

## Problem Set 3

For answering the following questions, please use your copy of Mas-Colell/Whinston/Green.

**Problem 3.1** Let there be two commodities, one input,  $z$ , and one output,  $q$ .  $Y \subset \mathbf{R}^2$  is the production set, and  $q = f(z)$  is the production function.

- (i) Define the production set.
- (ii) Give a direct proof of the following claim: “If  $Y$  is a convex set then  $f(z)$  is a concave function.”

**Problem 3.2** Let there be two commodities, one input,  $z$ , and one output,  $q$ .  $Y \subset \mathbf{R}^2$  is the production set, and  $q = f(z)$  is the production function. Give a direct proof of the following claim: “If  $f(z)$  is a concave function then  $Y$  is a convex set.”

**Problem 3.3** Prove the following claim:  
“The profit function,  $\pi(p)$ , is convex.”

**Problem 3.4** Let there be two commodities, one input,  $k \in \mathbf{R}_+$ , and one output,  $x$ . The production function is  $f(k)$ , so that  $x = f(k)$ . Define the production sets for the following production functions. Furthermore, state the relevant properties of the respective production sets.

- (i)  $f(k) = Ak$ , where  $A$  is some positive constant.
- (ii)  $f(k) = k^\alpha$ , with  $0 < \alpha < 1$ .