Exam: Mathematics 2/Calculus 2

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

Problem 1 (10 points)

Solve the following integral: $\int x^2 \cos(x)\, \mathrm{d}x$

Problem 2 (10 points)

Derive the Jacobian matrix J for the function $f : \begin{cases} \mathbb{R}^3 \to \mathbb{R}^2 \\ (x, y, z) \mapsto (y\,e^x, z\sin(x)) \end{cases}$

Problem 3 (25 points)

For the differential equation $\quad y''' = 4\{y' + \sin(2x)\} \quad$ find the general solution $y(x)$.

Problem 4 (15 points)

For $\quad y(x) = a\,x^2 + b\,x + 1 \quad$ with a and b being parameters create the differential equation.

Problem 5 (25 points)

A random variable X has the following probability mass function:

$$f(x) = \begin{cases} (x+1)/2 & \text{for } |x| \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the expectation and variance of X.

Problem 6 (15 points)

Three (independent) resistors in parallel connection are connected to a stable noise free voltage supply of $10\,\mathrm{V}$. The currents through the resistors are 5, 10 and $40\,\mathrm{mA}$ with noise (standard deviation) 20, 30 and $60\,\mathrm{nA}$, respectively. Treating the total current I_{tot} as a random variable, evaluate expectation, variance and standard deviation.