University of Bahrain
Department of Mathematics
MATHS104: Business Mathematics II
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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) $(x^n)' = nx^{n-1}$ — — — $(\text{variable})^{\text{number}}$

(6) $(\ln x) = \dfrac{1}{x}$

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

(8) $(a^x)' = a^x \ln a$ — — — $(\text{number})^{\text{variable}}$

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

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

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

5. Chain Rule

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