MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 7 **MATHEMATICS 1001** FALL 2025

Due: Friday, November 28th at 6:00pm. See the Gradescope Handout for submission information.

> **Note:** You should complete the WeBWorK problem sets "Integrals by Trigonometric Substitution" and "Improper Integrals", as well as Worksheets 3.3, 3.4, 4.1 and 4.2, before you work on this assignment.

1. Use a trigonometric substitution to evaluate each of the following.

   (a) $\displaystyle\int \frac{1}{x\sqrt{9-x^2}}\,dx$

   (b) $\displaystyle\int_{\sqrt{2}}^{2} \frac{24}{x^3\sqrt{x^2-1}}\,dx$

2. Evaluate the improper integral

$$\int_0^{\infty} \frac{e^x}{e^{2x}+1}\,dx$$

   or show that it is divergent.

3. Solve the initial value problem

$$t^3\frac{dy}{dt} - 8\sec(y) = 0, \quad y(1) = \frac{\pi}{2}.$$

4. Loss of habitat is impacting a herd of Peary caribou near the Arctic circle, causing their numbers to dwindle in proportion to the current size of the population. A team of scientists is tracking the herd, and they count 200 caribou. They return to the area 1 year later, and find that only 120 caribou remain. Approximately how many caribou were there in the herd 2 years before the start of the study?