MEMORIAL UNIVERSITY OF NEWFOUNDLAND
DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 5 **MATHEMATICS 1001** WINTER 2023

Due: Monday, March 20th, 2023 at 11:59pm. See the Gradescope Handout for submission information.

> **Note:** You should complete the WebAssign problem sets "The Fundamental Theorem of Calculus I", "The Fundamental Theorem of Calculus II", and "Definite Integrals by u-Substitution", as well as Worksheet 2.3, before you work on this assignment.

1. Use the First Fundamental Theorem of Calculus to find $f'(x)$, given

$$f(x) = \int_{-x}^{\sqrt{x}} \cos(t^2)\, dt.$$

2. Use the Second Fundamental Theorem of Calculus to evaluate each of the following definite integrals.

   (a) $\displaystyle \int_{1}^{e} \sqrt{x}\ln(x)\, dx$

   (b) $\displaystyle \int_{0}^{\pi} \sin(2t)\cos(2t)\sin(\cos(2t))\, dt$

3. Given the piecewise function

$$f(x) = \begin{cases} 5x + 6, & x < -2 \\ -4, & -2 \le x \le 1 \\ 3\sqrt{x} - 7, & x > 1 \end{cases}$$

   determine $\displaystyle \int_{-1}^{9} f(x)\, dx$.

4. Find the area of the region which lies under the curve

$$y = \frac{1}{2x^2 + 6x + 9},$$

   above the x-axis, and between the line $x = -\frac{3}{2}$ and the y-axis.