Math 241 Exam 2 Spring 2008

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. $\boxed{CIRCLE}$ your answer. **CHECK** your answer whenever possible. **No Calculators.**

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

2. Find the equation of the plane tangent to $z^2 = x^2 + y^2$ at the point $(3,4,5)$.

3. Find all points of intersection of the line $x = -1+t$, $y = 2+t$, $z = 2t+7$ and the surface $z = x^2+y^2$. Please check your answer.

4. Find the equation of the plane that contains the lines $x = -2+t$, $y = 3+2t$, $z = 4-t$, and $x = 3-t$, $y = 4-2t$, $z = t$. Please check your answer.

5. (8 points) The temperature of a plate at the point (x,y) is $T(x,y) = 100 + x^2 - y^2$. Find the path that a heat seeking particle would travel if it starts at the point $(5,\sqrt{75})$. (The particle always moves in the direction of the greatest increase in temperature.)

6. (a) Find $\lim\limits_{\substack{(x,y)\to(0,0)\\ \text{along } y=3x}} \frac{x^3y}{x^6+2y^2}$.

   (b) Find $\lim\limits_{\substack{(x,y)\to(0,0)\\ \text{along } y=x^3}} \frac{x^3y}{x^6+2y^2}$.

7. Let $\vec{\boldsymbol{a}} = \vec{\boldsymbol{i}} + 2\vec{\boldsymbol{j}} + 3\vec{\boldsymbol{k}}$ and $\vec{\boldsymbol{b}} = 3\vec{\boldsymbol{i}} + 7\vec{\boldsymbol{j}} + 13\vec{\boldsymbol{k}}$. Find vectors $\vec{\boldsymbol{u}}$ and $\vec{\boldsymbol{v}}$ with $\vec{\boldsymbol{b}} = \vec{\boldsymbol{u}} + \vec{\boldsymbol{v}}$, $\vec{\boldsymbol{u}}$ parallel to $\vec{\boldsymbol{a}}$, and $\vec{\boldsymbol{v}}$ perpendicular to $\vec{\boldsymbol{a}}$. Please check your answer.