Basic Formulas of Derivatives

General Derivative Formulas:

1) $\frac{d}{dx}(c) = 0$ where c is any constant.

2) $\frac{d}{dx}x^n = nx^{n-1}$ is called the Power Rule of Derivatives.

3) $\frac{d}{dx}x = 1$

4) $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1}\frac{d}{dx}f(x)$ is the Power Rule for Functions.

5) $\frac{d}{dx}\sqrt{x} = \frac{1}{2\sqrt{x}}$

6) $\frac{d}{dx}\sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}}\frac{d}{dx}f(x) = \frac{1}{2\sqrt{f(x)}}f'(x)$

7) $\frac{d}{dx}c \cdot f(x) = c\frac{d}{dx}f(x) = c \cdot f'(x)$

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

9) $\frac{d}{dx}[f(x) \cdot g(x)] = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$ is called the Product Rule.

10) $\frac{d}{dx}[\frac{f(x)}{g(x)}] = \frac{g(x)\frac{d}{dx}f(x) - f(x)\frac{d}{dx}g(x)}{[g(x)]^2}$ is called the Quotient Rule.

Derivative of Logarithm Functions:

11) $\frac{d}{dx}\ln x = \frac{1}{x}$

12) $\frac{d}{dx}\log_a x = \frac{1}{x \ln a}$

13) $\frac{d}{dx}\ln f(x) = \frac{1}{f(x)}\frac{d}{dx}f(x)$

14) $\frac{d}{dx}\log_a f(x) = \frac{1}{f(x)\ln a}\frac{d}{dx}f(x)$

Derivative of Exponential Functions:

15) $\frac{d}{dx}e^x = e^x$

16) $\frac{d}{dx}e^{f(x)} = e^{f(x)}\frac{d}{dx}f(x)$

17) $\frac{d}{dx}a^x = a^x \ln a$

18) $\frac{d}{dx}a^{f(x)} = a^{f(x)} \ln a \frac{d}{dx}f(x)$

19) $\frac{d}{dx}x^x = x^x(1+\ln x)$

Derivative of Trigonometric Functions:

20) $\frac{d}{dx}Sinx = Cosx$

21) $\frac{d}{dx}Cosx = -Sinx$

22) $\frac{d}{dx}Tanx = Sec^2x$

23) $\frac{d}{dx}Cotx = -Cosec^2x$

24) $\frac{d}{dx}Secx = Secx \cdot Tanx$

25) $\frac{d}{dx}Cosec\,x = -Cosec\,x \cdot Cotx$

Derivative of Hyperbolic Functions:

26) $\frac{d}{dx}Sinhx = Coshx$

27) $\frac{d}{dx}Coshx = Sinhx$

28) $\frac{d}{dx}Tanhx = Sech^2 x$

29) $\frac{d}{dx}Cothx = -Co\sec h^2 x$

30) $\frac{d}{dx}Sechx = -Sechx \cdot Tanhx$

31) $\frac{d}{dx}Ce\sec hx = -Co\sec hx \cdot Cothx$

Derivative of Inverse Trigonometric Functions:

32) $\frac{d}{dx}Sin^{-1}x = \frac{1}{\sqrt{1-x^2}},\ -1 < x < 1$

33) $\frac{d}{dx}Cos^{-1}x = \frac{-1}{\sqrt{1-x^2}},\ -1 < x < 1$

34) $\frac{d}{dx}Tan^{-1}x = \frac{1}{1+x^2}$

35) $\frac{d}{dx}Cot^{-1}x = \frac{-1}{1+x^2}$

36) $\frac{d}{dx}Sec^{-1}x = \frac{1}{x\sqrt{x^2-1}},\ |x| > 1$

37) $\frac{d}{dx}Cosec^{-1}x = \frac{-1}{x\sqrt{x^2-1}},\ |x| > 1$

Derivative of Inverse Hyperbolic Functions:

38) $\frac{d}{dx}Sinh^{-1}x = \frac{1}{\sqrt{1+x^2}}$

39) $\frac{d}{dx}Cosh^{-1}x = \frac{1}{\sqrt{x^2-1}}$

40) $\frac{d}{dx}Tanh^{-1}x = \frac{1}{1-x^2},\ |x| < 1$

41) $\frac{d}{dx}Coth^{-1}x = \frac{1}{x^2-1},\ |x| > 1$

42) $\frac{d}{dx}Sech^{-1}x = \frac{-1}{x\sqrt{1-x^2}},\ 0 < x < 1$

43) $\frac{d}{dx}Co\sec h^{-1}x = \frac{-1}{x\sqrt{1+x^2}},\ x > 0$