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Some Important Derivative

For BSc or BS Level

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- $\frac{d}{dx}(c)=0$, where c is constant
- $\frac{d}{dx}(x^n)=nx^{n-1}$
- $\frac{d}{dx}\left[f(x)\right]^n=n\left[f(x)\right]^{n-1}\frac{d}{dx}\left[f(x)\right]$

- $\frac{d}{dx}\sin x=\cos x$
- $\frac{d}{dx}\cos x=-\sin x$
- $\frac{d}{dx}\tan x=\sec^2 x$
- $\frac{d}{dx}\cot x=-\csc^2 x$
- $\frac{d}{dx}\csc x=-\csc x\cot x$
- $\frac{d}{dx}\sec x=\sec x\tan x$

- $\frac{d}{dx}Sin^{-1}x=\frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}Cos^{-1}x=\frac{-1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}Tan^{-1}x=\frac{1}{1+x^2}$
- $\frac{d}{dx}Cot^{-1}x=\frac{-1}{1+x^2}$
- $\frac{d}{dx}Sec^{-1}x=\frac{1}{x\sqrt{x^2-1}}$
- $\frac{d}{dx}Csc^{-1}x=\frac{-1}{x\sqrt{x^2-1}}$

- $\frac{d}{dx}a^x=a^x\ln a$
- $\frac{d}{dx}e^x=e^x$
- $\frac{d}{dx}\log_a x=\frac{1}{x\ln a}$
- $\frac{d}{dx}\ln x=\frac{1}{x}$

- $\frac{d}{dx}\sinh x=\cosh x$
- $\frac{d}{dx}\cosh x=\sinh x$
- $\frac{d}{dx}\tanh x=\text{sech}^2 x$
- $\frac{d}{dx}\coth x=-\text{csch}^2 x$
- $\frac{d}{dx}\text{sech}\, x=-\text{sech}\, x\tanh x$
- $\frac{d}{dx}\text{csch}\, x=-\text{csch}\, x\coth x$

- $\frac{d}{dx}Sinh^{-1}x=\frac{1}{\sqrt{x^2+1}}$
- $\frac{d}{dx}Cosh^{-1}x=\frac{1}{\sqrt{x^2-1}}$
- $\frac{d}{dx}Tanh^{-1}x=\frac{1}{1-x^2}$
- $\frac{d}{dx}Coth^{-1}x=\frac{1}{1-x^2}$
- $\frac{d}{dx}Sech^{-1}x=\frac{-1}{x\sqrt{1-x^2}}$
- $\frac{d}{dx}Csch^{-1}x=\frac{-1}{x\sqrt{1+x^2}}$

Some Standard nth Derivative

- $\frac{d^n}{dx^n}(ax+b)^m=\frac{m!}{(m-n)!}a^n\left(ax+b\right)^{m-n}\ if\ m\geq n$
- $\frac{d^n}{dx^n}\left(\frac{1}{ax+b}\right)=\frac{\left(-1\right)^n n!a^n}{(ax+b)^{n+1}}$
- $\frac{d^n}{dx^n}\left[\ln(ax+b)\right]=\frac{(-1)^{n-1}\left(n-1\right)!a^n}{(ax+b)^n}$
- $\frac{d^n}{dx^n}e^{ax}=a^ne^{ax}$
- $\frac{d^n}{dx^n}\sin(ax+b)=a^n\sin\left(ax+b+n.\frac{\pi}{2}\right)$
- $\frac{d^n}{dx^n}\cos(ax+b)=a^n\cos\left(ax+b+n.\frac{\pi}{2}\right)$
- $\frac{d^n}{dx^n}e^{ax}\sin(bx+c)=(a^2+b^2)^{\frac{n}{2}}e^{ax}\sin\left(bx+c+n\tan^{-1}\frac{b}{a}\right)$
- $\frac{d^n}{dx^n}e^{ax}\cos(bx+c)=(a^2+b^2)^{\frac{n}{2}}e^{ax}\cos\left(bx+c+n\tan^{-1}\frac{b}{a}\right)$

Leibniz's Theorem

- $\frac{d^n}{dx^n}(uv)={}^nC_0u^{(n)}v+{}^nC_1u^{(n-1)}v'+{}^nC_2u^{(n-2)}v''+\ldots+{}^nC_{n-1}u'v^{n-1}+{}^nC_nuv^n$

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