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**REFERENCE PAGES**

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**DIFFERENTIATION RULES**

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## GENERAL FORMULAS

1.  $\frac{d}{dx}(c) = 0$

3.  $\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$

5.  $\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$  (Product Rule)

7.  $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$  (Chain Rule)

2.  $\frac{d}{dx}[cf(x)] = cf'(x)$

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

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

8.  $\frac{d}{dx}(x^n) = nx^{n-1}$  (Power Rule)

## EXPONENTIAL AND LOGARITHMIC FUNCTIONS

9.  $\frac{d}{dx}(e^x) = e^x$

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

10.  $\frac{d}{dx}(a^x) = a^x \ln a$

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

## TRIGONOMETRIC FUNCTIONS

13.  $\frac{d}{dx}(\sin x) = \cos x$

16.  $\frac{d}{dx}(\csc x) = -\csc x \cot x$

14.  $\frac{d}{dx}(\cos x) = -\sin x$

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

15.  $\frac{d}{dx}(\tan x) = \sec^2 x$

18.  $\frac{d}{dx}(\cot x) = -\csc^2 x$

## INVERSE TRIGONOMETRIC FUNCTIONS

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

22.  $\frac{d}{dx}(\csc^{-1}x) = -\frac{1}{x\sqrt{x^2-1}}$

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

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

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

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

## HYPERBOLIC FUNCTIONS

25.  $\frac{d}{dx}(\sinh x) = \cosh x$

28.  $\frac{d}{dx}(\operatorname{csch} x) = -\operatorname{csch} x \coth x$

26.  $\frac{d}{dx}(\cosh x) = \sinh x$

29.  $\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \tanh x$

27.  $\frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$

30.  $\frac{d}{dx}(\operatorname{coth} x) = -\operatorname{csch}^2 x$

## INVERSE HYPERBOLIC FUNCTIONS

31.  $\frac{d}{dx}(\sinh^{-1}x) = \frac{1}{\sqrt{1+x^2}}$

34.  $\frac{d}{dx}(\operatorname{csch}^{-1}x) = -\frac{1}{|x|\sqrt{x^2+1}}$

32.  $\frac{d}{dx}(\cosh^{-1}x) = \frac{1}{\sqrt{x^2-1}}$

35.  $\frac{d}{dx}(\operatorname{sech}^{-1}x) = -\frac{1}{x\sqrt{1-x^2}}$

33.  $\frac{d}{dx}(\tanh^{-1}x) = \frac{1}{1-x^2}$

36.  $\frac{d}{dx}(\operatorname{coth}^{-1}x) = \frac{1}{1-x^2}$