Limit Formulas

MathWise Institute

December 2022

1 Introduction

This file contains a set of useful properties and formulas to solve limit problems. Any questions or concerns should be sent to the owner at agflores1979@gmail.com.

2 Properties

(1) $\lim\limits_{x \to \alpha} \lambda f(x) = \lambda \lim\limits_{x \to \alpha} f(x)$ where λ is a constant

(2) $\lim\limits_{x \to \alpha} [f(x) + g(x)] = \lim\limits_{x \to \alpha} f(x) + \lim\limits_{x \to \alpha} g(x)$

(3) $\lim\limits_{x \to \alpha} [f(x) - g(x)] = \lim\limits_{x \to \alpha} f(x) - \lim\limits_{x \to \alpha} g(x)$

(4) $\lim\limits_{x \to \alpha} [f(x)g(x)] = \lim\limits_{x \to \alpha} f(x) \lim\limits_{x \to \alpha} g(x)$

(5) $\lim\limits_{x \to \alpha} \left[\dfrac{f(x)}{g(x)} \right] = \dfrac{\lim_{x \to \alpha} f(x)}{\lim_{x \to \alpha} g(x)}$

provided that the numerator and denominator are not both equal to zero or infinity

(6) $\lim\limits_{x \to \alpha} [f(x)]^n = \left[\lim\limits_{x \to \alpha} f(x) \right]^n$ where $n \in \mathbb{R}$

3 Formulas

$$(1) \lim_{x \to \alpha} \frac{x^n - \alpha^n}{x - \alpha} = n\alpha^{n-1} \text{ where } n \in \mathbb{R}$$

$$(2) \lim_{x \to 0} \frac{e^x - 1}{x} = 1$$

$$(3) \lim_{x \to 0} \frac{\alpha^x - 1}{x} = \ln \alpha$$

$$(4) \lim_{x \to 0} \frac{\sin x}{x} = 1$$

$$(5) \lim_{x \to 0} \frac{x}{\sin x} = 1$$

$$(6) \lim_{x \to 0} \frac{\tan x}{x} = 1$$

$$(7) \lim_{x \to 0} \frac{1 - \cos x}{x} = 0$$

$$(8) \lim_{x \to 0} [1 + x]^{\frac{1}{x}} = e$$

$$(9) \lim_{x \to \infty} \left[1 + \frac{1}{x}\right]^x = e$$