Math 202
Sparing 2019
Final
05/09/2019
Time Limit: 3 hours

Name (Print): ____________________

This exam contains 8 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.
- **Any answer or solution on scratch paper will receive no credit**.

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. No partial credit for Problem 1.

   (a) (5 points) (a) Find the equation of plane passing through the points $A = (0, 1, 3)$, $B = (2, 1, -1)$, $C = (0, 3, 2)$. (b) Find the distance from the origin to this plane.

   (b) (5 points) Compute the double integral $\int_0^1 (\int_x^{\sqrt{x}} e^{x/y} dy) dx$.

(c) (5 points) Calculate $\int_{\boldsymbol{c}}(x + y^2 + z^2)ds$, where $\boldsymbol{c}$ is the helix $\boldsymbol{c}(t) = (\cos t, \sin t, t)$ for $0 \leq t \leq 3\pi$.

(d) (5 points) Let C be a piecewise smooth closed curve that is the boundary of a surface S, calculate $\int_C (2019, 5, 9) \cdot ds$.

2. (a) (10 points) Evaluate $\iint_S \boldsymbol{F} \cdot dS$, where $\boldsymbol{F} = (x^2, y^2, z^2)$, and $S = \{(x, y, z) | x^2+y^2+z^2 = 4\}$.

(b) (10 points) Let $0 < r < 1$ be a positive real number, $D = \{(x, y) \mid r^2 \leq x^2 + y^2 \leq 1\}$, compute $\int_{\partial D} P ds$, where $P = \frac{y}{x^2+y^2}$, and ∂D is the positive oriented boundary of D.

3. (20 points) State Stokes' theorem for parametrized surfaces. (including under which condition) (5 pts). Use Stokes' theorem to evaluate (1) $\iint_{S_1} \nabla \times \boldsymbol{F} \cdot dS_1$, (2) $\iint_{S_2} \nabla \times \boldsymbol{F} \cdot dS_2$, where $S_1 = \{(x,y,z)|0 \leq z, z+x^2+y^2 = 9\}$ oriented by the outward normal vectors, $S_2 = S_1 \cup \{(x,y,z)|z = 0, x^2+y^2 \leq 9\}$ oriented by the outward normal vectors, and $\boldsymbol{F} = (x-y, x+y, z^2+z^3)$. (15 pts)

4. (20 points) (1) Evaluate the integral $\int_{C^+} x^{2019} dx + x^5 y^9 dy$, where C^+ is the perimeter of the square $[0,1] \times [0,1]$ in the counterclockwise direction. (10 pts) (2) Evaluate the integral $\int_{\boldsymbol{c}} x^{2019} dx + (y^5 + y^9) dy$, where $\boldsymbol{c} : [1,2] \to \mathbb{R}^2$ is given by $\boldsymbol{c}(t) = (e^{t-1}, \sin(\pi/t))$. (10 pts)

5. (20 points) Let $x_i \geq 0, i = 1, 2, \ldots, n$, be non-negative real numbers such that $x_1 + x_2 + \cdots + x_n = 1$. Let $f(x_1, \ldots, x_n) = x_1 x_2 \cdots x_n$. Use Lagrange Multiplier Strategy to find the maximum value of f when (1) $n = 3$; (10 pts) (2) n is any fixed positive integer. (10 pts)

Please estimate your score.