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

Exam: Mathematics 1

Hamburg University of Applied Science
Faculty of Engineering & Computer Science, Department of Information and Electrical Engineering
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: $f(z) = \sum_{k=0}^{\infty} \frac{(z-2\mathrm{j})^k}{5}$, $z \in \mathbb{C}$

Problem 2 (16 points)

Resolve, i.e. differentiate the following expressions:

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

Problem 3 (15 points)

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

Problem 4 (15 points)

For the kinetic energy $E_{\mathrm{kin}} = \frac{1}{2}mv^2$ 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)

$x+2y+z=1$ $x+y+z=1$ $3x+2y+2z=2$ $2x+2y+z=1$

For the given system of linear equations evaluate the ranks of coefficient matrix and extended coefficient matrix and draw your conclusion on the solution behaviour.

Problem 6 (18 points)

For $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 0 & -2 \\ 2 & 2 & 1 \end{pmatrix}$ find A^{-1} and $\det(A)$.

What is the volume of a parallelepiped spanned by the three column vectors of A?