EXAM 1

Math 212, 2016-2017 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 _____

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

1. _____

Signature: _____

2. _____

3. _____

4. _____

5. _____

Total Score _____ (/100 points)

1. *(20 pts)*

   (a) Find a vector that is perpendicular to both $(1, 2, 3)$ and $(2, 1, 1)$.

   (b) The component of $\vec{v} \times \vec{w}$ in the direction of the vector $\vec{x}$ is -2, and the volume of the parallelepiped defined by $\vec{v}, \vec{w}, \vec{x}$ is 6.

   Compute the magnitude of $\vec{x}$, and decide if the listing $\vec{x}, \vec{v}, \vec{w}$ is in left hand order or right hand order. What about the listing $\vec{v}, \vec{x}, \vec{w}$?

2. *(20 pts)* Find the symmetric equations for the line that is the intersection of the planes with equations below. Be sure to show all of the steps in the reasoning. *(Hint: Consider the possible relevance of the point $(1, 1, 1)$.)*

$$3x - 2y + z = 2 \quad \text{and} \quad x + 2y + z = 4$$

2

3. *(20 pts)* A particle is moving with its velocity vector given by $\vec{v}(t) = (4t, 3t^2, e^t)$ and initial position $\vec{x}(0) = (1, 0, 2)$.

(a) Find an expression for the position of this particle as a function of t.

(b) Find the curvature of the particle's path at $t = 0$.

4. *(20 pts)* The surface S in $\mathbb{R}^3$ has equation $x^2 + y^2 - z^2 + 1 = 0$.

(a) Give a geometric description of S, and use a method from class to justify your description.

(b) Is S a level set of some function $f : \mathbb{R}^n \to \mathbb{R}^m$? If so, find n, m, and an expression for f.

(c) Is some portion of S a graph of some function $h : \mathbb{R}^a \to \mathbb{R}^b$? If so, describe which portion, and find a, b, and an expression for h.

5. *(20 pts)* Compute (or show that it does not exist) the limit below.

$$\lim_{(x,y)\to(0,0)} \frac{x^4 - y^6}{x^4 + y^4}$$