EXAM 1
Math 212, 2017-2018 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. ________

2. ________

3. ________

4. ________

5. ________

Signature: _____________________________

Total Score ____________ (/100 points)
1. (20 pts) 

(a) Compute the cross product of $\vec{v} = (1, 2, 3)$ and $\vec{w} = (2, 0, 1)$. 

(b) Find the area of the parallelogram defined by $\vec{v}$ and $\vec{w}$. 

(c) Make explicit use of the cross product computed in part (a) to find the volume of the parallelepiped defined by $\vec{v}$, $\vec{w}$, and $\vec{x} = (3, 3, 5)$ and to decide if the listing $\vec{v}$, $\vec{w}$, $\vec{x}$ is in right or left hand order. 

(d) Find the angle between $\vec{x}$ and the parallelogram defined by $\vec{v}$ and $\vec{w}$. 
2. (20 pts) Find the point of intersection of the plane with equation $2x - 4y + 3z = 1$ and the line parametrized by $(x, y, z) = (2 + t, 1 - 5t, 3 + 2t)$. 
3. (20 pts) A dog runs through a field from $t = 0$ to $t = 2\pi$ with his position parametrized by

$$\vec{x}(t) = \begin{pmatrix} t + \cos t \\ \sin t \end{pmatrix}$$

(a) Compute expressions for the dog’s velocity and the acceleration.

(b) At what time is the dog moving the fastest?

(c) Set up, but do not evaluate, an integral to compute the total distance the dog runs.
4. (20 pts) Bob makes a surface $S$ by starting with the curve $C$ in the $xy$-plane with equation $x^2 - y^2 + 1 = 0$, stretching by a factor of 3 in the $x$-direction, shifting in the negative $y$-direction by a distance of 2, and then rotating the result around the $y$-axis.

What is the equation for the surface $S$? Explain with figures how you know if it is a sphere, ellipsoid, paraboloid, hyperboloid of one sheet, hyperboloid of two sheets, or hyperbolic paraboloid.
The plane $P$ has equation $x - 2y - 3z = 7$.

(a) Find a function $g$ whose graph is $P$, and note specifically the domain and the target of $g$.

(b) Find a function $L$ one of whose level sets is $P$, and note specifically the domain and the target of $L$.

(c) The line $L$ in $P$ has its shadow in the $xy$-plane parametrized by $(t+1, 4t)$. Find a parametrization $\vec{x}$ of the line $L$, and note specifically the domain and the target of $\vec{x}$. 