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Created: Friday 12th April, 2024

My Calculus Notes

Abstract

The Derivative of any continuous function $f(x)$ is the function $f'(x)$ for which $\forall a$ in the domain of f, geometrically speaking, $f'(a)$ equals the slope of the line *tangent* to the point $(a, f(a))$. In other words, $f'(x)$ is the instantaeous rate of change of $f(x)$ at any point in its domain.

The Limit Definition of Derivatives

$$\frac{d}{dx}f(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h} = \lim_{h\to a}\frac{f(h)-f(a)}{h-a}$$

Derivative Rules

- $\frac{d}{dx}x^a = ax^{a-1}$
- $\frac{d}{dx}f(x)g(x) = f'(x)g(x) + f(x)g'(x)$
- $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$
- $\frac{d}{dx}\sin(x) = \cos(x)$
- $\frac{d}{dx}e^x = e^x$
- $\frac{d}{dx}a^x = a^x\ln(a)$
- $\frac{d}{dx}f(x) \pm g(x) \pm \ldots = f'(x) \pm g'(x) \pm \ldots$
- $\frac{d}{dx}\frac{f(x)}{g(x)} = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$
- $\frac{d}{dx}f^{-1}(x) = \frac{1}{f'(f^{-1}(x))}$
- $\frac{d}{dx}\cos(x) = -\sin x$
- $\frac{d}{dx}\ln(x) = \frac{1}{x}$