

Exam: Calculus 1

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Prof. Dr. Robert Heß, 20.1.2014, duration: 90 min.

Result: of 100 points Mark: points.

Problem 1 (18 points)

Evaluate and plot the region of convergence of the power series: $f(z) = \sum_{k=0}^{\infty} \frac{(z - 2j)^k}{5}$, $z \in \mathbb{C}$

Problem 2 (16 points)

Resolve, i.e. differentiate the following expressions:

a) $\frac{d}{dx} \sin(xy + z)$ b) $\frac{d}{dt} e^{j(\omega t + \varphi_0) - \delta t}$ c) $\frac{d}{dx} \frac{x^3 - 2x + 5}{x^2 + 2x - 1}$ d) $\frac{d^n}{dy^n} \exp(xy - z)$

Problem 3 (15 points)

Find all solutions for $z \in \mathbb{C}$ with $z^3 = -8$.

Problem 4 (15 points)

For the kinetic energy $E_{\text{kin}} = \frac{1}{2}mv^2$ the mass m was measured with an accuracy of 0.5% and the velocity v with an accuracy of 1.5%. Evaluate the uncertainty of the kinetic energy.

Problem 5 (18 points)

Apply partial fraction decomposition on $f(x) = \frac{x^3 + 6x^2 + 9x - 7}{x^3 + 3x^2 - 4}$.

Problem 6 (18 points)

Analyse the function $f(x) = \frac{x^4}{4} + \frac{2x^3}{3} - 2x^2 - 8x + 1$ with respect to extrema.