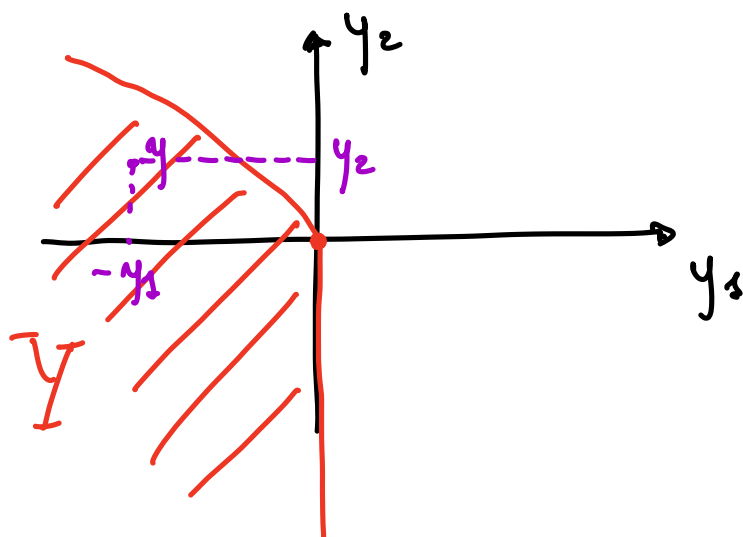
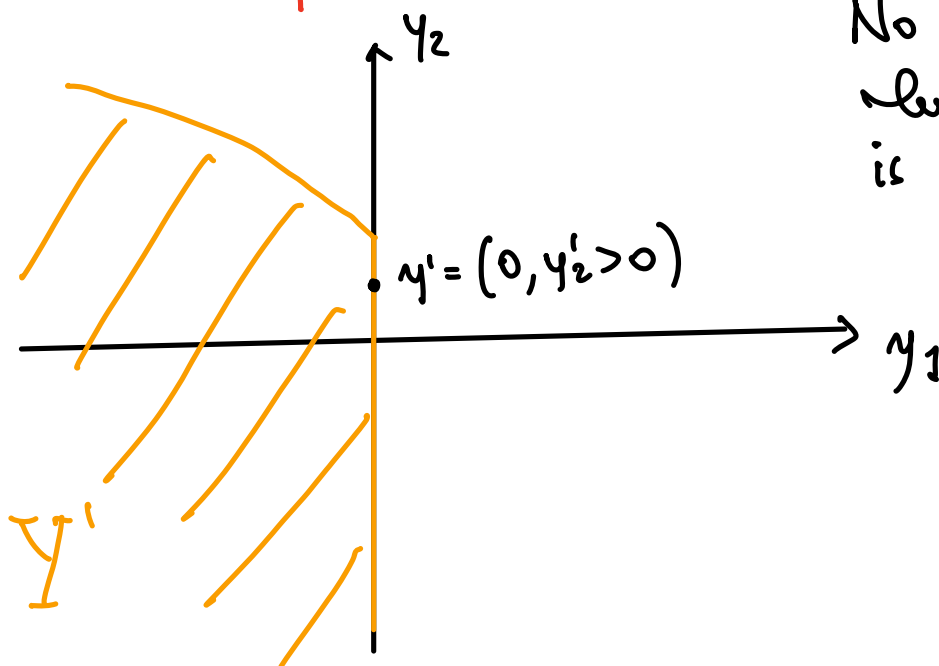


