UNIVERSITY OF MOHAMED KHIDER BISKRA
FACULTY OF EXACT SCIENCES AND NATURAL AND LIFE SCIENCES
TCSNV DEPARTMENT

FIRST WORKSHEET

First Year

Exercise 1

Consider the function f defined by:

$$f(x) = \frac{2x-4}{x+1}$$

a) Determine the natural domain of definition of the function f, denoted D_f.

b) Identify any points of discontinuity for the function f. Justify your answer using limits.

c) Calculate the limits of f at the boundaries of its domain (at $\pm\infty$).

d) Calculate the derivative function $f'(x)$.

e) Based on the derivative calculated in d), is the function f differentiable over its entire domain? Explain.

f) Given the function

$$g(x) = \frac{2x+2}{x+1},$$

calculate its limit at $x = -1$.

Exercise 2

Consider the function g defined piecewise by:

$$g(x) = \begin{cases} x^2 + ax + 1 & \text{if } x \leq 2 \\ 3x - b & \text{if } x > 2 \end{cases}$$

where a and b are real constants.

a) Determine the limit of $g(x)$ as x approaches 2 from the left ($\lim_{x\to 2^-} g(x)$) and from the right ($\lim_{x\to 2^+} g(x)$), in terms of a and b.

b) Find the values of constants a and b such that the function $g(x)$ is continuous at $x = 2$.

c) For the values of a and b found in question b), is the function $g(x)$ differentiable at $x = 2$? Justify your answer by comparing left-hand and right-hand derivatives.