



## Why

Often when speaking of a set, we are interested in speaking of those elements which are close to it.

## Definition

Let  $x \in \mathbf{R}^d$ . A subset  $N \subset \mathbf{R}^d$  is a *neighborhood of  $x$*  if there is a  $\delta > 0$  such that  $B(x, \delta) \subset N$ . The set  $\mathcal{N}_a$  of neighborhoods of  $x$  is called the *complete system of neighborhoods* of the point  $a$ .

We interpret a neighborhood of a point  $x \in X$  as a set containing all the points of  $X$  that are sufficiently close to  $a$ . A neighborhood of  $x$  “encloses”  $x$  by virtue of it containing an open ball about  $a$ .<sup>1</sup>

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<sup>1</sup>Future editions will continue to treatment, including pointing out that an open ball at  $x$  is a neighborhood of  $x$  and of all elements in the ball.