Production set

a) No free lunch :  $Y \cap \mathbb{R}_+^2 = \{\emptyset\}$



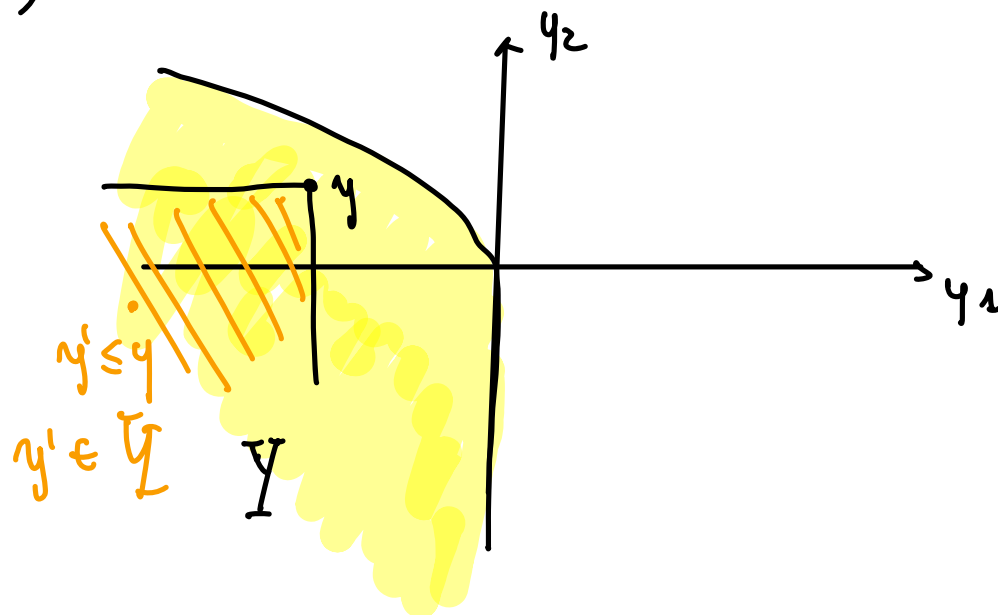
Geometric representation of  $Y$  that satisfies 4)



