MATH 126 A
Exam I
Autumn 2017

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	10	
3	12	
4	8	
5	10	
Total	50	

- Your exam should consist of this cover sheet, followed by 5 problems. 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 30X IIS (any color) and one 8.5×11-inch sheet of handwritten notes (two-sided). All other electronic devices (including graphing and programmable calculators and calculators with calculus functions) 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) Let $\mathscr{P}$ be the plane given by the equation

$$x + y - z = 5.$$

The point $Q(-2, 5, 3)$ **is not** on the plane $\mathscr{P}$. Find the equation of the line through Q orthogonal to the plane $\mathscr{P}$.

2. (10 points)

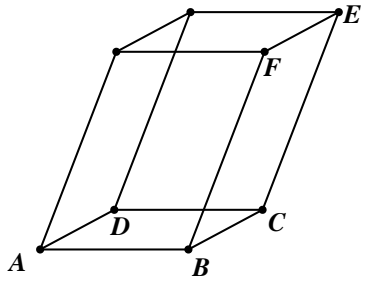
   (a) Suppose $\vec{b} = \langle 4, 5, -3 \rangle$, $\vec{b} \cdot \vec{a} = 20$, and $|\vec{a}| = \sqrt{50}$. Find the cosine of the angle between $\vec{a}$ and $\vec{b}$.

   (b) The points $(0, -6, 0)$, $(\sqrt{5}, 4, 0)$, and $(2, 0, 3)$ lie on the ellipsoid given by the equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1,$$

   for some positive real numbers a, b, and c. Find the point at which this ellipsoid intersects the positive x-axis.

3. (12 points) The shape below is a parallelepiped, a three-dimensional figure with six sides. Each side of the parallelepiped is a parallelogram. (The figure is not to scale.)



We know the following: $\overrightarrow{AB} = \langle 0, 4, 0 \rangle$, $\overrightarrow{AC} = \langle -9, 4, 0 \rangle$, $\overrightarrow{AE} = \langle -9, 6, 8 \rangle$.

(a) Find the vector $\overrightarrow{BC}$.

(b) Compute the area of the parallelogram with vertices A, B, C, and D.

(c) The point A has coordinates $(3, 5, 7)$. Find the coordinates of the point D.

4. (8 points) This is a multiple part, multiple choice question. For each polar equation, circle the curve that it best describes. **You are not required to show any work.**

   (a) $\{\theta = \pi/2\}$

   a. spiral **b.** vertical line **c.** diagonal line **d.** circle

   (b) $\{r = 4\sin\theta\}$

   a. spiral **b.** vertical line **c.** diagonal line **d.** circle

   (c) $\{r = \theta\}$

   a. spiral **b.** vertical line **c.** diagonal line **d.** circle

   (d) $\{\theta = \pi/4\}$

   a. spiral **b.** vertical line **c.** diagonal line **d.** circle

5. (10 points) Let $\mathbf{r}(t)$ be a vector function that represents the intersection of the surfaces

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

(a) Find an equation for $\mathbf{r}(t)$.

(b) Compute $\mathbf{r}'(t)$ and $\mathbf{r}''(\mathbf{t})$.

(c) Compute the curvature of $\mathbf{r}(t)$ at the point $(1, 1, 2)$.