Math 241 Exam 2 Spring 2018 **Justin ∇∇yss-Gallifent**

Directions: Do not simplify unless indicated. No calculators are permitted. Show all work as appropriate for the methods taught in this course. Partial credit will be given for any work, words or ideas which are relevant to the problem.

Please put problem 1 on answer sheet 1

1. (a) Give the equation of a cone opening around the positive y-axis with vertex at the origin. [5 pts]
   (b) Use tangent plane approximation to approximate $2.99^2 + \sqrt[3]{8.02}$ using $(x_0, y_0) = (3, 8)$. [15 pts]

Please put problem 2 on answer sheet 2

2. (a) Sketch the graph of $x^2 + y^2 = 9$. Label one point with its coordinates. Name the shape. [5 pts]
   (b) Sketch the level curve of $f(x, y) = x - y^2 + 1$ when $c = 3$. Label one point with its coordinates. [5 pts]
   (c) Find the equation of the plane tangent to the surface $xy = yz + z + 2$ at the point $(4, 2, 2)$. [10 pts]

Please put problem 3 on answer sheet 3

3. (a) Find the maximum directional derivative (a number!) of the function $f(x, y) = x^2 + \frac{x}{y}$ at the point $(4, 3)$. [10 pts]
   (b) An object follows the path $\bar{r}(t) = t^2\,\hat{\imath} + (t^3 + t)\,\hat{\jmath}$. If the temperature at (x, y) is given by $T(x, y) = x^2 + xy$, use the Chain Rule to find the temperature change (with respect to time) that the object is experiencing at $t = 1$. [10 pts]

Please put problem 4 on answer sheet 4

4. Find and categorize all relative maxima, relative minima, and saddle points for the function $f(x, y) = 3x^2y + y^3 - 3x^2 - 3y^2$. There are four critical points points. [20 pts]

Please put problem 5 on answer sheet 5

5. Use Lagrange Multipliers to find the minimum value (there is no maximum value) of the function $f(x, y) = 4x^2 + y^2$ subject to the constraint $xy = 2$. [20 pts]

The End and the TA Section List

Kevin	0111 ↔ 8:00	0121 ↔ 9:30
Noah	0112 ↔ 8:00	0122 ↔ 9:30
Nathaniel	0131 ↔ 12:30	0141 ↔ 2:00
Tessa	0132 ↔ 12:30	0142 ↔ 2:00