

Name:

Present group members:

Worksheet 7-3: Q1

Consider $\max \{\mathbf{x}^\top Q \mathbf{x} \mid \|\mathbf{x}\| \leq 1\}$ where $\mathbf{x} \in \mathbb{R}^n$ and $Q \succeq 0$.

(a) Does a maximizer exist? Justify by checking all the conditions of the relevant theorem.

(b) Let $\mathbf{x} \in \mathbb{R}^2$ (that is, assume $n = 2$ above) and answer the following questions.

(i) Using L_1 -norm for \mathbf{x} : Sketch the feasible region and point out where a maximizer, if it exists, can be found.

(ii) Using L_2 -norm for \mathbf{x} : Sketch the feasible region and point out where a maximizer, if it exists, can be found.

Worksheet 7-3: Q2
Consider the function

$$f : [0, \infty) \rightarrow \mathbb{R} \cup \{\infty\}$$
$$x \mapsto \begin{cases} \infty & \text{if } x = 0 \\ 1/x & \text{if } x > 0 \end{cases}$$

- What is the effective domain of f , $\text{dom}(f)$?

- Sketch the epigraph of f .

- Is f convex? Justify your answer.

Worksheet 7-3: Q3

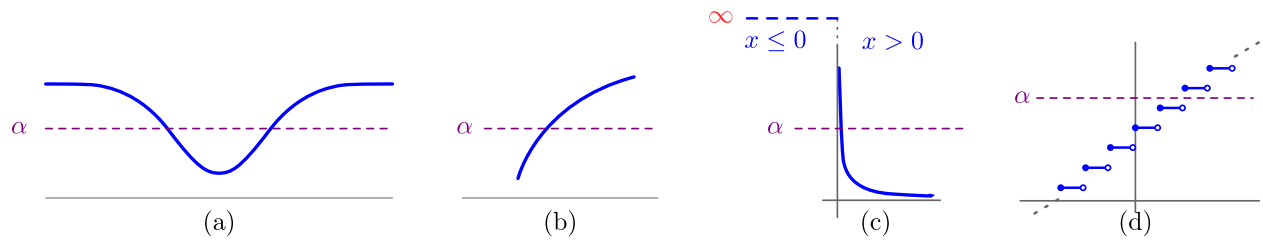


Figure 1: Problem 3

For each of the functions shown in the figure, answer the following:

- (i) Sketch the sublevel sets at level α .
- (ii) Sketch the epigraph.
- (iii) **Based only on your sketches**, is the function convex? Justify your answer.
- (iv) **Based only on your sketches**, is the function quasi-convex?