MA 213 — Calculus III   Spring 2018
Exam 2   March 8, 2018

Exam Scores

*Do not write in
the table below*

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.

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

1. (10 points) Find the length of the curve

$$\mathbf{r}(t) = \sqrt{2}\,t\mathbf{i} + e^t\mathbf{j} + e^{-t}\mathbf{k}, \quad (0 \le t \le 1).$$

Exact answer is expected. [Hint: Factor the expression under the square root.]

2. (10 points) Compute the curvature of the curve

$$\mathbf{r}(t) = t^3\mathbf{j} + t^2\mathbf{k}$$

at the point $(0, 1, 1)$.

3. (10 points) Find the limit
$$\lim_{(x,y)\to(0,0)} \frac{xy}{x^2 + y^2}$$
if it exists or, if it does not exist, explain why.

4. (10 points) Find $f_{xx}(2, -1)$ and $f_{xy}(2, -1)$, if

$$f(x, y) = \frac{y}{2x + 3y}.$$

5. (10 points) Find the linearization of $f(x,y) = 12\arctan(xy)$ at $(1,1)$. Exact answer is expected.

6. (10 points) Let

$$w = xy + yz + zx, \quad x = r\cos\theta, \quad y = r\sin\theta, \quad z = r\theta.$$

Use the chain rule to evaluate $\partial w/\partial r$ and $\partial w/\partial \theta$ when $r = 2$ and $\theta = \pi/2$.

7.   (10 points) Use implicit differentiation to find $\partial z/\partial x$ and $\partial z/\partial y$, if $e^z = xyz$.

8.   (10 points) Find an equation for the tangent plane to the surface $xy^2z^3 = 8$ at $(2, 2, 1)$. Write the equation in the form $x + by + cz = d$.

9. (10 points) Find the critical points of $f(x, y) = x^3 - 3x + y^4 - 2y^2$ and classify each of them as local maximum, local minimum, or saddle point.

10. (10 points) Find the absolute maximum and absolute minimum values of $f(x, y) = y^2 - x^2$ on the unit disk $D = \{(x, y) \mid x^2 + y^2 \leq 1\}$.