

Exam: Calculus 1

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Prof. Dr. Robert Heß, 2.7.2014, duration: 90 Min.

Result: of 100 points Mark: points.

Problem 1 (15 points)

Resolve/simplify the following complex expressions:

$$a = \operatorname{Im}(e^{-j\pi/2}) \qquad b = \arg(j - 1) \qquad c = |z^2| - z \cdot \bar{z}, \quad z \in \mathbb{C}$$

Problem 2 (15 points)

Check for convergence: $f : \mathbb{C} \rightarrow \mathbb{C}, z \mapsto \sum_{k=0}^{\infty} \frac{3^k (z + j)^k}{k!}$

Problem 3 (15 points)

Resolve, i.e. differentiate the following expressions:

$$a = \frac{d}{dy} e^{xy} \sin(2z) \qquad b = \frac{d}{dx} \frac{x^2 - 1}{e^{2x}} \qquad c = \frac{d^n}{dx^n} \hat{u} e^{j\omega x}$$

Problem 4 (25 points)

Perform partial fraction decomposition on: $f(x) = \frac{5x^3}{x^3 + x^2 - 2}$

Problem 5 (20 points)

Analyse the function $f(x) = x^4 - 24x^2 + 12x - 6$ with respect to inflection and saddle points.

Problem 6 (10 points)

You want to evaluate the power P absorbed in a resistor by measuring its resistance R with an accuracy of 2% and the applied voltage U with an accuracy of 0.5%. For the absorbed power given by $P = U^2/R$ what accuracy do you expect?