

BRANDENBURGISCHE TECHNISCHE UNIVERSITÄT COTTBUS

Fakultät 1, IAMWR

Lehrstuhl für Ingenieurmathematik

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Written Exam (Repetition)
Mathematics of Engineering II

October 7, 2008

Last name:

First Name:

Matricule No.:

Table with 9 columns: Problem, 1, 2, 3, 4, 5, 6, Σ, Grade. Rows include Possible points and Reached points.

The way by which a solution is found has to be comprehensible.

A pocket calculator is not needed and not accepted (you should give the value of e.g. sin(0), but do not need to compute e.g. e^3 etc.).

Please note: Your final exam will not be corrected in case you have already written the final exam in Math II twice.

1. (2+3) Find the limits

a) lim_{y -> inf} (12y^3 - 2y^2 + 1) / (4y^4 + y), b) lim_{x -> 0} (2[1 - cos(x)] / (x[e^-x - 1]))

2. (3+2) Verify for each of the following series whether it converges or diverges and compute the limit of the series in case it does converge:

a) sum_{k=1}^inf (4^{k+1} / 5^k), b) sum_{k=3}^inf (5 / (2k - 4))

3. (3+3+2+3) Consider the function

$$f(x) = \frac{x^2 + 8}{1 - x}, \quad x \neq 1.$$

a) Compute the first and the second derivative of f and verify that they equal

$$f'(x) = \frac{-x^2 + 2x + 8}{(1 - x)^2}, \quad f''(x) = \frac{18}{(1 - x)^3}.$$

b) Find all local minimizers and local maximizers of f .

c) Determine the smallest and the biggest function value of f in the interval $[-3, 0]$.

d) Sketch the function in its domain of definition.

4. (2+4+3) Evaluate the following proper or improper integrals:

$$\text{a) } \int [3 \sin(3x) + x^{-4} + e^{-2x}] dx, \quad \text{b) } \int_{-e}^{-1} 3x^2 \ln(-x) dx, \quad \text{c) } \int_{\pi/2}^{\pi} \frac{1}{\cos^2(x - \frac{\pi}{2})} dx.$$

5. (4+2) Consider the function

$$f(x) = x \ln\left(\frac{1}{x}\right), \quad x > 0.$$

a) Find the Taylor polynomial $T_2(x)$ of degree 2 of f for $x_0 = 1$.

b) Estimate the maximum of the error $|f(x) - T_2(x)|$ in the interval $[\frac{1}{2}, \frac{3}{2}]$.

6. (5+3+4) Consider the function

$$f(x, y) = \frac{4}{3}y^3 + \frac{1}{2}x^2 - 2xy - 4.$$

a) Give the gradient and the Hesse matrix of f .

b) Find all critical points of f .

c) Check whether these points are local minimizers, local maximizers, or saddle points of f .