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, 27.1.2015, duration: 90 Min.

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

Problem 1 (15 points)

Prove by mathematical induction: $\sum_{k=0}^{n} q^k = \frac{1-q^{n+1}}{1-q}$ for $q \neq 1$

Problem 2 (15 points)

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

Problem 3 (15 points)

Resolve, i.e. differentiate the following expressions:

$$a = \frac{\mathrm{d}}{\mathrm{d}t}\, e^{-\delta t} \sin(\omega t) \qquad b = \frac{\mathrm{d}}{\mathrm{d}x}\, \tan\left(x^2 - 2x + 5 + \ln(yz)\right) \qquad c = \frac{\mathrm{d}^4}{\mathrm{d}x^4}\, \hat{i}\, \cos(2\pi f x)$$

Problem 4 (15 points)

Evaluate and plot the region of convergence of the power series: $f(z) = \sum_{k=0}^{\infty} \frac{(z-3)^k}{2^k}$, $z \in \mathbb{C}$

Problem 5 (20 points)

Analyse the function $f(x) = x^4 - 6x^2 + 8x + 16$ with respect to extrema.

Problem 6 (20 points)

For $A = \begin{pmatrix} 1 & 1 & 3 & 1 \\ 0 & 1 & 3 & 1 \\ 1 & 1 & 2 & 1 \\ 0 & 3 & 3 & 2 \end{pmatrix}$ find A^{-1} and $\det(A)$.