MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

Assignment 5

MATHEMATICS 1000

Fall 2025

Due: Monday, November 3rd, 2025 at 6:00pm. See the Gradescope Handout for submission information.

Note: You should complete the WeBWorK problem sets "Derivatives of Algebraic Functions," "Algebraic Products and Quotients," "Derivatives of Trigonometric Functions", "Trigonometric Products and Quotients", "The Chain Rule" and "Derivatives of Exponential Functions", as well as Worksheets 2.3, 2.4, 3.1 and 3.2, before you work on this assignment. Beginning with this assignment, you may use the rules of differentiation rather than the limit definition of the derivative, unless otherwise noted.

- 1. Differentiate each of the following functions.
 - (a) $g(t) = \frac{t^2 e^t}{t^2 + e^t}$
 - (b) $y = 2^x \sin(x) \cos(x)$
 - (c) $y = e^{x \cot(x)}$
 - (d) $f(x) = \sec^5(x^3)$
- 2. A certain object moves in a straight line such that its position varies *cubically*. This means that, after t seconds, its position in metres is given by a function of the form

$$s(t) = At^3 + Bt^2 + Ct + D.$$

It is known that the object is initially at rest and that its starting position is 0 metres. A measuring device positioned at -36 metres records the object's presence there twice, at 2 seconds and at 6 seconds. Use calculus to determine the values of the constants A, B, C and D.