# Mathematical analysis 2, WNE, 2018/2019
# meeting 11.

26 March 2019

## Problems

1. Find all functions $f$, such that
$$\frac{\partial f}{\partial x}(x,y) = 2xy^3 + e^x \sin y,$$
$$\frac{\partial f}{\partial y}(x,y) = 3x^2y^2 + e^x \cos y + 1.$$
2. Find the directional derivative of the above function at point $(0,0)$ in direction $v = (2,1)$.
3. Examine the differentiability of:
   a) $f(x,y) = \begin{cases} xy\dfrac{x^2-y^2}{x^2+y^2} \text{ , for } (x,y) \neq (0,0) \\ 0 \text{ , for } (x,y) = (0,0) \end{cases}$ ,
   b) $f(x_1,\ldots,x_k) = \sqrt{x_1^2 + \ldots + x_k^2}$,
   c) $f(x,y) = \begin{cases} \dfrac{\sin xy}{y} \text{ , for } y \neq 0 \\ x \text{ , for } y = 0 \end{cases}$ .
   d) $f(x,y,z) = \sqrt{xyz}$
4. Calculate partial derivatives of $g \circ f$:
   a) $f\colon \mathbb{R}^+ \to \mathbb{R}^2$, $f(x) = (x, \sqrt{x})$, $g\colon \mathbb{R}^2 \to \mathbb{R}$, $g(a,b) = e^{-(a^2+b^2)}$,
   b) $f\colon \mathbb{R} \to \mathbb{R}^2$, $f(x) = (\cos x, \sin x)$, $g\colon \mathbb{R}^2 \setminus \{(0,0)\} \to \mathbb{R}$, $g(a,b) = \dfrac{1}{a^2+b^2}$,
   c) $f\colon \mathbb{R}^2 \to \mathbb{R}^2$, $f(x,y) = (x-y, x+y)$, $g\colon \mathbb{R}^2 \to \mathbb{R}^2$, $g(a,b) = (e^a \cos b, e^a \sin b)$.

## Homework

### Group 8:00

Calculate the derivative of $g \circ f$, for $f\colon \mathbb{R}^2 \to \mathbb{R}^3$, $f(x,y) = (x^2-y^2, x^2+y^2, x^2y^2)$, $g\colon \mathbb{R}^3 \to \mathbb{R}$, $g(a,b,c) = ab + bc + ac$.

### Group 9:45

Calculate the derivative of $g \circ f$, for $f\colon \mathbb{R}^2 \to \mathbb{R}^3$, $f(x,y) = (x-y, x+y, 2\sqrt{xy})$, $g\colon \mathbb{R}^3 \setminus \{0\} \to \mathbb{R}$, $g(a,b,c) = \ln(a^2+b^2+c^2)$.