Math 241 Exam 2 Fall 2017 **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 paraboloid opening down with vertex at $(0, 0, 1)$. [5 pts]

   (b) Use tangent plane approximation to approximate $\sqrt{2.02^2 + 4.95}$. [15 pts]

Please put problem 2 on answer sheet 2

2. (a) Sketch the graph of the equation $z = -2 + \sqrt{x^2 + y^2}$. Label one point with its coordinates. Name the shape. [5 pts]

   (b) Suppose $f(x, y) = xy + y^2$. If $\bar{u}$ is a unit vector which makes an angle of $\pi/6$ with ∇f at $(2, -1)$, find $D_{\bar{u}} f(2, -1)$. [15 pts]

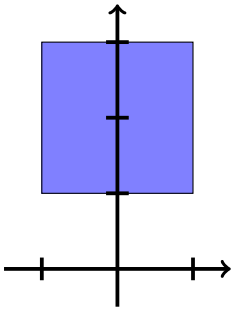
Please put problem 3 on answer sheet 3

3. (a) Find a vector perpendicular to the graph of the function $f(x, y) = x^2 y + 2x - y$ at $(-1, 2)$. [10 pts]

   (b) If $z = x^2 + y$ where $x = \frac{s}{t}$ and $y = st$, use the Chain Rule to find $\frac{\partial z}{\partial s}$ in terms of s and t. [10 pts]

Please put problem 4 on answer sheet 4

4. Find the maximum and minimum of $f(x, y) = x^2 + y^2$ where (x, y) is restricted by the filled-in box shown here. Each tick mark is one unit. [20 pts]



Please put problem 5 on answer sheet 5

5. Use Lagrange Multipliers to find the maximum value (there is no minimum value) of the function $f(x, y) = xy^2$ subject to the constraint $x + y^2 = 2$. [20 pts]
   Note: Your system should have three solutions.

The End and the TA Section List

Tessa	0411 = 8:00	0421 = 9:00
Weikun	0412 = 8:00	0422 = 9:00
Shuo	0431 = 10:00	0441 = 11:00
Zeyad	0432 = 10:00	0442 = 11:00