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Functions from a metric space to $\mathbb{R}$ extremum

Definition. Local and global extremum of a function from a metric space to $\mathbb{R}$

Given a function $f : X \rightarrow \mathbb{R}$, then at $x \in X$ f has a

- **global maxima** if $f(x) \geq f(a)$ for all $a \in X$
- **global minima** if $f(x) \leq f(a)$ for all $a \in X$
- **local maxima** if $f(x) \geq f(a)$ for all $a \in \epsilon\text{-}B(x)$ for some $\epsilon > 0$
- **local minima** if $f(x) \leq f(a)$ for all $a \in \epsilon\text{-}B(x)$ for some $\epsilon > 0$

☰ A continuous function from a compact metric space to $\mathbb{R}$ has a global maxima *and* a global minima. **>**

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