

DIFFERENTIATION RULES

GENERAL FORMULAS

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| 1. $\frac{d}{dx}(c) = 0$ | 2. $\frac{d}{dx}[cf(x)] = cf'(x)$ |
| 3. $\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$ | 4. $\frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x)$ |
| 5. $\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$ (Product Rule) | 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) |
| 7. $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$ (Chain Rule) | 8. $\frac{d}{dx}(x^n) = nx^{n-1}$ (Power Rule) |

EXPONENTIAL AND LOGARITHMIC FUNCTIONS

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| 9. $\frac{d}{dx}(e^x) = e^x$ | 10. $\frac{d}{dx}(a^x) = a^x \ln a$ |
| 11. $\frac{d}{dx} \ln x = \frac{1}{x}$ | 12. $\frac{d}{dx}(\log_a x) = \frac{1}{x \ln a}$ |

TRIGONOMETRIC FUNCTIONS

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| 13. $\frac{d}{dx}(\sin x) = \cos x$ | 14. $\frac{d}{dx}(\cos x) = -\sin x$ | 15. $\frac{d}{dx}(\tan x) = \sec^2 x$ |
| 16. $\frac{d}{dx}(\csc x) = -\csc x \cot x$ | 17. $\frac{d}{dx}(\sec x) = \sec x \tan x$ | 18. $\frac{d}{dx}(\cot x) = -\csc^2 x$ |

INVERSE TRIGONOMETRIC FUNCTIONS

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| 19. $\frac{d}{dx}(\sin^{-1}x) = \frac{1}{\sqrt{1-x^2}}$ | 20. $\frac{d}{dx}(\cos^{-1}x) = -\frac{1}{\sqrt{1-x^2}}$ | 21. $\frac{d}{dx}(\tan^{-1}x) = \frac{1}{1+x^2}$ |
| 22. $\frac{d}{dx}(\csc^{-1}x) = -\frac{1}{x\sqrt{x^2-1}}$ | 23. $\frac{d}{dx}(\sec^{-1}x) = \frac{1}{x\sqrt{x^2-1}}$ | 24. $\frac{d}{dx}(\cot^{-1}x) = -\frac{1}{1+x^2}$ |

HYPERBOLIC FUNCTIONS

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| 25. $\frac{d}{dx}(\sinh x) = \cosh x$ | 26. $\frac{d}{dx}(\cosh x) = \sinh x$ | 27. $\frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$ |
| 28. $\frac{d}{dx}(\operatorname{csch} x) = -\operatorname{csch} x \coth x$ | 29. $\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \tanh x$ | 30. $\frac{d}{dx}(\operatorname{coth} x) = -\operatorname{csch}^2 x$ |

INVERSE HYPERBOLIC FUNCTIONS

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| 31. $\frac{d}{dx}(\sinh^{-1}x) = \frac{1}{\sqrt{1+x^2}}$ | 32. $\frac{d}{dx}(\cosh^{-1}x) = \frac{1}{\sqrt{x^2-1}}$ | 33. $\frac{d}{dx}(\tanh^{-1}x) = \frac{1}{1-x^2}$ |
| 34. $\frac{d}{dx}(\operatorname{csch}^{-1}x) = -\frac{1}{ x \sqrt{x^2+1}}$ | 35. $\frac{d}{dx}(\operatorname{sech}^{-1}x) = -\frac{1}{x\sqrt{1-x^2}}$ | 36. $\frac{d}{dx}(\operatorname{coth}^{-1}x) = \frac{1}{1-x^2}$ |