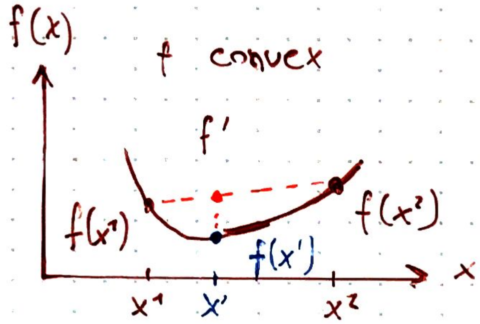
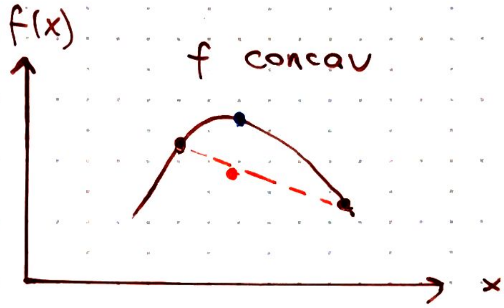
SW4

Convex and Concave functions:





Der rote Punkt wird in einer konvexen Funktion immer höher sein als der blaue.

Definitionen:

Convex Function: $f: S \to \mathbb{R}, \quad f(\lambda x^1 + (1-\lambda)x^2) \leq \lambda f(x^1) + (1-\lambda) f(x^2)$

Concav Function: $f: S \to \mathbb{R}, \quad f(\lambda x^1 + (1-\lambda)x^2) \geq \lambda f(x^1) + (1-\lambda) f(x^2)$

for $0 \leq \lambda \leq 1, x^1, x^2 \in S$

Convex optimization problem:

Theorem: In convex optimization, local optimum is global optimum. Convex functions need to be minimized, Concav functions need to be maximized.

Linear Programming:

Linearity: $f(ax+by) = af(x) + bf(y)$

Linear Function: $f(x) = a_1x_1 + a_2x_2 + \dots a_nx_n = \sum_{j=1}^{n} a_j x_j = a^T x$

Linear inequality: $\sum_{j=1}^{n} a_j x_j \leq b$ resp. $a^T x \leq b$

Linear Program (LP):

We have to minimize linear objective function subject to linear constraints.

We have three types of constraints ($\geq, =, \leq$) and three types of variables ($\geq 0, \leq 0$, free)

And we have three different forms of LP:

Canonical Form: Max $c^T x \to a^i x \leq b$, min $c^T x \to a^i x \geq b$

Standard Form: Only equality constraints

Inequality Form: Same with canonical, but no constraints!