MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 7 **MATHEMATICS 1000** FALL 2025

Due: Monday, November 24th, 2025 at 6:00pm. See the Gradescope Handout for submission information.

> **Note:** You should complete the WeBWorK problem sets "Inverse Trigonometric Functions", "Derivatives of Hyperbolic Functions" and "Higher Derivatives", as well as Worksheets 3.5 to 4.1, before you work on this assignment.

1. Find the equation of the line that is tangent to the curve

$$f(x) = \arctan\left(\frac{1}{x^2}\right)$$

at the point $x = 1$.

2. Find $\dfrac{d^2y}{dx^2}$ for each of the following.

(a) $y = \sinh\left(\sqrt{x}\right)$

(b) $xy = x^2 - y^2$

3. A 5-foot-tall woman walks away from a lamppost that is 20 feet high, casting her shadow on the ground in front of her. If she walks at a constant rate of 4 feet/sec, at what rate is the length of her shadow changing?

4. Ruby and Belinda are playing a location-based smartphone game, which involves capturing virtual-reality "monsters" in their vicinity. One day, Ruby discovers that there is an ultra-rare Derivitite monster situated 1200 metres south of her location. She runs towards it at a constant speed of 6 metres per second. She texts Belinda, who is just 400 metres east of the Derivitite. Belinda is playing with her baby daughter, so it takes her one minute to notice the message, and she can only move towards the monster at 2 metres per second. Determine the rate at which the distance between Ruby and Belinda is changing exactly two minutes after Belinda reads Ruby's text.