Math 303, Exam #2 Review **Fall 2008**

Topics that will be covered on the exam include: Cross product - computation and applications; Computing and approximating f_x, f_y, f_{xx}, f_{xy}, f_{yy} and $f_{\vec{u}}$, grad f from formulas, tables and contour diagrams; Geometric properties of grad $f(x,y)$ and grad $g(x,y,z)$; Chain rule; Computing and using Taylor polynomials; Using partial derivatives of a function to determine critical points, local maxima, local minima and saddle points; Lagrange multipliers; The definite integral of a function of two or three variables; Integrals in polar coordinates.

In addition to the following problems, you should review each of the worksheets, and homework.

1. Let $\vec{v} = \vec{i} + \vec{j} - \vec{k}$ and $\vec{w} = 2\vec{i} + \vec{j}$. Compute $\vec{v} \times \vec{w}$.

2. Find a formula for the plane containing the points (0,1,1), (1,2,-1) and (-1,3,0).

3. Let $f(x,y) = 3x^2y - 4xy^2$, and let $\vec{v} = \vec{i} - 2\vec{j}$. Compute f_x, f_y, f_{xx}, f_{xy}, f_{yy}, $f_{\vec{v}}(1,2)$, and grad f. Find the critical points of f. Illustrate grad $f(1,2)$ on a graph of the function f.

4. Let $g(x,y,z) = \dfrac{x+y}{z^2+1}$. Compute grad g. Compute grad $g(1,1,1)$. Describe grad g geometrically.

5. $f(x,y) = x^2 - y^2$, $x = uv^2 + v$, and $y = uv^2 - v$. Use the chain rule to compute f_u and f_v.

6. Let $f(x,y) = xy\sin(x+y)$. Find the first and second Taylor polynomials for $f(x,y)$ near $(\frac{\pi}{4}, \frac{\pi}{4})$.

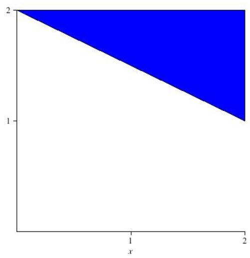
7. Find the maximum and minimum of the function $f(x,y) = x(y^2-1)$ subject to the constraint $x^2 + y^2 \leq 4$.

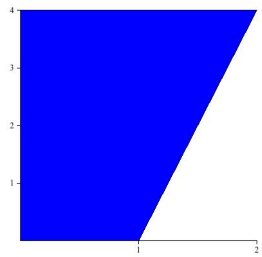
8. Sketch the region determined by $y \leq x \leq 4$, $0 \leq y \leq 2$.

9. Sketch and/or describe the solid determined by $-\sqrt{4-x^2-y^2} \leq z \leq 0$, $-\sqrt{4-x^2} \leq y \leq \sqrt{4-x^2}$, $0 \leq x \leq 2$.

10. Let $f(x,y) = x^2 + y^2$, and let R be the disk with radius 4 in the xy-plane. Set up the iterated integral for $\int_R f\,dA$ using Cartesian coordinates. Set up the iterated integral for $\int_R f\,dA$ using polar coordinates.

11. Set up the integral of a function $f(x, y)$ over each of the following regions:





12. Set up the integral of a function $f(x, y, z)$ over each of the following regions: