

Modern Optimization Techniques - Exercise Sheet 1

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Solutions need to be handed in until **Thursday , November 3rd, 2016 at 12:00**

Exercise 1: Optimization Problems (10P)

For the following real valued functions, find their associated minimum x^* and the minimal value p^* , if they exist. Is x^* unique?

- a) $f_1 : (a, b) \rightarrow \mathbb{R}$ with $f_1(x) = x$
- b) $f_2 : \mathbb{R} \rightarrow \mathbb{R}$ with $f_2(x) = c \cdot \sin(x)$ $c > 0$
- c) $f_3 : [0, 2\pi] \rightarrow \mathbb{R}$ with $f_3(x) = \cos(x)$
- d) $f_4 : \mathbb{R} \rightarrow \mathbb{R}$ with $f_4(x) = (x - a)^2 + b$ $a, b \in \mathbb{R}$

Exercise 2: Convexity and Linearity (10P)

Let f_i be the functions defined above for $i = 1, 2, 3, 4$. Answer the following questions for all f_i by either providing a proof or a counterexample.

- a) Is f_i a linear function?
- b) Is f_i a convex function?