MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 5 **MATHEMATICS 1000** FALL 2024

Due: Friday, October 25th, 2024 at 11:59pm. 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" and "Trigonometric Products and Quotients", as well as Worksheets 2.3, 2.4 and 3.1, 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) $f(x) = \dfrac{x - \cos(x)}{x + \cos(x)}$

   (b) $f(x) = \dfrac{x\cos(x)}{x + \cos(x)}$

   (c) $f(x) = \dfrac{x + \cos(x)}{x\cos(x)}$

   (d) $y = e^x \csc(x)\cot(x)$

2. If we neglect air resistance, the position of an object moving vertically through the air can be described by

$$s(t) = \frac{1}{2}gt^2 + v_0 t + s_0,$$

   where $g \approx -9.8$ m/sec^2 is the acceleration due to gravity, v_0 is the object's initial velocity, and s_0 is its initial position. Such an object is launched from the ground and rises to a maximum height of 250 metres. Use calculus to determine the exact value of its initial velocity.