

2. Let $A \subset \mathbb{R}^2$. For $x \in \mathbb{R}^2$, is a limit point of A if for all $\delta > 0$

$$B(x, \delta) \cap A \setminus \{x\} \neq \emptyset,$$

where $B(x, \delta) = \{y \in \mathbb{R}^2 : |x - y| < \delta\}$. Let $\alpha \in \mathbb{R}$ and define $f : \mathbb{R} \rightarrow \mathbb{R}$ to be given by

$$f(x) = \begin{cases} x^\alpha \sin(\frac{1}{x}) & x \neq 0 \\ 0 & x = 0 \end{cases}$$

Let

$$A \equiv A(\alpha) = \{(x, f(x)) : x \in \mathbb{R}\}.$$

Find the limit points of A .