Problem: Consider the linear space $L = \mathbb{R}^2$. Define for $x = (x_1, x_2) \in L$ the seminorms

$$p_1(x) = |x_1|, \quad p_2(x) = |x_2|.$$ 

Construct for $x \in L$, $j \in \{1, 2\}$, and $\varepsilon \in (0, \infty)$, the sets

$$\mathcal{B}_{x,j,\varepsilon} = \{y \in L : p_j(x - y) < \varepsilon\}.$$ 

Describe these sets geometrically. What is the topology generated by the collection of semi-norms $\{p_1\}$? Is it Hausdorff? What is the topology generated by the collection of semi-norms $\{p_1, p_2\}$? Is it Hausdorff?