

Optimization Prof. Carlson

Homework 5

From the text, end of chapter 2, #1, 5, 7, 9

- A. (i) *Show that the intersection of any collection of convex sets is convex.*
(ii) *Show by example that the union of convex sets may not be convex.*

B. Show that a strictly convex function $f : \mathbb{R} \rightarrow \mathbb{R}$ cannot have more than two zeros.

C. Suppose $f : \mathbb{R} \rightarrow \mathbb{R}$ is convex. Show that the set Ω lying above the graph of f ,

$$\Omega = \{(x, y) \in \mathbb{R}^2 \mid y \geq f(x)\}$$

is convex.

Suppose $f : \mathbb{R}^N \rightarrow \mathbb{R}$ is convex. Let $X \in \mathbb{R}^N$, $y \in \mathbb{R}$. Show that the set

$$\Omega = \{(X, y) \in \mathbb{R}^{N+1} \mid y \geq f(X)\}$$

is convex.