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Business Analytics & Machine Learning
Homework sheet 11: Convex Optimization

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Exercise H11.1 *Convex function*

You are given the following function:

$$f(x, y) = \exp(ax + by^2)$$

Determine all parameters $a, b \in \mathbb{R}$ such that f is convex.

Exercise H11.2 *Convex functions*

Determine if the following functions are convex.

a) $f(x, y) = \exp(3x + 2y^2)$

b) $f(x, y) = \frac{1}{2}x^2 + \exp(-y) + 3xy$

c) $f(x) = |x| + \cos(x)$

d) $f(x) = 3x^{5n}$ for even n

Exercise H11.3 *Extreme points*

You are given the following function:

$$f(x, y) = 2xy^3 - 3x^2 - 6xy - 1$$

a) Determine all local minima and maxima of f in $\mathbb{R}^2$.

b) Determine all local minima and maxima of f in the square $[0, 1] \times [0, 1]$. Consider the edges as well.