MATH 126 C
Exam I
Winter 2018

Name _____

Student ID #_____ Section _____

HONOR STATEMENT

"I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam."

SIGNATURE:_____

1	10	
2	8	
3	6	
4	9	
5	8	
6	9	
Total	50	

- Your exam should consist of this cover sheet, followed by 6 problems on 5 pages. Check that you have a complete exam.
- Pace yourself. You have 50 minutes to complete the exam and there are 5 pages. Try not to spend more than 10 minutes on each page.
- Unless otherwise indicated, **show all your work and justify your answers**.
- Unless otherwise indicated, your answers should be exact values rather than decimal approximations. (For example, $\frac{\pi}{4}$ is an exact answer and is preferable to its decimal approximation 0.7854.)
- You may use a **TI 30XII S** calculator and one 8.5×11-inch sheet of handwritten notes. **All other calculators, electronic devices, and sources are forbidden**.
- **You are not allowed to use scratch paper**. If you need more room, use the back of the page and indicate to the reader that you have done so.
- The use of headphones or earbuds during the exam is not permitted.
- There are multiple versions of the exam, you have signed an honor statement, and cheating is a hassle for everyone involved. DO NOT CHEAT.
- You are not allowed to use your phone for any reason during this exam. **Turn your phone off and put it away for the duration of the exam**.

GOOD LUCK!

1. (10 points)

   (a) In this problem $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are non-zero vectors in $\mathbb{R}^3$. Indicate whether each of the following expressions is a scalar (**S**), a vector (**V**), or nonsense (**N**). (You do not need to show any work for this part.)

expression	(circle one)		
$\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w})$	**S**	**V**	**N**
$(\mathbf{u} \cdot \mathbf{v}) \times \mathbf{w}$	**S**	**V**	**N**
$\dfrac{\mathbf{u} \cdot \mathbf{v}}{\lvert\mathbf{w}\rvert}$	**S**	**V**	**N**
$\left(\dfrac{\mathbf{u} \cdot \mathbf{v}}{\lvert\mathbf{w}\rvert}\right) \mathbf{w}$	**S**	**V**	**N**
$\mathbf{comp}_{\mathbf{w}}(\mathbf{u} - \mathbf{v})$	**S**	**V**	**N**
$\dfrac{1}{\lvert\mathbf{u}\rvert}\mathbf{proj}_{\mathbf{w}}(\mathbf{v})$	**S**	**V**	**N**

   (b) Find two vectors with magnitude 4 that are parallel to $\mathbf{a} = \mathbf{i} - 2\mathbf{k}$.

2. (8 points) Identify the trace (if it exists) of the quadric surface $x^2 - y^2 + z^2 = 1$ given the plane. (You do not need to show any work.)

   Choose your answers from the following list:

circle	ellipse	hyperbola	parabola
point	line	pair of lines	does not exist

   (a) the plane $x = -1$

   (b) the plane $x = k$, $k \neq \pm 1$

   (c) the plane $y = 0$

   (d) the plane $y = k$, $k \neq 0$

3. (6 points)

   (a) Find Cartesian coordinates of the point with polar coordinates $\left(-10, \frac{11\pi}{6}\right)$.

   (b) Find polar coordinates with $r < 0$ for the point whose Cartesian coordinates are $(0, 14)$.

4. (9 points) Find the equation of the plane that is parallel to the vector $\mathbf{v} = \langle 2, -1, 4 \rangle$ and contains the line of intersection of the planes

$$x + y + z = 5 \text{ and } x + 3y - 5z = -1.$$

Simplify your answer to the form $ax + by + cz = d$.

5. (8 points) A particle moves along the curve of intersection of the surfaces

$$x^2 + y^2 = 16 \text{ and } z = x + y.$$

Find a vector function $\mathbf{r}(t)$ for the particle's path and use it to find the normal and tangential components of the particle's acceleration at the point $(-4, 0, -4)$.

6. (9 points) Beginning at $t = 0$, a particle moves along the curve defined by

$$\mathbf{r}(t) = \langle \sin t - t\cos t, \cos t + t\sin t, \sqrt{6}t^2 \rangle.$$

(a) Reparametrize the curve with respect to arc length measured from the point where $t = 0$ in the direction of increasing t.

(b) Give the coordinates (x, y, z) of the particle after it has traveled 10 distance units along this curve.