MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 5 **MATHEMATICS 1001** WINTER 2025

Due: Monday, March 10th, 2025 at 11:59pm. See the Gradescope Handout for submission information.

> **Note:** You should complete the WeBWorK 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

$$f(x) = \int_x^{5x} \sqrt{1+t^4}\, dt.$$

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

   (a) $\displaystyle\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \sin^3(\theta)\cos(\theta)\, d\theta$

   (b) $\displaystyle\int_1^e \frac{\ln(x)}{x^3}\, dx$

   (c) $\displaystyle\int_{-5}^{5} |x+2|\, dx$

3. Use the Fundamental Theorem of Calculus to find the area of the region which lies under the curve $f(x) = \dfrac{1}{x^2+25}$ and between the lines $x = 0$ and $x = 5$.