Mathematics 210 Name: _____
Professor Alan H. Stein
Due Monday, October 29, 2007 This problem set is worth 50 points.

Make sure that you check the course website for instructions, fill out the pledge form and hand it in with your paper. The instructions for problem sets and take-home examinations along with the pledge form are available from the *General Policies* portion of the web site. *No paper will be accepted without a signed pledge form.* Remember that your paper may be handed in before the deadline but that no late papers will be accepted regardless of the reason. The course website also includes an explanation of how your average will be calculated if you fail to complete this assignment.

Note that, since most of the calculations involved can be done routinely using either a calculator or a symbolic manipulation program such as Maple or Mathematica, it will obviously be necessary to show, through your work, exactly how you came up with your solutions.

Each part of each question will be given the same weight.

1. Find an equation tangent to the surface $x^2 + 5xyz + y^2 + z^3 = 80$ at the point $(2, -1, 5)$.

2. Find all critical points for the function $f(x, y) = (1-x)(1-y)(x+y-1)$ and determine whether they are relative extrema or saddle points.

3. Find all critical points for the function $f(x, y) = x^4 - 2(x-y)^2 + y^4$ and determine whether they are relative extrema or saddle points.

4. Find the points on the ellipsoid $\frac{x^2}{4} + y^2 + \frac{z^2}{25} = 1$ closest to and farthest from the origin.

5. Find the shortest distance between the circle $x^2 + y^2 = 1$ and the curve $x^2y = 16$. *Getting to the point where you need to solve a system of equations in order to find possible points where the curves are closest will be enough to earn full credit; actually finding the shortest distance will earn extra credit.*

6. Use a double integral to find the area of the region in the first quadrant between $x = 1$ and $x = 2$ and beneath the curve $y = \frac{1}{x}$.

(7-11): Rewrite each double integral as an iterated integral.

7. $\iint_{\mathcal{D}} x^2 + 3xy\,dA$, where $\mathcal{D} = \{(x, y) | 2x \leq y \leq 5x + 3,\ 0 \leq x \leq 10\}$.

8. $\iint_{\mathcal{D}} x^2 + 3xy\,dA$, where $\mathcal{D}$ is the circle with center at $(-3, 5)$ and radius 2. *Set up the iterated integral so that the integration is done first with respect to y.*

9. $\iint_{\mathcal{D}} x^2 + 3xy\,dA$, where $\mathcal{D}$ is the circle with center at $(-3, 5)$ and radius 2. *Set up the iterated integral so that the integration is done first with respect to x.*

10. $\iint_{\mathcal{D}} x^2 + 3xy\,dA$, where $\mathcal{D}$ is the region bounded by the lines $x + y = 7$, $5x + 2y = 29$ and $y = 2x + 1$. *Set up the iterated integral so that the integration is done first with respect to y.*

11. $\iint_{\mathcal{D}} x^2 + 3xy\,dA$, where $\mathcal{D}$ is the region bounded by the lines $x + y = 7$, $5x + 2y = 29$ and $y = 2x + 1$. *Set up the iterated integral so that the integration is done first with respect to x.*

Extra Credit

Extra credit will be awarded for the best joke. All jokes must observe standards of good taste. The determination of the best joke will be made by popular vote in class when the papers are returned.