Math 241 Exam 3 Spring 2008

Please leave room in the upper left corner for the staple.
TAKE THESE QUESTIONS HOME WITH YOU WHEN YOU LEAVE.
I WILL POST SOLUTIONS LATER TODAY.

Write your answers as legibly as you can on the blank sheets of paper provided. Use only **one side** of each sheet. Be sure to number your pages. Put your solution to problem 1 first, and then your solution to number 2, etc.; although, by using enough paper, you can do the problems in any order that suits you.

There are 7 problems. Most of the problems are worth 7 points. The exam is worth 50 points. SHOW your work. Make your work be coherent and clear. Write in complete sentences whenever this is possible. $\boxed{\textit{CIRCLE}}$ your answer. **CHECK** your answer whenever possible. **No Calculators.**

1. Find the directional derivative of $f(x,y) = xe^{xy}$ at the point $(2,3)$ in the direction of the vector $\vec{\boldsymbol{a}} = 3\,\vec{\boldsymbol{i}} + 4\,\vec{\boldsymbol{j}}$.

2. Find the equation of the plane tangent to $z = x^2 + y^2$ when $x = 1$ and $y = 2$.

3. Find all relative maxima, relative minima, and saddle points of $f(x,y) = y^2 + xy + 3y + 2x + 3$.

4. (8 points) Find the points on the sphere $x^2 + y^2 + z^2 = 36$ that are closest to and farthest from the point $(1,2,2)$.

5. Find $\iint_R \sin(y^3)dA$, where R is the region in the xy-plane bounded by $y = \sqrt{x}$, $y = 2$, and $x = 0$.

6. Find the volume of the region between $z = 9 - x^2 - y^2$ and $z = 0$.

7. Find $\iiint_G (1 - x^2 - y^2 - z^2)dV$, where G is the region inside the sphere $x^2 + y^2 + z^2 = 1$.