

Mathematics 1 - Limits and Continuity

Topics : <u>Computer engineering</u> Written on <u>March 13, 2024</u>

1. Limits:

- A limit describes the behavior of a function as its input approaches a certain value.
- The limit of a function f(x) as x approaches a is denoted by $\lim(x \rightarrow a) f(x)$ and represents the value that f(x) approaches as x gets closer to a (but not necessarily equal to a).
- $\circ\,$ If the limit exists and is equal to a finite value, the function is said to be continuous at that point.

2. Types of Limits:

- Left-hand Limit: $\lim(x \rightarrow a) f(x)$ represents the behavior of f(x) as x approaches a from the left side (values less than a).
- Right-hand Limit: $\lim(x \to a+) f(x)$ represents the behavior of f(x) as x approaches a from the right side (values greater than a).
- Infinite Limits: If the limit of a function approaches positive or negative infinity as x approaches a certain value, it's called an infinite limit.

3. Continuity:

- A function is continuous at a point a if three conditions are met:
 - 1. The function is defined at a.
 - 2. The limit of the function as x approaches a exists.
 - 3. The limit of the function as x approaches a is equal to the value of the function at a.
- If a function is continuous at every point in its domain, it's called a continuous function.

4. Types of Discontinuity:

- Removable Discontinuity: A point where a function is not defined or has a hole, but it can be filled in to make the function continuous at that point.
- $\circ\,$ Jump Discontinuity: A point where the function has a sudden jump from one value to another.
- $\circ\,$ Infinite Discontinuity: A point where the function approaches positive or negative infinity.
- $\circ\,$ Asymptotic Discontinuity: A point where the function approaches a vertical asymptote.

5. Properties of Continuous Functions:

 $\circ\,$ Continuous functions satisfy several important properties, such as the intermediate

value theorem, the extreme value theorem, and the composition of continuous functions is continuous.

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