Math 241 Exam 1 Fall 2019 **Justin Wyss-Gallifent**

Directions: Do not simplify unless indicated. No calculators are permitted. Show all work as appropriate for the methods taught in this course. Partial credit will be given for any work, words or ideas which are relevant to the problem.

Please put problem 1 on answer sheet 1

1. (a) Given the two vectors [10 pts]

$$\mathbf{a} = 2\,\mathbf{i} + 5\,\mathbf{j} + 0\,\mathbf{k} \text{ and } \mathbf{b} = 1\,\mathbf{i} + 0\,\mathbf{j} - 2\,\mathbf{k}$$

Find the cosine of the angle between them.

(b) Find the symmetric equation of the line passing through $(3, 2, 1)$ and perpendicular to the plane $4x + 2y - z = 1$. [10 pts]

Please put problem 2 on answer sheet 2

2. (a) Explain why the vector valued function $\mathbf{r}(t) = (t^2 - 4t)\,\mathbf{i} + 3\,\mathbf{j} + (t^3 - 12t)\,\mathbf{k}$ with $0 \le t \le 4$ is piecewise smooth but not smooth. [10 pts]

(b) Find the distance between the point $(1, 2, 3)$ and the plane $x - y + z = 0$. [10 pts]

Please put problem 3 on answer sheet 3

3. (a) Sketch the plane with equation $-10x + 2y = 20$. Label four points with their coordinates. [5 pts]

(b) Consider the line with symmetric equation: [15 pts]

$$\frac{x-3}{2} = \frac{2-z}{5},\ \ y = 6$$

Find the equation of the plane containing the line as well as the point $(1, -1, 0)$. Write this in the form $ax + by + cz = d$.

Please put problem 4 on answer sheet 4

4. (a) Sketch the curve with parametrization $\mathbf{r}(t) = -2\,\mathbf{i} + (2 + 2\cos t)\,\mathbf{j} + 4\sin t\,\mathbf{k}$ for $0 \le t \le \pi$ and indicate the start point, middle point, and end point with their coordinates. [10 pts]

(b) Find the parametrization(s) for the curve consisting of the part of $x^2 + y^2 = 9$ in the second quadrant along with the line segment joining the end points in a counterclockwise direction. [10 pts]

Please put problem 5 on answer sheet 5

5. Given the vector-valued function $\mathbf{r}(t) = t^3\,\mathbf{i} - 5t^2\,\mathbf{j} + e^{2-t}\,\mathbf{k}$

(a) Set up but do not evaluate the integral for the length of the curve with $0 \le t \le 4$. [6 pts]

(b) Find the tangent vector at $t = 2$ [6 pts]

(c) Find the tangential component of acceleration at $t = 2$. [8 pts]

The End and the TA Section List

Stephen S.	0311 $\Leftrightarrow$ 10:00	0321 $\Leftrightarrow$ 11:00
Ke	0312 $\Leftrightarrow$ 10:00	0322 $\Leftrightarrow$ 11:00
Stephen G.	0331 $\Leftrightarrow$ 12:00	0341 $\Leftrightarrow$ 1:00
Chenzhi	0332 $\Leftrightarrow$ 12:00	0342 $\Leftrightarrow$ 1:00