Math 241 Exam 2 ෴ 2020 **ĵustîn Wyss-Gallîfent**

Directions: Do not simplify non-Calc3 things 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, pictures or ideas which are relevant to the problem.

Please put problem 1 on answer sheet 1

1. (a) Sketch the surfaces $x^2+y^2=9$ and $z=\sqrt{x^2+y^2}$ together. Name the surfaces and describe what the intersection is. [12 pts]

   (b) Write down the equation of the upper hemisphere with center $(2,3,0)$ and radius 5. [8 pts]

Please put problem 2 on answer sheet 2

2. (a) All together on one set of axes sketch the level curves for $f(x,y)=\frac{x}{|y|+1}$ for $c=-1,0,1,2$. Label each curve with its value of c. [10 pts]

   (b) Find the symmetric equation of the line in the plane $y=2$ which is tangent to the intersection of the plane with the function $f(x,y)=3x^2+y^2$ at the point $(1,2,7)$. [10 pts]

Please put problem 3 on answer sheet 3

3. (a) Use tangent plane approximation at $(4,27)$ to approximate the value of $\sqrt{3.9}+\sqrt[3]{28}$. [6 pts]

   (b) Suppose the temperature at (x,y) is given by $f(x,y)=xy+x^2y$. If an object is following the curve $\mathbf{r}(t)=t^2\hat{\boldsymbol{\imath}}+\left(t^3-t\right)\hat{\boldsymbol{\jmath}}$, what instantaneous temperature change is the object experiencing with respect to distance at the instant $t=2$? [14 pts]

Please put problem 4 on answer sheet 4

4. Find all three (guaranteed to be three!) of the critical points for the function: [20 pts]

$$f(x,y)=x^2y-xy+3y^2$$

   For each critical point calculate if it is a relative maximum, relative minimum or saddle point.

Please put problem 5 on answer sheet 5

5. Use the method of Lagrange Multipliers to find the maximum and minimum of the function $f(x,y)=xy-2y$ subject to the constraint $x^2+4y^2=4$. [20 pts]

The End and the TA Section List

Vlassis	0211 ↔ 8:00	0221 ↔ 9:00
Michael	0212 ↔ 8:00	0222 ↔ 9:00
Luis	0231 ↔ 10:00	0241 ↔ 1:00
Tao	0232 ↔ 10:00	0242 ↔ 1:00