Math 241,   Exam 3,   Fall, 2018

Write everything on the blank paper provided. **YOU SHOULD KEEP THIS PIECE OF PAPER.** If possible: return the problems in order (use as much paper as necessary), use only one side of each piece of paper, and leave 1 square inch in the upper left hand corner for the staple. If you forget some of these requests, don't worry about it – I will still grade your exam.

The exam is worth 50 points. Each problem is worth 10 points. Please make your work coherent, complete, and correct. Please $\boxed{CIRCLE}$ your answer. Please **CHECK** your answer whenever possible.

The solutions will be posted later today.

The exams will be returned on Tuesday.

No Calculators, Cell phones, computers, notes, etc.

(1) Find all local minima, local maxima and saddle points for the function $f(x, y) = x^2 + 4y^2 - 6x + 8y - 15$.

(2) Find the absolute maximum and the absolute minimum values of

$$f(x, y) = 3xy - 6x - 3y + 7$$

on the triangular region with vertices $(0, 0)$, $(3, 0)$, and $(0, 5)$.

(3) Describe, graph, and name $x^2 + y^2 - z^2 = 1$ in 3-space.

(4) Suppose $\vec{r}\,'(t) = 2t\,\vec{i} + 3t^2\,\vec{j}$ and $\vec{r}(0) = \vec{i} - \vec{j}$. Find $\vec{r}(t)$.

(5) Let $f(x, y) = 4x^3y^2$. Find the directional derivative of f at the point $P = (2, 1)$ in the direction of $\vec{a} = 4\,\vec{i} - 3\,\vec{j}$.