CEGEP CHAMPLAIN ST. LAWRENCE CHAMPLAIN REGIONAL COLLEGE

MATHEMATICS 201-NYB-05
Integral Calculus
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Rules of Differentiation

Definition

$$f'(x)=\lim_{\Delta x\to 0}\frac{f(x+\Delta x)-f(x)}{\Delta x}$$

Alternative Definition

$$f'(x)=\lim_{t\to x}\frac{f(t)-f(x)}{t-x}$$

Rules

1. $(cf)'=cf'$
2. $(f+g)'=f'+g'$
3. $(f-g)'=f'-g'$
4. $(fg)'=f'g+fg'$
5. $\left(\frac{f}{g}\right)'=\frac{f'g-fg'}{g^2}$
6. $\frac{d}{dx}\left[f(g(x))\right]=f'(g(x))g'(x)$ or $\frac{dy}{dx}=\frac{dy}{du}\frac{du}{dx}$
7. $\frac{d}{dx}[c]=0$
8. $\frac{d}{dx}\left[x^n\right]=nx^{n-1}$
9. $\frac{d}{dx}\left[e^x\right]=e^x$
10. $\frac{d}{dx}\left[a^x\right]=a^x\ln a$
11. $\frac{d}{dx}[\ln x]=\frac{1}{x}$
12. $\frac{d}{dx}[\log_a x]=\frac{1}{x\ln a}$
13. $\frac{d}{dx}[\sin x]=\cos x$
14. $\frac{d}{dx}[\cos x]=-\sin x$
14. $\frac{d}{dx}[\tan x]=\sec^2 x$
16. $\frac{d}{dx}[\cot x]=-\csc^2 x$
17. $\frac{d}{dx}[\sec x]=\sec x\tan x$
18. $\frac{d}{dx}[\csc x]=-\csc x\cot x$
19. $\frac{d}{dx}[\arcsin x]=\frac{1}{\sqrt{1-x^2}}$
20. $\frac{d}{dx}[\arccos x]=-\frac{1}{\sqrt{1-x^2}}$
21. $\frac{d}{dx}[\arctan x]=\frac{1}{1+x^2}$
22. $\frac{d}{dx}[\operatorname{arc\,cot} x]=-\frac{1}{1+x^2}$
23. $\frac{d}{dx}[\operatorname{arc\,sec} x]=\frac{1}{x\sqrt{x^2-1}}$
24. $\frac{d}{dx}[\operatorname{arc\,csc} x]=-\frac{1}{x\sqrt{x^2-1}}$

Parametric Equations

$$\begin{cases}x=f(t)\\ y=g(t)\end{cases}$$

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

$$\frac{d^2y}{dx^2}=\frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$$