MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 4 **MATHEMATICS 1000** FALL 2025

Due: Monday, October 27th, 2025 at 6:00pm. 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. Use the limit definition of the derivative to differentiate

$$f(x) = \frac{3x}{x+2}.$$

2. Consider the function $f(x) = x^3 - 5x + 1$.

   (a) Use the limit definition to find the derivative $f'(x)$.

   (b) Determine the equation of the line that is tangent to the curve $y = f(x)$ at the point $x = -2$.

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

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

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