IG: elevateiq_tutoring
Email: elevateiqtutor@gmail.com

Common derivatives

Common Derivatives

Polynomials

$\frac{d}{dx}(c) = 0$ $\quad \frac{d}{dx}(x) = 1$ $\quad \frac{d}{dx}(cx) = c$ $\quad \frac{d}{dx}(x^n) = nx^{n-1}$ $\quad \frac{d}{dx}(cx^n) = ncx^{n-1}$

Trig Functions

$\frac{d}{dx}[\sin(x)] = \cos(x)$ $\quad \frac{d}{dx}[\cos(x)] = -\sin(x)$ $\quad \frac{d}{dx}[\tan(x)] = \sec^2(x)$

$\frac{d}{dx}[\csc(x)] = -\csc(x)\cot(x)$ $\quad \frac{d}{dx}[\sec(x)] = \sec(x)\tan(x)$ $\quad \frac{d}{dx}[\cot(x)] = -\csc^2(x)$

Inverse Trig Functions

$\frac{d}{dx}[\sin^{-1}(x)] = \frac{1}{\sqrt{1-x^2}}$ $\quad \frac{d}{dx}[\cos^{-1}(x)] = -\frac{1}{\sqrt{1-x^2}}$ $\quad \frac{d}{dx}[\tan^{-1}(x)] = \frac{1}{1+x^2}$

$\frac{d}{dx}[\csc^{-1}(x)] = -\frac{1}{|x|\sqrt{x^2-1}}$ $\quad \frac{d}{dx}[\sec^{-1}(x)] = \frac{1}{|x|\sqrt{x^2-1}}$ $\quad \frac{d}{dx}[\cot^{-1}(x)] = -\frac{1}{1+x^2}$

Exponential & Logarithm Functions

$\frac{d}{dx}[a^x] = a^x \ln(a)$ $\quad \frac{d}{dx}[\mathbf{e}^x] = \mathbf{e}^x$

$\boxed{\frac{d}{dx}[\ln(x)] = \frac{1}{x}}, \ x > 0$ $\quad \frac{d}{dx}[\ln|x|] = \frac{1}{x}, \ x \neq 0$ $\quad \frac{d}{dx}[\log_a(x)] = \frac{1}{x\ln(a)}, \ x > 0$

Hyperbolic Functions

$\frac{d}{dx}[\sinh(x)] = \cosh(x)$ $\quad \frac{d}{dx}[\cosh(x)] = \sinh(x)$ $\quad \frac{d}{dx}[\tanh(x)] = \operatorname{sech}^2(x)$

$\frac{d}{dx}[\operatorname{csch}(x)] = -\operatorname{csch}(x)\coth(x)$ $\quad \frac{d}{dx}[\operatorname{sech}(x)] = -\operatorname{sech}(x)\tanh(x)$ $\quad \frac{d}{dx}[\coth(x)] = -\operatorname{csch}^2(x)$

$\frac{d}{dx}(x^n)$

$x^3 \to 3n^{3-1}$

$\to 3n^2$

$\frac{d}{dx}(\sin(x)) \to \cos(x)$

$\frac{d}{dx}\cos(x) \to -\sin(x)$

Examples:

1) $F(x) = \underbrace{x^3}_{g(x)} + \underbrace{e^x}_{h(x)}$

Polynomial and exponential Derivatives

Sum Rule: $F(x) = g(x) + h(x)$

$F'(x) = g'(x) + h'(x)$

Constant multiple rule: $F(x) = C \cdot g(x)$

$F'(x) = C \cdot g'(x)$

$g(x) = x^3 \quad h(x) = e^x$

$g'(x) = 3 \cdot x^{3-1}$

$= 3x^2$

$h'(x) = e^x$

$F'(x) = 3x^2 + e^x$

2) $F(x) = \underbrace{\sin(x)}_{g(x)} + \underbrace{\cos(x)}_{h(x)}$

Trig Derivatives

Sum rule: $F(x) = g(x) + h(x)$

$F'(x) = g'(x) + h'(x)$

$g'(x) = \cos(x)$ — $g(x) = \sin(x)$

$h'(x) = -\sin(x)$ ← $h(x) = \cos(x)$

$F'(x) = \underbrace{\cos(x)}_{g'(x)} \overset{+}{-} \underbrace{\sin(x)}_{h'(x)} \to \underbrace{\cos(x)}_{g'(x)} + \underbrace{(-\sin(x))}_{h'(x)} \to \cos(x) - \sin(x)$

$- \times + = -$

3) $F(x) = \underbrace{\ln(x)}_{g(x)} + \underbrace{\tan^{-1}(x)}_{h(x)}$ → arctan(x)

Logarithmic and inverse Trig

Sum Rule: $F(x) = g(x) + h(x)$

$F'(x) = g'(x) + h'(x)$

$g'(x) = \frac{1}{x} \to \ln(x)$

$h'(x) = \frac{1}{1+x^2} \to \tan^{-1}(x)$

$F'(x) = \underbrace{\frac{1}{x}}_{g'(x)} + \underbrace{\frac{1}{1+x^2}}_{h'(x)}$