MA 213 — Calculus III Spring 2018
Exam 3 April 11, 2018

Name: ____________________________

Section: ___________________________

Last 4 digits of student ID #: _______

- No books or notes may be used.
- Turn off all your electronic devices and do not wear ear-plugs during the exam.
- You may use a calculator, but not one which has symbolic manipulation capabilities or a QWERTY keyboard.
- Additional blank sheets for scratch work are available upon request.
- All questions are free response questions. Show all your work on the page of the problem. Clearly indicate your answer and the reasoning used to arrive at that answer. Unsupported answers may not receive credit.

Exam Scores

Do not write in the table below

Question	Score	Total
1		10
2		10
3		10
4		10
5		10
6		10
7		10
8		10
9		10
10		10
Total		100

Free Response. Show your work!

1. (10 points) Evaluate

$$\iint_R \frac{xy^2}{x^2+1}\, dA,$$

where $R = \{(x,y) \mid 0 \le x \le 1, -3 \le y \le 3\}$.

2. (10 points) Change the order of integration in

$$\int_1^2 \int_0^{\ln x} f(x,y)\, dy\, dx,$$

i.e. determine A, B, C, D for which

$$\int_1^2 \int_0^{\ln x} f(x,y)\, dy\, dx = \int_A^B \int_C^D f(x,y)\, dx\, dy.$$

3. (10 points) Set up an iterated integral in polar coordinates to compute the area inside the circle $(x-1)^2 + y^2 = 1$ and outside the circle $x^2 + y^2 = 1$. Do not evaluate the integral.

4. (10 points) Find the average distance from a point (x, y) of the disk $x^2 + y^2 \leq R^2$ to its center.

5. (10 points) Find the mass of a lamina occupying the region D in the xy-plane bounded by $y = 1 - x^2$ and $y = 0$ if the density is $\rho(x, y) = 3y$.

6. (10 points) Find the surface area of the part of the plane $2x + 2y + z = 5$ inside the cylinder $x^2 + y^2 = 3$.

7. (10 points) Consider

$$\iiint_E z\,dV,$$

where E is enclosed by

$$z = 0, \quad z = x^2 + y^2, \quad \text{and} \quad x^2 + y^2 = 4.$$

Use cylindrical coordinates to express this triple integral as an iterated integral. Do not evaluate the integral.

8. (10 points) Find the spherical coordinates (ρ, θ, ϕ) of a point whose rectangular coordinates are $(-1, \sqrt{3}, 2\sqrt{3})$.

Free Response. Show your work!

9. (10 points) Change to spherical coordinates

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \int_{\sqrt{x^2+y^2}}^{\sqrt{2-x^2-y^2}} x^2y^3 \, dz \, dy \, dx.$$

Do not evaluate the integral.

10. (10 points) Evaluate

$$\iiint_E (1 + ye^{x^2 z}) \, dV$$

where E is the cube $E = [-1,1] \times [-1,1] \times [-1,1]$. [Hint: Integrate with respect to y first.]