

DIFFERENTIATION RULES

GENERAL FORMULAS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

HYPERBOLIC FUNCTIONS

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

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

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

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

$$\cancel{32.} \frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$$

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

INVERSE HYPERBOLIC FUNCTIONS

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

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

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

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

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

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