

# EXAM 1

Math 212, 2014-2015 Spring, 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 \_\_\_\_\_

Disc.: Number \_\_\_\_\_ TA \_\_\_\_\_ Day/Time \_\_\_\_\_

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

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

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

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

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

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

6. \_\_\_\_\_

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

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

1. (20 pts) The lines  $L_1$  and  $L_2$  are parametrized by  $\vec{x} = (3 - 2t, 4t - 1, 3t + 2)$  and  $\vec{x} = (6t + 3, -1 - t, 2 - 2t)$ , respectively. Find the symmetric equations for the line that orthogonally intersects both  $L_1$  and  $L_2$ .

2. (20 pts) A plane is flying with position given by  $\vec{x}(t) = (t^2 - 3t, 2t, 4t^4 + 5)$ . At the moment when  $t = 1$ , what is the component of the planes velocity in the direction of the vector  $(12, 3, 4)$ ?

3. (20 pts) The surface  $S$  has equation  $4x^2 - y^2 + z^2 + 1 = 0$ . Give a clear description of what  $S$  looks like, and explain how you come to that conclusion.

4. (20 pts) Find a function  $h$  such that one of the level sets of  $h$  is the graph of the function  $f : \mathbb{R}^3 \rightarrow \mathbb{R}^1$  defined by  $f(x, y, z) = 3xy - xz^2 + e^{xyz}$ . What is the domain of  $h$ , and what is the target of  $h$ ?

5. (20 pts) Find the function  $G(x, y, z)$  that is the linear approximation to the function  $p(x, y, z) = xy^4 + ye^{z^2}$  at the point  $(3, 1, 0)$ .