Announcements.

- The second hour exam will be on Friday, 5 November 2004, 2-2:50 in CB 349.
- Please read the syllabus to find out if you may use your calculator on the exam.
- The final exam will be 1-3pm on Wednesday, 15 December 2004 in our regular (lecture) classroom, CB 349. Please visit http://www.uky.edu/Registrar/finals-fall.html for the University final exam schedule. The time listed in the course calendar is not correct.
- Below are several review questions and problems to help you prepare for the exam. In addition, you should study your notebook problems to help prepare for the exam.
- The exam will cover sections §§12.3–12.8 and §§13.1-13.4, 13.6. See the assignment sheets for a list of topics. See your notes from lecture for a more detailed description of the material covered.

Review questions and problems.

1. Be familiar with the following bits of notation.
$$f_x,\ \frac{\partial f}{\partial x},\ D_{\mathbf{u}}f,\ \nabla f,\ =, \iint$$
2. What does it mean for a function $f(x, y)$ to be differentiable at (x_0, y_0)?
   State a theorem which can be used to show that a function is differentiable.
3. Give the geometric interpretation of the gradient.
4. Let $f(x, y) = \cos(x^2 + y^2)$. For which unit vectors $\mathbf{u}$ does the directional derivative of f, $D_{\mathbf{u}}f(\sqrt{\pi}, 0) = 0$?
5. Find a point on the surface $x^2 + y^2 - 2z^2 = 23$ and find the tangent plane to the surface at that point.
6. If $f_x(2, 3) = 1$, $f_y(2, 3) = 2$, $x(4, 5) = 2$, $y(4, 5) = 3$, $x_u(4, 5) = 6$, $x_v(4, 5) = 7$, $y_u(4, 5) = 8$ and $y_v(4, 5) = 9$, then find $f_v(x(4, 5), y(4, 5))$.
   Do you need to know if $x = x(u, v)$ or $x = x(v, u)$?
7. Find the differential of the function for the volume of a right circular cone $V = \frac{1}{3}\pi r^2 h$.
   If $V(r_0, h_0) = 10$, can you estimate $V(r_0 + 0.01, h_0 + 0.02)$?
8. Find two unit tangent vectors to the surface $z = \cos(x)\cos(y)$ at the point where $x = \pi/6$ and $y = \pi/4$.
9. Let f be a differentiable function of one variable. If $u(x, t) = f(x + 2t)$, show that $u_{tt} - 4u_{xx} = 0$.

10. Give a geometric interpretation of the Lagrange multiplier condition for constrained local extreme values.

11. Give a geometric interpretation of the integral

$$\iint_R f(x,y)\,dxdy.$$

12. Be able to define regions of type I and type II.

13. State Fubini's theorem.

14. Find the value of the integral

$$\int_0^1 \int_x^1 \sin(y^2)\,dy\,dx.$$

15. Consider the surface $S = \{(x,y,z) : z = f(x,y), (x,y) \in R\}$ which is a graph over a region R in the (x,y)-plane. Compare the area of the surface S and the area of the region R. Which is larger?

16. The following questions from homework would be good examination problems.

    §12.3 #50, 76a, §12.4 #3, 33, §12.5 #17, 33, §12.6 #19, 43, §12.7 #30, 45, §12.8 #15, 23. §13.2 #23, §13.3 #15, 25, 39, §13.4 # 9, 21. §§13.6 #1, 7.

October 29, 2004