Simple Differentiation And Succesive Differentiation

Formulas of differentiation

① $\frac{d}{dx}(c) = 0$

② $\frac{d}{dx}(x^n) = nx^{n-1}$

③ $\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

④ $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$

⑤ $\frac{d}{dx}[f(x)\,g(x)] = f(x)\frac{d}{dx}[g(x)] + g(x)\frac{d}{dx}[f(x)]$

⑥ $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\frac{d}{dx}[f(x)] - f(x)\frac{d}{dx}[g(x)]}{[g(x)]^2}$

⑦ $\frac{d}{dx}(\sin x) = \cos x$

⑧ $\frac{d}{dx}(\cos x) = -\sin x$

⑨ $\frac{d}{dx}(\tan x) = \sec^2 x$

⑩ $\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$

⑪ $\frac{d}{dx}(\sec x) = \sec x \tan x$

⑫ $\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$

⑬ $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$

⑭ $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$

⑮ $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$

⑯ $\frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2}$

⑰ $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}}$

⑱ $\frac{d}{dx}(\operatorname{cosec}^{-1} x) = -\frac{1}{\sqrt{x^2-1}}$

⑲ $\frac{d}{dx}(a^x) = a^x \ln a$

⑳ $\frac{d}{dx}(\ln x) = \frac{1}{x}$

Formula For Integration

1. $\int x^n dx = \frac{x^{n+1}}{n+1} + c$
2. $\int \sin x dx = -\cos x + c$
3. $\int \cos x dx = \sin x + c$
4. $\int \tan x dx = -\ln|\cos x| + c$
5. $\int \cot x dx = \ln|\sin x| + c$
6. $\int \sec x \tan x dx = \sec x + c$
7. $\int \operatorname{cosec} x \cdot \cot x dx = -\operatorname{cosec} x + c$
8. $\int e^x dx = e^x + c$
9. $\int e^{mx} dx = \frac{e^{mx}}{m} + c$
10. $\int a^x dx = \frac{a^x}{\ln a} + c$
11. $\int \ln x dx = x \ln x - x + c$
12. $\int \frac{1}{x} dx = \ln|x| + c$
13. $\int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \ln\left|\frac{a+x}{a-x}\right| + c$
14. $\int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \ln\left|\frac{x-a}{x+a}\right| + c$
15. $\int \frac{dx}{1+x^2} = \tan^{-1} x + c$
16. $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + c$
17. $\int \frac{x dx}{x^2 + a^2} = \frac{1}{2} \ln(x^2 + a^2) + c$
18. $\int \frac{dx}{\sqrt{1-x^2}} = \sin^{-1} x + c$
19. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \frac{x}{a} + c$
20. $\int \frac{x dx}{\sqrt{x^2 - a^2}} = \sqrt{x^2 - a^2} + c$