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) (5 points)

   $$f(x, y) = \tan(y + 2x).$$

   Solution:

   (b) (15 points)

   $$f(x, y, z) = ye^{(xy+z)}.$$

   Solution:

2. Let $f(x, y) = x^2 + xy + y^2 - 6x - 3$.

   (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:

3. (20 points) Determine the area under the graph $y = \cos(x) + 1$ between $x = -\pi/4$ and $x = \frac{7\pi}{6}$. Simplify your answer as much as possible.

   Solution:

4. (25 points) Calculate the following double integral

$$\iint_R x^2 y^2 dx dy,$$

where R is the region enclosed by the lines $y = x$ and $y = -x$ between $x = -1$ and $x = 1$.

Solution:

5. (25 points) The profits from the sale of x units of radiators for automobiles and y units of radiators for generators is given by

$$P(x, y) = -x^2 - y^2 + 4x + 8y.$$

Find the values of x and y that lead to the maximum profit if the firm must produce 6 units of radiators. Use the method of Lagrange Multipliers to solve this problem. Be sure to justify why it is a maximum.

Solution:

END OF EXAM