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 $\boldsymbol{u} = -\boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k}$, $\boldsymbol{v} = \boldsymbol{i} - \boldsymbol{j} + \boldsymbol{k} \in \mathbb{R}^3$.

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

(c) (5 points) Determine the distance from the plane $3x + 2y + 5z - 1 = 0$ to the point $(2, 0, -1)$.

(d) (5 points) Let $\boldsymbol{v}, \boldsymbol{w} \in \mathbb{R}^n$, if $||\boldsymbol{v}|| = 2||\boldsymbol{w}||$, compute $(\boldsymbol{v} + 2\boldsymbol{w}) \cdot (\boldsymbol{v} - 2\boldsymbol{w})$.

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

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

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

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

3. Let $f(x,y) = \frac{xy}{x^2+y^2}$ 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 $\frac{\partial f}{\partial y}(0,0)$.

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

4. (a) (10 points) Let $f(x) = x^3$. Let $z = f(x^2 - y^2)$, use chain rule to compute $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y}$.

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

5. (a) (10 points) Let $f(x, y) = (xy - 1)^2 + x^2$. Find the critical points of $f(x, y)$ (5pts) and use the second derivative test to classify them (local max, local min, saddle, no information) (5pts).

(b) (10 points) Use the method of Lagrange multipliers to find the maximum value of the function $f(x, y) = x^2y$ on the circle $x^2 + y^2 = 3$.

(You can use this page as scratch paper.)