



METRIC CONTINUITY

Why

We define continuity for functions between metric spaces.

Definition

Our inspiration is continuity of functions from the set of real numbers to the set of real numbers. There we decided on a definition which codified our intuition that numbers which are sufficiently close to each other are mapped to numbers that are close to each other.

A function from a first metric space to a second metric space is *continuous at* an object of its domain if, for every positive real number (no matter how small), there is a second positive real number (possibly, though not necessarily, smaller) so that every element in the domain whose distance to the fixed object is less than the second positive number has a result under the function whose distance to the result of the fixed object is less than the first positive number.

A function between metric spaces is continuous if it is *continuous at* every object of its domain.

Notation

Let (A, d) and (B, d') be metric spaces. Let $f : (A, d) \rightarrow (B, d')$. Then f is continuous at $\bar{a} \in A$, if for all real numbers

$\varepsilon > 0$, there exists a real number $\delta > 0$ such that for all $a \in A$,

$$d(\bar{a}, a) < \delta \implies d'(f(\bar{a}), f(a)) < \varepsilon.$$

