

# EXAM 3

Math 102, 2010-2011 Fall, 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.

All answers must be simplified. All of the policies and guidelines  
on the class webpages are in effect on this exam.

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) Find the absolute maximizer of the function  $f : \mathbb{R}^2 \rightarrow \mathbb{R}^2$  defined by

$$f(x, y) = -x^2 - 4y^2 + 3xy + 3x + 2y$$

2. (20 pts) Find the maximizers and minimizers of the function  $f$  defined by  $f(x, y, z) = x + 2y + 4z$  with the constraints that  $y^2 + z^2 = 1$  and  $2x - y + 3z = 2$ .

3. (20 pts) Find the absolute maximizer of the function  $f$  defined by  $f(x, y) = x^2 + y^2$  with constraints  $x \geq 0$ ,  $y \geq 0$ ,  $2x + 3y \leq 15$ ,  $3x + 2y \leq 15$ ,  $x + y \leq 5$ ,  $x - y = 2$ .

4. (20 pts) According to a market model that you have devised, the probability that the price of corn will rise above  $7\frac{3}{8}$  in the next year is expressed by the integral of the function  $f(s, t) = se^{s-t}$  on the domain defined by  $s - t \leq 0$ ,  $s \geq 0$ ,  $t \leq 1$ . Compute this probability.

5. (20 pts) The domain  $D$  is bounded by the surfaces  $y^2 + z^2 = 1$ ,  $x = -y^2 - 3z^2$ , and  $x + y + z^2 = 5$ . Write the triple integral  $\iiint_D f \, dV$  as a triple nested integral. (Do not evaluate the integral.)