MEMORIAL UNIVERSITY OF NEWFOUNDLAND
DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 4 **MATHEMATICS 1000** FALL 2022

Due: Wednesday, October 19th, 2022 at 11:59pm. Show all work. See the Gradescope Handout for submission information.

> **Note:** For this assignment, differentiation may be performed only by using the limit definition of the derivative. (The alternative limit definition may also be used, where appropriate.) You should complete Worksheet 2.2 before you work on this assignment.

1. Differentiate the function
$$y = \frac{4x}{x-3}.$$

2. Find the equation of the line that is tangent to the graph of $f(x) = \sqrt{x+4}$ at the point $x = -3$.

3. Given that each of the following functions is continuous at $x = 1$, determine whether it is also differentiable at $x = 1$.

   (a) $f(x) = \begin{cases} \dfrac{4x^2 - 8x + 4}{x^2 - 1}, & \text{for } x < 1 \\ 3x^2 - 4x + 1, & \text{for } x \geq 1 \end{cases}$

   (b) $g(x) = \begin{cases} \dfrac{4x^2 - 8x + 4}{x^2 - 1}, & \text{for } x < 1 \\ 1 - x, & \text{for } x \geq 1 \end{cases}$