

# EXAM 3

Math 102, Fall 2008-2009, Clark Bray.

You have 50 minutes.

No notes, no books, no calculators.

YOU MUST SHOW ALL WORK AND EXPLAIN ALL REASONING  
TO RECEIVE CREDIT. CLARITY WILL BE CONSIDERED IN GRADING.

Good luck!

Name \_\_\_\_\_

ID number \_\_\_\_\_

“I have adhered to the Duke Community  
Standard in completing this  
examination.”

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

Signature: \_\_\_\_\_

Total Score \_\_\_\_\_ (/100 points)

1. (20 pts) Use the Lagrange method to find the absolute maximum value of the function  $f(x, y) = y - 3x^2$  on the domain defined by  $y^2 - x^4 = 0$ . (You may assume for this problem the true fact that an absolute maximum value for this function on this domain is attained somewhere on this domain.)

2. (20 pts) Find the absolute maximum value of the function  $f(x, y) = x^2 + y^2$  on the solid triangle with vertices at the points  $(-2, 1)$ ,  $(1, -1)$  and  $(1, 1)$ .

3. (20 pts) Find the absolute maximum value of the function  $f(x, y, z) = x + 2y + 3z$  with the constraints that  $y^2 + z^2 = 1$  and  $x + y + z = 0$ .

4. (20 pts) The population density of Parabol county is given by  $\delta(x, y) = 3 + x + y$ . The county borders are the  $y$ -axis and the curve  $x + y^2 = 4$ . Write down a double integral representing the total population of Parabol county, rewrite it as a nested integral, and then evaluate.

5. (20 pts) Write the triple integral  $\iiint_D f \, dV$  as a single explicit nested integral, but do not evaluate. The domain  $D$  is bounded by the surfaces  $y = 0$ ,  $x = y$ ,  $x + y = 2$ ,  $z = 0$ ,  $z = 4 - x$ .