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, 3.7.2017, duration: 90 Min.
Permitted aids: up to six A4-pages of personal notes (i.e. single sided sheets)

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

Problem 1 (10 points)

Describe the terms a) *injectivity*, b) *surjectivity* and c) *bijectivity*.

Problem 2 (20 points)

Prove by mathematical induction that $n^4 - 4n^2$ has the divisor 3 for all $n \in \mathbb{N}$.

Problem 3 (15 points)

Find all solutions in Cartesian form for $z \in \mathbb{C}$ with $z^2 = -18\mathrm{j}$.

Problem 4 (15 points)

Is the series $\sum_{k=1}^{\infty} \frac{k^{2k}}{3^k}$ convergent? Check by root test.

Problem 5 (15 points)

With $\omega \in \mathbb{R}$ and $n \in \mathbb{N}$ resolve and simplify the following expressions:

$$a = \frac{\mathrm{d}}{\mathrm{d}x} \ln(x^2) \qquad b = \frac{\mathrm{d}^{2n}}{\mathrm{d}x^{2n}} \cosh(\omega x) \qquad c = \frac{\mathrm{d}}{\mathrm{d}x} \frac{\arctan(x)}{x^2+1}$$

Problem 6 (25 points)

Solve the following SLE:

$$\begin{aligned} a + b + c &= 2 \\ a + c - d &= 0 \\ a + b + d &= 4 \\ b + c - d &= -3 \end{aligned}$$