

Derivative Formulas

Definition Of Derivative:

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \quad \text{Use it for a general variable } x$$

$$f'(a) = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a} \quad \text{Use it for a particular value } a$$

① $(x^r)' = rx^{r-1}, \quad r \in \mathbb{R}$

② $(c)' = 0, \quad (cx)' = c, \quad c \text{ is a constant}$

③ $(cf(x))' = cf'(x), \quad c \text{ is a constant}$

④ $(f(x) \pm g(x))' = f'(x) \pm g'(x)$

⑤ **Product Rule:**

$$(f(x).g(x))' = f'(x).g(x) + f(x).g'(x)$$

⑥ **Quotient Rule:**

$$\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x).g(x) - f(x).g'(x)}{(g(x))^2}$$

⑦ $(r^x)' = r^x \ln r, \quad r \in \mathbb{R}$

⑧ $(e^x)' = e^x, \quad e \cong 2.718 \dots$

⑨ $(\log_r x)' = \frac{1}{x \ln r}, \quad r \in \mathbb{R}$

⑩ $(\ln x)' = \frac{1}{x}$

⑪ $(\sin x)' = \cos x$

⑫ $(\cos x)' = -\sin x$

⑬ $(\tan x)' = \sec^2 x = 1 + \tan^2 x$

⑭ $(\cot x)' = -\csc^2 x = -(1 + \cot^2 x)$

⑮ $(\sec x)' = \sec x \cdot \tan x$

⑯ $(\csc x)' = -\csc x \cdot \cot x$

⑰ **Chain Rule:**

$$(f(g(x)))' = f'(g(x)).g'(x)$$

$$\frac{dy}{dx} = \frac{dy}{dt} \cdot \frac{dt}{dx}$$

⑱ $(\sin^{-1} x)' = \frac{1}{\sqrt{1-x^2}}$

⑲ $(\cos^{-1} x)' = -\frac{1}{\sqrt{1-x^2}}$

⑳ $(\tan^{-1} x)' = \frac{1}{1+x^2}$

㉑ $(\cot^{-1} x)' = -\frac{1}{1+x^2}$

㉒ $(\sec^{-1} x)' = \frac{1}{x\sqrt{x^2-1}}$

㉓ $(\csc^{-1} x)' = -\frac{1}{x\sqrt{x^2-1}}$

㉔ If $f(a) = b$, then $(f^{-1})'(b) = \frac{1}{f'(a)}$

㉕ $|x|' = \frac{x}{|x|} = \frac{|x|}{x}$