

*I pledge that I have neither given nor received
unauthorized assistance during this examination.*

Signature:

- **DON'T PANIC!** If you get stuck, take a deep breath and go on to the next question.
- Unless the problem says otherwise **you must show your work** sufficiently much that it's clear to me how you arrived at your answer.
- You may use a scientific calculator on this exam, but you may not use a graphing calculator.
- You may bring a two-sided sheet of notes on letter-sized paper in your own handwriting.
- There are 6 problems on 8 pages.

Question	Points	Score
1	12	
2	8	
3	12	
4	12	
5	16	
6	12	
Total:	72	

Good luck!

1. Find the derivatives of the following functions. You do **not** need to simplify your solutions.

[3 points]

(a) $f(x) = x^2 \sin(2x)$

[3 points]

(b) $f(t) = \frac{2^t}{\ln t}$

[3 points] (c) $g(x) = \frac{1}{\sqrt[3]{x + \sqrt{x}}}$

[3 points] (d) $y = \frac{x^{2x}(x-1)^3}{(3+5x)^4}$

- [8 points] 2. Find the equation for the tangent line to the graph of $f(x) = \sqrt{x^2 + 5}$ at the point $(2, 3)$.

- [12 points] 3. A spherical snowball melts so that its surface area decreases at a rate of $1 \text{ cm}^2/\text{min}$. (The surface area of a sphere with radius r is $4\pi r^2$.) What is the rate of change of the radius of the snowball when it is equal to 5 cm?

4. Consider the graph of $y = 10x^3 - x^5$.

[4 points]

(a) List the intervals on which this function is increasing.

[1 point]

(b) Give the x -coordinates of all local minima, or say that there are none.

[1 point]

(c) Give the x -coordinates of all local maxima, or say that there are none.

[4 points] (d) List the intervals on which this function is concave up.

[2 points] (e) List the x -coordinates of all inflection points.

[8 points] 5. (a) Find the slope of the tangent line to the curve defined by

$$x^2y + y^4 = 4 + 2x$$

at the point $(-1, 1)$.

[8 points] (b) Using linear approximation, estimate a y -value on this curve when $x = -0.9$.

- [12 points] 6. Find the minimum and maximum value taken by the function $f(x) = 2\sqrt{x} - x$ in the interval $[0, 3]$.