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

# Exam: Mathematics 2

Hamburg University of Applied Science
Faculty of Engineering & Computer Science, Department of Information and Electrical Engineering
Prof. Dr. Robert Heß, July $16^{\text{th}}$ 2022, 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 (15 points)

Solve the following integral: $\displaystyle\int_{-2}^{4} |x^2 - 2x|\,\mathrm{d}x$

## Problem 2 (10 points)

Evaluate the gradient of the following function:   $f(x, y, z) = \ln(x)\cos(y)e^z$

## Problem 3 (10 points)

Let $y(x)$ be a parabola symmetric around the ordinate with arbitrary width and vertical position. Find the differential equation with $y(x)$ being the solution.

## Problem 4 (25 points)

For the differential equation   $y''' - 2y'' + 5(y' - 2x) = 6$   find the general solution $y(x)$.

## Problem 5 (20 points)

Out of $100\,000$ produced $1\,\text{k}\Omega$ resistors specified with $1\,\%$ tolerance typically 135 turn out to be too large and another $2\,275$ to be too small in resistance. Assuming normal distribution what is expectation $\mu$ and standard deviation $\sigma$ of the resistance?

## Problem 6 (20 points)

For the probability density function   $f(x) = \begin{cases} 6(x - x^2) & \text{for } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$
evaluate expectation, variance and standard deviation.