

**DO NOT TURN OVER UNTIL
INSTRUCTED TO DO SO.**

CALCULATORS ARE NOT PERMITTED

**YOU MAY USE YOUR OWN BLANK
PAPER FOR ROUGH WORK**

**SO AS NOT TO DISTURB OTHER
STUDENTS, EVERYONE MUST STAY
UNTIL THE EXAM IS COMPLETE**

**REMEMBER THIS EXAM IS GRADED BY
A HUMAN BEING. WRITE YOUR
SOLUTIONS NEATLY AND
COHERENTLY, OR THEY RISK NOT
RECEIVING FULL CREDIT**

Name and section: _____

GSI's name: _____

This exam consists of 5 questions. Answer the questions in the spaces provided.

1. Find all first partial derivatives of the following functions:

(a) (10 points)

$$f(x, y) = \ln(x^4 + 9y^2)$$

Solution:

(b) (10 points)

$$f(x, y, z) = \frac{\cos(xyz)}{x + 1}$$

Solution:

PLEASE TURN OVER

2. (25 points) Calculate the following double integral

$$\iint_R \frac{3 + 5y}{\sqrt{x}} dx dy,$$

where R is the region given by $4 \leq x \leq 9$ and $1 \leq y \leq 2$.

Solution:

PLEASE TURN OVER

3. Let $f(x, y) = e^{x(y+1)}$

- (a) (10 points) Find all the possible relative maxima/minima using the first derivative test.

Solution:

- (b) (10 points) Use the second derivative test to determine the nature of each such point.

Solution:

PLEASE TURN OVER

4. (25 points) Using the method of Lagrange Multipliers, find three positive numbers whose sum is 30 and whose product is maximized. You may assume a maximum exists without justification.

Solution:

PLEASE TURN OVER

5. (20 points) Determine the total area enclosed by the graph $y = \sin(x)$ and the x -axis between $x = 0$ and $x = 4\pi/3$. Note that I am asking for the total area, namely the sum of the areas above and below the x -axis.

Solution:

END OF EXAM