

# LIMFINITY

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## Definition and Usage

The limfinity symbol,  $\mathcal{L}$ , means **the limit at infinity**. This refers to the mathematical limit of an expression as some quantity approaches infinity. Formally we may equate

$$\mathcal{L} = \lim_{x \rightarrow \infty}$$

If no argument is identified by a subscript, then a variable should be understood from context. As studied in calculus, the limfinity of a function is a horizontal asymptote. More generally, the limfinity construct is ubiquitous in the analysis of asymptotic behavior.

$$\mathcal{L}_{\tan^{-1} x} = \frac{\pi}{2} \quad \mathcal{L}_{e^x} = 0 \quad \mathcal{L}_{\left(1 + \frac{1}{n}\right)^n} = e$$

Evaluating these is referred to as *taking the limfinity*. Notice the flexibility in specifying what variable or expression approaches infinity. In fact, instead of taking a regular (perhaps one-sided) limit at zero, we could write this:

$$\mathcal{L}_{\frac{\sin \theta}{\theta}} = 1 \quad \mathcal{L}_{\frac{|x|}{x}} = 1$$

Here  $\theta$  and  $x$  are understood to become infinitesimally small as their reciprocals become large. Not all functions have a limfinity; for example  $\mathcal{L} \cos(x)$  does not exist. Here are some more samples of limfinity usage:

$$f'(x) = \mathcal{L}_{\pm k} k \cdot [f(x + k^{-1}) - f(x)]$$

$$\sum_{n=1}^{\infty} \frac{1}{n} = \mathcal{L} \sum_{n=1}^N \frac{1}{n} = \infty$$

$$\iint_{\mathbb{R}^2} f(x, y) dA = \mathcal{L}_{X, Y} \int_{-Y}^Y \int_{-X}^X f(x, y) dx dy = \mathcal{L}_R \int_0^{2\pi} \int_0^R f(r, \theta) r dr d\theta$$

## History

The limfinity symbol was created in a calculus class at Carson-Newman College in the fall of 2003. Professor Alden Starnes devised the convenient notation to simplify calculations involving infinite sequences and series. In 2005, Kenneth Massey joined the department and helped extend the notation by introducing the subscript described above.

Starnes and Massey formed the **Limfinity Matrix Group** consulting firm in the fall of 2005. The limfinity symbol serves as the LMG logo, a fitting emblem of their mission to help clients set and reach long-term goals.

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