Surname: .... Forename: .... MatrNo.: ....

Exam: Calculus 1

Hamburg University of Applied Science
Faculty of Engineering & Computer Science, Department of Information and Electrical Engineering
Prof. Dr. Robert Heß, July 12th 2013, duration: 90 Min.

Result: .... of 100 points Mark: .... points.

Problem 1 (16 points)

Resolve or simplify the following complex expressions:

1. j^{-7} 2. $\dfrac{1-\mathrm{j}}{1+\mathrm{j}}$ 3. $\arg(\mathrm{j}-1)$ 4. $\left|\sqrt[3]{(2+2\mathrm{j})^2}\right|$

Problem 2 (20 points)

Check for convergence and sketch the region of convergence on the complex plane:

$$f(z) = \sum_{k=0}^{\infty} \frac{3^k}{4}(z+1)^k, \quad z \in \mathbb{C}$$

Problem 3 (15 points)

Resolve, i.e. differentiate the following expressions:

1. $\dfrac{\mathrm{d}}{\mathrm{d}x} \ln(2x^2)$ 2. $\dfrac{\mathrm{d}^2}{\mathrm{d}t^2} \hat{u} \sin(\mathrm{j}\omega t + \varphi_0)$ 3. $\dfrac{\mathrm{d}}{\mathrm{d}x} (x^2+1)\arctan(x)$

Problem 4 (20 points)

Apply partial fraction decomposition on: $f(x) = \dfrac{x^4 + x^3 + x^2 - 4x + 7}{x^3 - 3x + 2}$

Problem 5 (20 points)

Analyse the function $f(x) = x^3 + x^2 - 2x$ with respect to inflection and saddle points.

Problem 6 (9 points)

For an extremum the condition $f'(x) = 0$ is	☐ sufficient	☐ necessary
For an extremum the condition $f'(x) = 0 \wedge f''(x) \neq 0$ is	☐ sufficient	☐ necessary
For an inflection point the condition $f''(x) = 0$ is	☐ sufficient	☐ necessary
For a saddle point the condition $f'(x) = 0$ is	☐ sufficient	☐ necessary