Math 10C Second Midterm 40 points November 17, 2004

- Write version on your blue book **VERSION B**
- Put your name, ID number, and section number (or time) on your blue book.
- You may have ONE 2-sided page of notes. NO CALCULATORS are allowed.
- *You must show your work to receive credit.*

1. (12 points) The table at the bottom of this page gives wave heights (w) in feet produced by various wind speeds (s in knots) blowing for various lengths of time (t) in hours. Thus we have a table of some values of $w(s,t)$.
   (a) Estimate $\nabla w(50,10) = \langle w_s(50,10), w_t(50,10)\rangle$.
   (b) What are the units of each of these partial derivatives? (For example — but wrong — knots per hour.)
   (c) Estimate the wave height when a wind of 49 knots has been blowing for 11 hours. You can leave arithmetic like $(27/4)\times 3 - 1$ in your answer. (Of course, this is not the answer.)

2. (12 points) Compute the indicated derivatives.
   (a) $f'(1)$ given that $f(t) = g(x(t), y(t))$, $g(3,1) = -4$, $g(1,1) = 3$, $g_x(3,1) = 1$, $g_y(3,1) = -2$, $g_x(1,1) = -3$, $g_y(1,1) = 2$, $x(1) = 3$, $x'(1) = 1$, $y(1) = 2$, and $y'(1) = 3$.
   Misprint: "$y(1) = 2$" should be "$y(1) = 1$".
   (b) $\dfrac{\partial f_y(x,y)}{\partial x}$ given that $f(x,y) = x^3 y - y\cos^2(\ln y)$.
   (c) $D_{\mathbf{u}} f(0,1)$ given that $f(x,y) = x^2 - 2xy$ and $\mathbf{u}$ is a unit vector in the same direction as $\langle 1, 2\rangle$.

3. (8 points) Find the equation of the tangent plane to the surface $3x^2 + y^2 + 2z^2 = 21$ at the point $(1, -4, 1)$.

4. (8 points) Find the local maxima, local minima and saddle points of the function $f(x,y) = xy^2 - x^2 - y^2 + 5$. To help you with your calculations, the critical points are at $(0,0)$, $(1,\sqrt{2})$ and $(1,-\sqrt{2})$.

table of wave height (feet)	Duration (hours) 5	10	15	20	30	40	50
30 knots	9	13	16	17	18	19	19
40 knots	14	21	25	28	31	33	33
50 knots	19	29	36	40	45	48	50
60 knots	24	37	47	54	62	67	69

END OF EXAM