(x^2 + 4x) = \underbrace{e^x}_{\neq 0} \cdot x(x+4) = 0 \Rightarrow \underline{x_1 = 0} \vee \underline{x_2 = -4}$

d) $f(x) = e^{8x} - 32x^2$; $f'(x) = e^{8x} \cdot 8 - 64x = 8 \cdot e^{x \cdot 8} - 64x$

$f''(x) = 64 \cdot e^{8x} - 64 = 0 \Rightarrow e^{8x} = 1 \mid \ln \Rightarrow 8x = \ln(1) = 0 \Rightarrow \underline{x_1 = 0}$

e) $f(x) = e^{2x} - e^x - 10x$; $f'(x) = 2 \cdot e^{2x} - e^x - 10$

$f''(x) = 4 \cdot e^{2x} - e^x = 0 \Rightarrow e^x \cdot (4 \cdot e^x - 1) = 0 \Rightarrow 4 \cdot e^x = 1 \mid :4$

$e^x = \frac{1}{4} \mid \ln \Rightarrow \underline{x_1 = \ln(\frac{1}{4})} = \ln(1) - \ln(4) = \underline{-\ln(4)}$

f) $f(x) = e^{2x} + 4x^2 - 12e^x$; $f'(x) = 2 \cdot e^{2x} + 8x - 12 \cdot e^x$

$f''(x) = 4 \cdot e^{2x} + 8 - 12e^x = 0 \mid$ Sub: $u = e^x$

$4u^2 - 12u + 8 = 0 \Rightarrow u_{1,2} = \frac{12 \pm \sqrt{144 - 4 \cdot 4 \cdot 8}}{2 \cdot 4} = \frac{12 \pm 4}{8}$

$u_1 = 2 \vee u_2 = 1$

Rück. Sub

$e^x = 2 \Rightarrow \underline{x_1 = \ln(2)} \vee e^x = 1 \Rightarrow \underline{x_2 = \ln(1) = 0}$

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