

Exam: Calculus I

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 Prof. Robert Heß, July 11th 2012, duration: 90 Min.

Result: of 68 points Mark: points.

Question 1 (8 points)

Resolve the following expressions, i.e. bring it into the form $a + jb$ where $a, b \in \mathbb{R}$:

$$1. \quad j^{-6} \qquad 2. \quad \operatorname{Im}(2 - j) \qquad 3. \quad \frac{1 + j}{1 - j} \qquad 4. \quad \left| \sqrt[3]{2 + 2j} \right|^2$$

Question 2 (10 points)

Find the radius of convergence and plot the region of convergence on the complex plane for:

$$f(z) = \sum_{k=0}^{\infty} \frac{(z - 1)^k}{4^k}, \quad z \in \mathbb{C}$$

Question 3 (8 points)

Resolve, i.e. differentiate the following expressions:

$$1. \quad \frac{d}{dt} \hat{u} e^{2\pi j f t} \qquad 2. \quad \frac{d}{dx} x^2 \cos(x/2) \qquad 3. \quad \frac{d}{dy} x^2 \sqrt{y} z \qquad 4. \quad \frac{d^3}{dx^3} \hat{s} \sin(j\omega x)$$

Question 4 (20 points)

Separate the following expression into partial fractions: $f(x) = \frac{x^4 + 2x^3 + 5x + 1}{x^3 + 3x^2 - 4}$

Question 5 (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 current I through the resistor with an accuracy of 1%. For the absorbed power given by $P = I^2 R$ what accuracy do you expect?

Question 6 (12 points)

Analyse the function $f(x) = x^3 - 3x^2 - 9x + 11$ with respect to extrema.