# Limits

## Concepts

Topics covered are:

1. Limits
2. Continuity

### Limits

Let $f(x)$ be a function defined on $(a, b)$ except at $c$. Then, as $x$ approaches $c$, if $f(x)$ approaches $L$, then we say

$$\lim_{x \to c} f(x) = L$$

A limit exists at $x = c$ if the left-hand and right-hand limits are equal:

$$\lim_{x \to c^-} f(x) = \lim_{x \to c^+} f(x) = L$$

### Continuity

A function $f(x)$ is said to be continuous in $(a, b)$ if:

$$\lim_{x \to c^-} f(x) = \lim_{x \to c^+} f(x) = f(c), \quad c \in (a, b)$$

Otherwise, it is said to be discontinuous. Continuity of a function can be found at a point in the function as well.

Graphically, a function is continuous if its graph is smooth. i.e. There are no breaks throughout its domain.

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## Uses

**Limits**: Predicting what a function value could be if it was defined at a point. Especially for functions where undefined points exist.

**Continuity**: As an extended topic of limits, it is useful to check if a function has any breakpoints, without actually having to draw the graph.