

Multivariable calculus/Flervariabelanalys

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Minimum requirements:

Comp./El. Engineering : Grade 5: 27p, 4: 21p, 3: 15p.

Information Science (ECTS) : Grade A: 27p, B: 24p, C: 21p, D: 18p, E: 15p, FX: 9p.

One of the following handbooks can be used:

Råde/Westergren: 'Mathematics Handbook', Papula: 'Mathematische Formelsammlung',
Bartsch: 'Taschenbuch math. Formeln', Chaudhry/Saif-Ur-Rehman/Shahid: 'A collection of
math. formulae and important results', 'Chinese math. Handbook', Spiegel/Liu: 'Schaum's
Math. Handbook of Formulas and Tables', 'BIT Dhaka Collection of Formulae'.

In addition, each student can use one ordinary (non-mathematical) dictionary.

1. Calculate the directional derivative of $g(x, y, z) = x^{2y} + yz + z^2$
at the point $P = (1, 1, 1)$ and in the direction of $\mathbf{v} = (2, 1, 2)$. (2p)

2. Determine an equation of the tangent plane to the surface $xy^2 + yz - z^3 + 2 = 0$
at the point $(-2, 1, 1)$. (2p)

3. Calculate the limit (if it exists) $\lim_{(x,y) \rightarrow (0,0)} \frac{xy^2 - x^3}{x^2 + y^2}$. (2p)

4. Determine the third order Taylor-polynomial of the function $f(x, y) = \ln(2x^2 + y)$
at the point $(0, 1)$. (3p)

5. a) Find the general solution of the partial differential equation

$$x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = 2x^2, \quad x > 0, y > 0. \quad (3p)$$

Use the following transformation $u = x, \quad v = \frac{x}{y}$.

b) Find the particular solution $f(x, y)$, for which $f(1, y) = 1 + \sqrt{y+1}$. (2p)

6. Find the largest and smallest value of the function $f(x, y) = x^2 + y^2 + xy - 6x$
on the set $\Delta = \{(x, y) \mid 0 \leq x \leq 5, -3 \leq y \leq 0\}$. (5p)

7. Calculate $\int \int_A y \sqrt{x} \, dx \, dy$, $A = \{(x, y) \mid x \geq 0, x^2 \leq y \leq 2 - x^2\}$. (3p)

8. Calculate $\int \int_D y^2 e^{xy} \, dx \, dy$, where the region D is a triangle with corners
at the points $(0, 0)$, $(0, 1)$, and $(1, 1)$. (3p)

9. Calculate $\int \int \int_K zy^2 \, dx \, dy \, dz$,
 $K = \{(x, y, z) \mid x \geq 0, 0 \leq y \leq x, 1 \leq z \leq \sqrt{4 - x^2 - y^2}\}$. (5p)