

Math 241, Exam 2, Fall, 2024

**YOU SHOULD KEEP THIS PIECE OF PAPER.** Write everything on the **blank paper provided**. Return the problems **IN ORDER** (use as much paper as necessary), use **ONLY ONE SIDE** of each piece of paper. Number your pages and write your name on each page. Take a picture of your exam (for your records) just before you turn the exam in. I will e-mail your grade and my comments to you. (I will return your exam in the next class.) **Fold your exam in half** before you turn it in.

The exam is worth 50 points. Each problem is worth 10 points. **Make your work coherent, complete, and correct.** Please CIRCLE your answer. Please **CHECK** your answer whenever possible.

The solutions will be posted later today.

**No Calculators, Cell phones, computers, notes, etc.**

- (1) Find a system of parametric equations for the line tangent to the curve  $\vec{r}(t) = e^t \vec{i} + 3t^2 \vec{j} + \cos \frac{\pi t}{2} \vec{k}$  at  $t = 1$ .
- (2) Find an equation for the plane through the points  $P_1 = (3, -2, 0)$ ,  $P_2 = (7, 2, 1)$ , and  $P_3 = (2, 0, 2)$ . **Check your answer. Make sure it is correct.**
- (3) Express  $\vec{v} = 3\vec{i} + \vec{j}$  as the sum of a vector parallel to  $\vec{b} = 4\vec{i} + 8\vec{j}$  plus a vector perpendicular to  $\vec{b}$ . **Check your answer. Make sure it is correct.**
- (4) The position vector at time  $t$  of an object moving on the  $xy$ -plane is  $\vec{r}(t) = x(t)\vec{i} + y(t)\vec{j}$ . If

$$\vec{r}''(t) = 2\vec{i}, \quad \vec{r}'(0) = 3\vec{i} + 2\vec{j}, \quad \text{and} \quad \vec{r}(0) = 4\vec{i},$$

then what is the  $x$ -coordinate of the object when the  $y$ -coordinate is 4?

- (5) Name, describe, and graph the set of all points in three-space which satisfy  $y^2 + x^2 - z^2 = 1$ . Is this object a finite set of points, or a curve, or a surface, or a solid?