1 General Limit Laws

Suppose $\lim_{x\to a} f(x)$ and $\lim_{x\to a} g(x)$ both exist, and let c be any constant.

1. Sum Law: $\lim_{x\to a}[f(x)+g(x)] = \lim_{x\to a} f(x) + \lim_{x\to a} g(x)$
2. Difference Law: $\lim_{x\to a}[f(x)-g(x)] = \lim_{x\to a} f(x) - \lim_{x\to a} g(x)$
3. Constant Multiplier Law: $\lim_{x\to a}[cf(x)] = c\lim_{x\to a} f(x)$
4. Product Law: $\lim_{x\to a}[f(x)g(x)] = \left(\lim_{x\to a} f(x)\right)\left(\lim_{x\to a} g(x)\right)$
5. Quotient Law: $\lim_{x\to a}\left[\frac{f(x)}{g(x)}\right] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$ provided $\lim_{x\to a} g(x) \neq 0$.
6. Power Law: $\lim_{x\to a}[f(x)]^n = \left[\lim_{x\to a} f(x)\right]^n$ where n is a positive integer.
7. Root Law: $\lim_{x\to a}\sqrt[n]{f(x)} = \sqrt[n]{\lim_{x\to a} f(x)}$ where n is a positive integer, and where $\lim_{x\to a} f(x) > 0$ if n is even.

2 Particular Limit Results

1. Constants: $\lim_{x\to a} c = c$
2. Limit of $f(x) = x$: $\lim_{x\to a} x = a$
3. Polynomials: If $f(x)$ is a polynomial (for eg. $f(x) = 5x^3 - \pi x^2 - 1/2$) then $\lim_{x\to a} f(x) = f(a)$.
4. Sine & Cosine: $\lim_{x\to a}\sin(x) = \sin(a), \quad \lim_{x\to a}\cos(x) = \cos(a)$.
5. Rational Functions: If $f(x)$ and $g(x)$ are polynomials and $g(a) \neq 0$ then $\lim_{x\to a}\frac{f(x)}{g(x)} = \frac{f(a)}{g(a)}$.
6. Squeeze Theorem: If $f(x) \leq g(x) \leq h(x)$ for x near a and $\lim_{x\to a} f(x) = \lim_{x\to a} h(x) = L$, then $\lim_{x\to a} g(x) = L$.
7. Important Trig Limit: $\lim_{x\to 0}\frac{\sin(x)}{x} = 1$