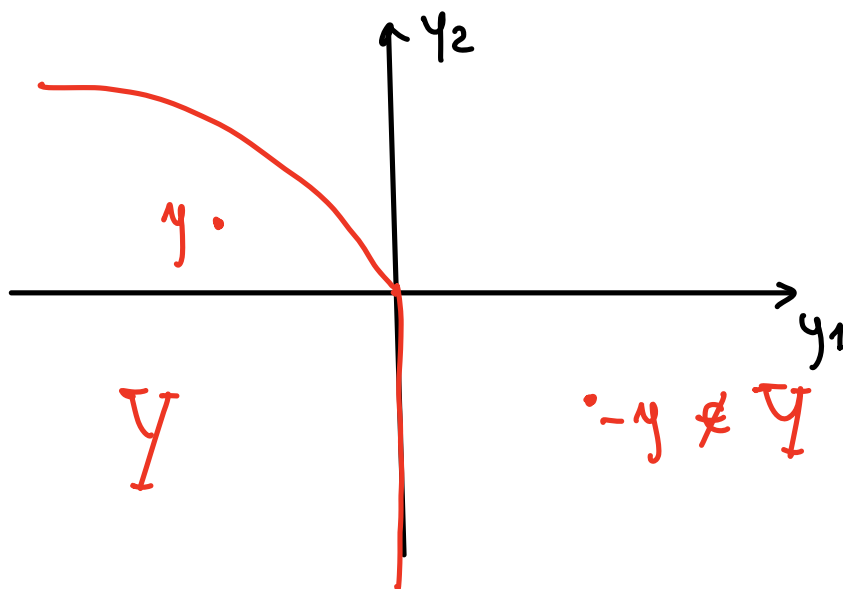
No free lunch is violated

Inputs are essential for production

5) Free disposal :  $\mathcal{Y} - \mathbb{R}_+^2 \subseteq \mathcal{Y}$



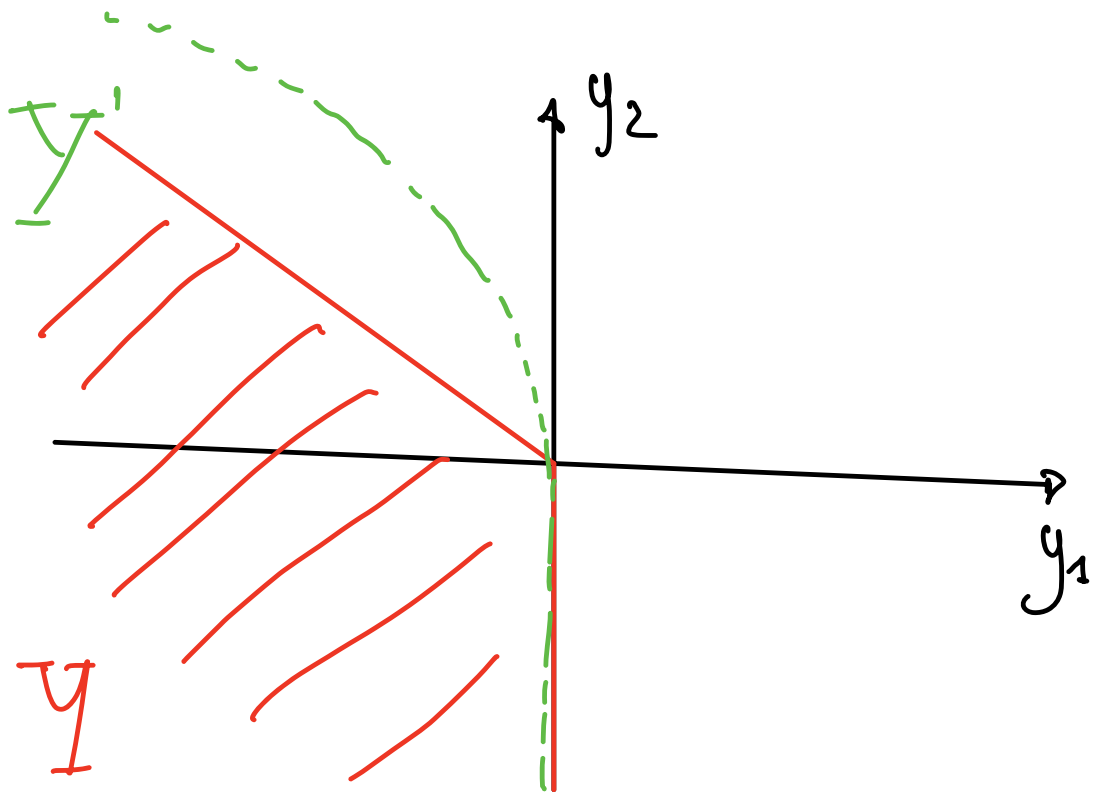
6) Irreversibility : if  $\forall y \in \mathcal{Y}$  with  $y \neq 0$   
then  $-y \notin \mathcal{Y}$

