Math 202 Review for Exam 1
February 20, 2000

The exam will cover Chap XV (all), Chap XVI (all), Chap XVII (1,2), Chap XVII(1,2,3), and Note I. NO CALCULATORS ON THE EXAM.

To prepare for the exam, do all the problems in the above sections, without looking at any solutions until you've finished a section. Then practice further with these:

1. Find the equation of the tangent plane to the sphere $x^2 + y^2 + z^2 = 14$ at the point $(1, 2, 3)$.

2. Find parametric equations for the line of intersection of the two planes

$$x + y + z = 0, \qquad x + 2y + 3z = 0.$$

3. Find the parametric equations for the lines on the saddle $z = xy$ which cross at the point $(1, 1, 1)$. Find the equation of the tangent plane at this point, and show that the two lines are on this plane.

4. In what direction is the function $f(x, y, z) = xyz$ increasing most rapidly at the point $p = (1, 2, 3)$? Find the directional derivative of f at p in the direction of the vector $(1, -1, 0)$.

5. A curve $C(t)$ travels on the sphere $x^2 + y^2 + z^2 = 1$. Find the angle between the velocity vector of $C(t)$ and the acceleration vector of C, as a function of t.

6. Find the critical points of $f(x, y) = x^3 - x^2 - y^2$, and determine whether they are max, min or saddle.

7. Find the critical points of $f(x, y) = (x - 2y)(3x + y)$, determine whether they are max, min or saddle, and sketch level curves of f for positive, negative and zero values. Draw some gradient arrows on these level curves.

8. Do problem 7 for the functions $f(x, y) = \cos(x)\cos(y)$, $f(x, y) = \cosh(x)\sin(y)$.

9. Find the least squares best line through the points $(0, 0), (1, 1), (2, 3)$.

10. Find the point on the saddle $z = xy$ which is closest to the point $p = (0, 0, c)$. (Minimize the squared distance from p to a point (x, y, xy). For small c, the closest point is $(0, 0, 0)$, but then at a certain height, the closest point jumps to another point on the saddle.)