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Merging man and maths

Some Important Derivative

For Bachelor Level

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- $\frac{d}{dx}c = 0$ where c is constant
- $\frac{d}{dx}x^n = nx^{n-1}$

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

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

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

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

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

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

Leibniz's Theorem

$$\frac{d^n}{dx^n}(uv) = {}^nC_0\, u^{(n)}v + {}^nC_1\, u^{(n-1)}v' + {}^nC_2\, u^{(n-2)}v'' + \cdots\cdots + {}^nC_{n-1}u'v^{n-1} + {}^nC_n\, u v^n$$

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