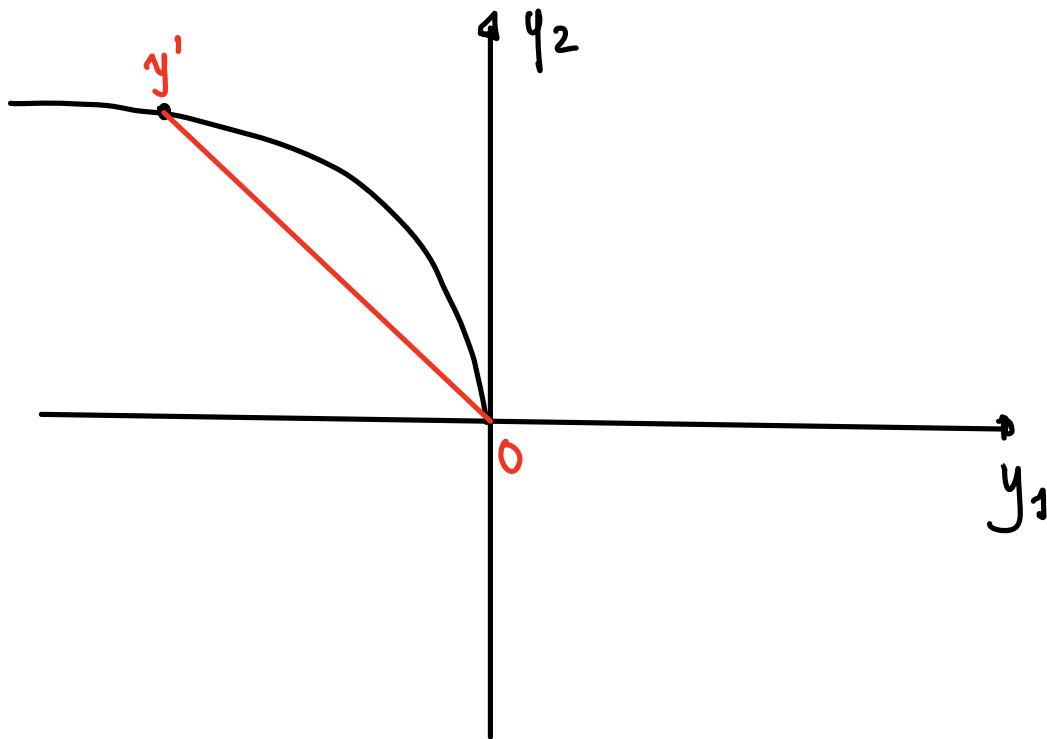


# RETURNS TO SCALE

2) Non-increasing returns to scale

$$\forall y \in Y \Rightarrow \alpha y \in Y \quad \forall \alpha \in [0, 1]$$





if  $0 \in Y$ ,  $\forall \alpha \in [0, 1]$

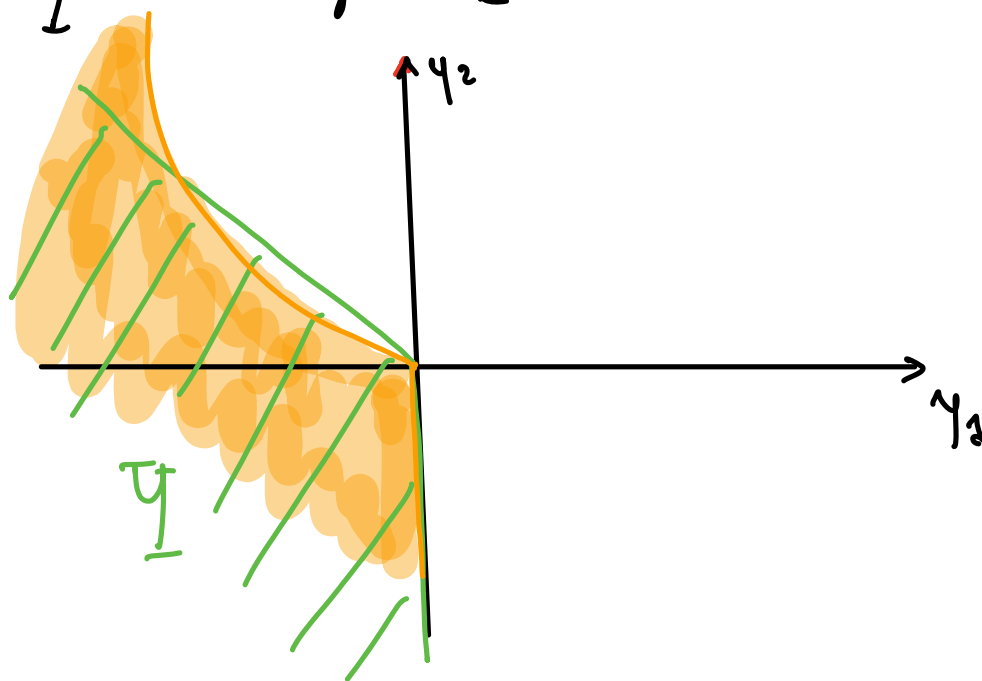
$\alpha y' + (1 - \alpha) 0 \in Y$  convexity implies

non-increasing returns to scale

$\alpha y' \in Y \quad \forall \alpha \in [0, 1]$ .

8) Non-decreasing returns to scale

$$\forall y \in Y \Rightarrow \alpha y \in Y \quad \forall \alpha \geq 1$$



9) Constant returns to scale

$$\forall y \in Y \Rightarrow \alpha y \in Y \quad \forall \alpha \geq 0$$

