Calculus I (UN1101) Practice Midterm #2

Instructor: Robin Zhang

Student Name (UNI): _____

Instructions:

This exam contains **7 pages** (including this cover page) and **5 questions**. The total number of possible points is **35 points**. You will have **60 minutes** to complete this exam.

- **Print your name and UNI** in the space above.
- **Answer the questions in the space provided** on the question sheets. You may use extra paper.
- **Clearly identify and simplify your answers**. You will not receive full credit if there are multiple apparent answers, even if one of them is correct.
- **Write legibly and show your work**. You may receive partial credit for intermediate steps. Correct answers without any reasoning or work will not receive full credit.
- **No calculators, computational devices, or consulting other people** during the duration of this exam. Any cheating will result in an automatic failing grade in the course and potential administrative action.
- **You may consult your notes and textbook** for this exam. This does not include WebAssign, Courseworks, or other online resources.

Do not write in the table to the right.

Question	Points	Score
1	11	
2	9	
3	5	
4	6	
5	4	
Total:	35	

1. Consider the function

$$f(x) = (3x - 1)e^{3x}$$

on the interval $[-2, 2]$.

(a) (3 points) Find $f'(x)$ and $f''(x)$.

(b) (4 points) What are the local maxima, local minima, absolute maxima, and absolute minima of $f(x)$ in the interval $[-2, 2]$?
Hint: You can use that $0 < e^{-6} < \frac{1}{100}$

(c) (2 points) What does the Mean Value Theorem tell you about $f(x)$ on the interval $[-2, 2]$?
Hint: first determine if $f(x)$ *even satisfies the conditions of the Mean Value Theorem!*

(d) (2 points) Sketch a graph of the function on the interval $[-2, 2]$ with its endpoints, critical points, and local/absolute extrema.

2. Consider

$$y = \ln(x)^2 + e^{-x}$$
$$z = (x^2)^{\sin(x)}.$$

(a) (3 points) Find $\frac{dy}{dx}$.

(b) (3 points) Find $\frac{dz}{dx}$.

(c) (3 points) Use the linearization of y at $x = 1$ to approximate the value of y when $x = 2$.

3. Consider the curve given by the equation

$$3y^3 - 8x^7y = 4y$$

(a) (3 points) Find $\frac{dy}{dx}$ in terms of x and y.

(b) (2 points) Find the equation of the tangent line to the curve at $(1, 2)$.

4. Find the limit if it exists. If the limit does not exist, explain why.

   (a) (3 points)

$$\lim_{x \to 0^-} \frac{xe^x}{\tan(x)^2}$$

   (b) (3 points)

$$\lim_{x \to 0^+} \sqrt{x} \ln(x)$$

5. (4 points) A spherical tumor is growing in volume at a constant 2 cubic millimeters per month. How fast is the circumference of the tumor growing when the volume is 36 cubic millimeters?