University of Oum el Bouaghi 2024/2025
Faculty of SESNV
Department of Biology
Module : Mathematics-Statistics

Serie Tutorial $N^0 1$

Exercise 0.1 *Determine the domain of definition of the following functions*
$f_1(x) = \dfrac{1}{4-x^2}$, $f_2(x) = \dfrac{1}{\sqrt{4-x^2}}$, $f_3(x) = \sqrt{x-x^3}$, $f_4(x) = \sqrt[3]{x+1}$, $f_5(x) = \ln\left(\dfrac{2+x}{2-x}\right)$,
$f_6(x) = \sqrt{\dfrac{x^2-2}{(x-1)(x+1)}}$, $f_7(x) = \dfrac{\cos x}{e^x-1}$, $f_8(x) = \sqrt{\ln(x)+1}$

Exercise 0.2 *Calculate the following limits*
$\lim\limits_{x\to0} \dfrac{x}{\sqrt{1-x^2}-\sqrt{1+x}}$, $\lim\limits_{x\to1} \dfrac{\ln x}{x-1}$, $\lim\limits_{x\to0} \dfrac{\ln(1+x^2)}{\sin^2 x}$, $\lim\limits_{x\to0} \dfrac{\ln(1+x)-x}{x^2}$,
$\lim\limits_{x\to+\infty} \dfrac{\ln(1+e^{2x})}{x}$, $\lim\limits_{x\to4} \dfrac{3-\sqrt{x+5}}{1-\sqrt{5-x}}$, $\lim\limits_{x\to+\infty} \sqrt{x^2+4x+3}-(x+2)$,

Exercise 0.3 *I) Study the continuity of the following functions*

$$f_1(x) = \frac{x^2}{x-2},\ f_2(x) = \ln\left(\frac{2+x}{2-x}\right)$$

II) Can we extend by continuity at the point $x_0 = 0$ the following functions?

$$f_1(x) = \frac{1-\cos x}{x^2},\ \ f_2(x) = \frac{e^x - e^{-x}}{x}$$

Exercise 0.4 *Let f a function defined by*

$$\begin{cases} \dfrac{2x}{1+x^2} & \text{if } x \in [-1,0] \\ \sqrt{x} & \text{if } x \in [0,3] \end{cases}$$

1) Determine if the function f is continuous and differentiable at the points: $x_0 = -1$; $x_0 = 0$ and $x_0 = 3$:
2) Discuss the continuity and differentiability of f in its domain of definition.
3) Determine $f'(x)$ at the points where it is differentiable.

Exercise 0.5 *Evaluate the following integrals*

$$\int \frac{x}{\sqrt{25-x^2}}dx,\quad \int \frac{x+1}{x^2}dx,\quad \int x\cos(x^2)dx,\quad \int \sin(2x)\,dx,$$
$$\int \frac{x^2}{1-x^2}dx,\quad \int \frac{dx}{(1+x)(1+x^2)},\quad \int \frac{dx}{(x^2+2x-3)},$$