Math 202 **Name (Print):** _____
Sparing 2019
Midterm
03/08/2019
Time Limit: 50 Minutes

This exam contains 9 pages (including this cover page) and 5 problems. Check to see if any pages are missing.

Statement of Ethics

I agree to complete this exam without unauthorized assistance from any person, materials, or device.

Signature _____ Date _____

1 Lin T 1:30-2:20 Shriver 104
2 Lin T 3:00-3:50 Hodson 301
3 Sherwood Th 4:30-5:20 Gilman 119
4 Sherwood Th 3:00-3:50 Maryland 309
5 Koh T 4:30-5:20 Gilman 119
6 Stubis Th 1:30-2:20 Hodson 313
7 Stubis Th 3:00-3:50 Hodson 301
8 VanBlargan T 3:00-3:50 Gilman 119

Your section number: _____

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.
- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.
- If you need more space, use the back of the pages; clearly indicate when you have done this.

Do not write in the table to the right.

Problem	Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total:	100	

1. (a) (5 points) Compute $||\boldsymbol{u}||$, $||\boldsymbol{v}||$, and $\boldsymbol{u} \cdot \boldsymbol{v}$, where $\boldsymbol{u} = -\boldsymbol{i} + 3\boldsymbol{k}$, $\boldsymbol{v} = 4\boldsymbol{j} \in \mathbb{R}^3$.
A: $||\boldsymbol{u}|| = \sqrt{10}, ||\boldsymbol{v}|| = 4, \boldsymbol{u} \cdot \boldsymbol{v} = 0$.

(b) (5 points) What's the volume of the parallelepiped with sides $\boldsymbol{i}, 3\boldsymbol{j} - \boldsymbol{k}, 4\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{k}$?
A: 1.

(c) (5 points) Determine the distance from the plane $12x + 13y + 5z + 2 = 0$ to the point $(1, 1, -5)$.
A: $\frac{\sqrt{2}}{13}$.

(d) (5 points) Let $\boldsymbol{v}, \boldsymbol{w} \in \mathbb{R}^n$, if $||\boldsymbol{v}|| = ||\boldsymbol{w}||$, compute $(\boldsymbol{v} + \boldsymbol{w}) \cdot (\boldsymbol{v} - \boldsymbol{w})$.
A: 0.

2. (a) (10 points) Compute or show does not exist:

$$\lim_{(x,y)\to(0,0)} \frac{xy}{x^2+y^2}.$$

A: Not.

(b) (10 points) Compute or show does not exist:

$$\lim_{(x,y,z)\to(0,0,0)} \frac{xyz}{x^3+y^3+z^3}.$$

A: Not.

3. Let $f(x,y) = \frac{x^2y^4}{x^4+6y^8}$ if $(x,y) \neq (0,0)$ and $f(x,y) = 0$ if $(x,y) = (0,0)$.

   (a) (10 points) Compute $\frac{\partial f}{\partial x}(0,0)$ and $\frac{\partial f}{\partial y}(0,0)$.
   A: 0,0.

   (b) (10 points) Determine whether f is differentiable at $(0,0)$ or not.
   A: Not.

4. (a) (10 points) Suppose that $f(x)$ is differentiable on $\mathbb{R}$. Let $z = f(x - y)$, compute $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y}$.
A: 0.

(b) (10 points) Find the equation of the plane tangent to the surface defined by $4xy + z^2 = 5$ at $(1, 1, 1)$.
A: $2x + 2y + z = 5$.

5. (a) (10 points) Let $f(x,y) = (3-x)(3-y)(x+y+3)$. Find the critical points of $f(x,y)$ (5pts) and use the second derivative test to classify them (relative max, relative min, saddle, no information) (5pts).

   A: $(0,0)$ local max, $(3,3)$ saddle, $(3,-6)$ saddle, $(-6,3)$ saddle.

(b) (10 points) Use the method of Lagrange multipliers to find the maximum value of the function $f(x, y) = xy$ on the ellipse $3x^2 + y^2 = 6$.
A: $\sqrt{3}$.

(You can use this page as scratch paper.)