

Limits and Continuity

A function's limit can be one of its own outputs. When this happens the function is called a continuous function.

A Limit of a function is not necessarily one of the function's output values.

A Limit of a function can be one of the function values.

$$\lim_{x \rightarrow a} f(x) = f(a)$$

Then we can say that function is continuous at $x = a$

This means for a function to be continuous at $x = a$

- $f(a)$ must exist
- $\lim_{x \rightarrow a} f(x)$ must exist
- $\lim_{x \rightarrow a} f(x) = f(a)$

$$\lim_{x \rightarrow 1} (x^2 + 2x + 1)$$

This function is continuous.

Algebraic Test for Limits

Graphical Check of Continuity

A graph with no breaks is continuous. Graphically a continuous function should have none of the following.

- Holes - A hole in a graph is called removable discontinuity, because they can be determined by studying neighbouring values using Limits.
- Jumps - Jump discontinuity, due to a sudden change in values.

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$$\begin{cases} x^2, & \text{if } x < 1 \\ x + 4, & \text{if } x \geq 1 \end{cases}$$