

# MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

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ASSIGNMENT 7

MATHEMATICS 1000

FALL 2023

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**Due: Monday, November 20th, 2023 at 4:00pm. SHOW ALL WORK.**

**Note:** You should complete the WebAssign problem sets “Derivatives of Logarithmic Functions”, “Inverse Trigonometric Functions”, “Derivatives of Hyperbolic Functions” and “Higher Derivatives”, as well as Worksheets 3.4, 3.5, 3.6, 3.7 and 4.1, before you work on this assignment.

1. Use logarithmic differentiation to differentiate each of the following.

(a)  $y = (x^2 + 3)^{x^3 - 4}$

(b)  $y = \frac{x\sqrt{x^5 + 3}}{e^x \cosh^4(x)}$

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

(a)  $y = \arcsin(x) \arccos(x)$

(b)  $x^3 - y^2 = 4$

3. Complete each of the following related rates problems.

(a) An airplane, flying at an altitude of 12 km and a speed of 250 km/hr, passes directly over a radar antenna. Some time later, the radar detects that the distance to the plane along the direct line of sight is 13 km. How quickly is this distance changing?

(b) A girl who is 3 feet tall walks at a rate of 2 feet per second away from a streetlamp that is 15 feet above the ground, so that the light casts a shadow in front of the girl. When the girl is 10 feet from the lamppost, at what rate is the length of her shadow changing?