Universität Konstanz
Fachbereich Mathematik und Statistik
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Optimierung
1. Übungsblatt

☐ Exercise 1

Let $X \subseteq \mathbb{R}^n$, $f : X \to \mathbb{R}$, x^* a (strict) local minimizer of f and γ an admissible path towards x^*.

Show that 0 is a (strict) local minimizer of $f \circ \gamma$.

☐ Exercise 2

Let $X \subseteq \mathbb{R}^n$, $f : X \to \mathbb{R}$ and $x^* \in X$. Assume that there is a neighbourhood U around x^* such that each point $x \in X \cap U$ can be connected with x^* by an admissible path γ in $X \cap U$.

Show that x^* is a (strict) **local** minimizer of f if 0 is a (strict) **global** minimizer of $f \circ \gamma$ for each such path γ.

☐ Exercise 3

Calculate the local critical points of the Rosenbrock function

$$f : \mathbb{R}^2 \to \mathbb{R}, \qquad f(x_1, x_2) := 100 \cdot (x_2 - x_1^2)^2 + (1 - x_1)^2$$

and figure out their types (minimal point, maximal point or saddle point).

☐ Exercise 4

Consider the function

$$f : \mathbb{R}^2 \to \mathbb{R}, \qquad (x_1, x_2) \mapsto f(x_1, x_2) := 3x_1^4 - 4x_1^2 x_2 + x_2^2.$$

Prove that $x_0 := (0, 0)$ is a local critical point of f. Show that f, restricted on any line through x_0, has a strict local minimum in x_0. Is x_0 a local minimizer of f?
