



Numerical Algorithms

Winter term 2019/20
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Sheet 1

Submission on **Tuesday, 15.10.19** in class.

Exercise 1. (chain rule)

Let X , Y , and Z be Banach spaces. Show that for $f: X \rightarrow Y$ and $g: Y \rightarrow Z$ both differentiable, one has that $g \circ f$ is differentiable and satisfies

$$D(g \circ f)(x) = Dg(f(x)) \circ Df(x) \quad (1.1)$$

for all $x \in X$.

(5 points)

Exercise 2. (gradient and inverse)

Let V and W be open subsets of \mathbb{R}^n and $j: V \rightarrow W$ be differentiable and bijective. Furthermore, assume that $Dj(v)$ is an isomorphism for all $v \in V$. For a differentiable function $f: V \rightarrow \mathbb{R}$, compute $\nabla(f \circ j^{-1})$.

(5 points)