University of California, Los Angeles
Practice for Midterm 1
Math 32A
Date: Oct 17, 2025
Instructor: Jack Sempliner

Name: ____________ Discussion Section: ____________ UID: ________

Please read the following instructions carefully.

- You have 50 minutes to complete this exam. This question booklet contains 3 questions, 4 pages (including the cover) for a total of 40 points/marks.
- Check to see if any pages are missing. Please use a separate sheet for rough work. Carefully cross out marks on the page from false starts or scratch work, leaving only the calculations relevant to your answer.
- All the questions are compulsory and all the notations have their usual meaning.
- No outside resources are allowed, beyond your cheat sheet. No electronic devices may be used.

Question	Points	Score
1	10	
2	10	
3	20	
Total:	40	

1. Consider the plane Pl defined by the following equation

$$2x - 3y + z = 5$$

and the line L defined by the following parameterization

$$\vec{l}(t) = (1, 2, -4) + t \cdot (3, 1, 2).$$

(a) (5 points) Find the intersection of the line L with the plane Pl.

(b) (5 points) Compute the projection of the vector $(3, 1, 2)$ onto the plane Pl.

2. (10 points) Find the area of the triangle with vertices at the points

$$P = (1, 0, 0)$$
$$Q = (0, 1, 0)$$
$$R = (0, 0, 1).$$

3. Let $\mathbb{E}$ be the vector $\hat{j} = (0,1,0)$, and let $\mathbb{B}$ be the vector $\hat{k} = (0,0,1)$. Suppose a particle traces out a path $\vec{r}(t)$ such that the acceleration vector $\vec{a}(t) = \vec{r}''(t)$ satisfies the vector equation

$$\vec{a}(t) = (\mathbb{E} + \vec{v} \times \mathbb{B})$$

where here $\vec{v}(t) = \vec{r}'(t)$ is the velocity function along the path.

(a) (10 points) Suppose the particle has initial velocity $\vec{v}(0) = (v_0, 0, 0)$. Find explicit equations expressing the components of $\vec{a}(t)$ in terms of the components of $\vec{v}(t)$. Partially solve to express $\hat{k} \cdot \vec{v}(t)$ as a function of time.

(b) (5 points) Let $\vec{w}(t) = \vec{v}(t) - (1,0,0)$. Show using part ($a$) that the norm $||\vec{w}||$ is constant as a function of t.

(c) (5 points) It can be deduced from part (b) that the velocity function

$$\vec{v}(t) = (1 + (v_0 - 1)\cos(t), -(v_0 - 1)\sin(t), 0).$$

Taking this formula for $\vec{v}(t)$ as a given, and given the initial position $\vec{r}(0) = (0,0,0)$, solve for the position of the particle $\vec{r}(t)$ as a function of time.

End of exam.