University of Bahrain
Department of Mathematics
MATHS101: Calculus I
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Differentiation Rules

(1) $(c)' = 0$

(2) $(x)' = 1$

(3) $\left(\sqrt{x}\right)' = \dfrac{1}{2\sqrt{x}}$

(4) $\left(\dfrac{1}{x}\right)' = \dfrac{-1}{x^2}$

(5) (Power Rule)

$(x^n)' = nx^{n-1}$ $\quad - - -$ $(\text{variable})^{\text{number}}$

(6) (Derivative of the Trigonometic function)

$(\sin x)' = \cos x$ $\qquad$ $(\cos x)' = -\sin x$

$(\tan x)' = \sec^2 x$ $\qquad$ $(\cot x)' = -\csc x$

$(\sec x)' = \sec x \tan x$ $\qquad$ $(\csc x)' = -\csc x \cot x$

(7) (Derivative of the exponential function)

$(e^x)' = e^x$

$(a^x)' = a^x \ln a$ $\quad - - -$ $(\text{number})^{\text{variable}}$

(8) (Derivative of the logarithmic function)

$$(\ln x) = \frac{1}{x}$$

$$(\log_a x) = \frac{1}{x \ln a}$$

(9) (Derivative of the inverse function)

$$(f^{-1}(x))' = \frac{1}{f'(f^{-1}(x))}$$

(10) (Derivative of the Inverse Trigonometic functions)

$$(\sin^{-1} x)' = \frac{1}{\sqrt{1-x^2}} \qquad (\cos^{-1} x)' = \frac{-1}{\sqrt{1-x^2}}$$

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

$$(\sec^{-1} x)' = \frac{1}{|x|\sqrt{x^2-1}} \qquad (\csc^{-1} x)' = \frac{-1}{|x|\sqrt{x^2-1}}$$

1. Constant Multiple Rule

$$\begin{aligned}(cf(x))' &= c \cdot f'(x) \\ &= c \cdot \text{Derivative of the function}\end{aligned}$$

2. Sum Rule

$$\begin{aligned}(f(x)+g(x))' &= f'(x)+g'(x) \\ &= \text{Derivative of first} + \text{Derivative of second}\end{aligned}$$

3. Product Rule

$$\begin{aligned}(f(x)g(x))' &= f'(x)g(x)+f(x)g'(x) \\ &= (\text{derivative of first})\,(\text{second}) + (\text{first})(\text{derivative of second})\end{aligned}$$

4. Quotient Rule

$$\begin{aligned}\left(\frac{f(x)}{g(x)}\right)' &= \frac{g(x)f'(x)-f(x)g'(x)}{g(x)^2} \\ &= \frac{(\text{deno})(\text{derivative of numerator}) - (\text{num})(\text{derivative of denominator})}{(\text{denominator})^2}\end{aligned}$$

5. Chain Rule

$$\begin{aligned}(f(g(x)))' &= f'(g(x)) \cdot g'(x) \\ &= \text{derivative of outer}\,(\text{inner}) \cdot (\text{derivative of inner})\end{aligned}$$