The Extension of the Sandwich theorem for limits

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Abstract: The scope of the Sandwich theorem for limit in analysis is limited to two sided-limits only. This paper extends the scope of the Sandwich theorem by considering one-sided limit as well and gives a more general version of the Sandwich theorem by making the criterion of the Sandwich theorem more loose.

The Sandwich theorem is simple yet powerful tool in analysis to determine and to analyze the limit of a function at a given point. We can leverage the known limits to calculate the unknown limits. Suppose, we know the limits of $g(x)$ and $h(x)$ at $x = c$ to be the same limit L and here $f(x)$ happens to be sandwich between $g(x)$ and $h(x)$ in some neighborhood of c. Then we can conclude the limit of $f(x)$ at $x = c$ as L by the Sandwich theorem which is as follows.

Theorem 0.1 (The Sandwich Theorem)**.** *[1] Suppose $g(x) \leq f(x) \leq h(x)$ in some open interval containing c, expect possibly at $x = c$ itself. Suppose also that*

$$\lim_{x\to c} g(x) = \lim_{x\to c} h(x) = L.$$

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

Keywords: Limit, One-Sided Limit, Sandwich Theorem, Function.

References

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