DERIVATIVE OF THE NATURAL EXPONENTIAL FUNCTION

\[ \frac{d}{dx} (e^x) = e^x \]

THE POWER RULE (GENERAL VERSION) If \( n \) is any real number, then

\[ \frac{d}{dx} (x^n) = nx^{n-1} \]

\[ \frac{d}{dx} (c) = 0 \quad \frac{d}{dx} (x^n) = nx^{n-1} \quad \frac{d}{dx} (e^x) = e^x \]

\( (cf)' = cf' \quad (f + g)' = f' + g' \quad (f - g)' = f' - g' \)

\[ (fg)' = fg' + gf' \quad \left( \frac{f}{g} \right)' = \frac{gf' - fg'}{g^2} \]

DERIVATIVES OF TRIGONOMETRIC FUNCTIONS

\[ \frac{d}{dx} (\sin x) = \cos x \]
\[ \frac{d}{dx} (\csc x) = -\csc x \cot x \]

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

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

THE CHAIN RULE If \( g \) is differentiable at \( x \) and \( f \) is differentiable at \( g(x) \), then the composite function \( F = f \circ g \) defined by \( F(x) = f(g(x)) \) is differentiable at \( x \) and \( F' \) is given by the product

\[ F'(x) = f'(g(x)) \cdot g'(x) \]

In Leibniz notation, if \( y = f(u) \) and \( u = g(x) \) are both differentiable functions, then

\[ \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} \]