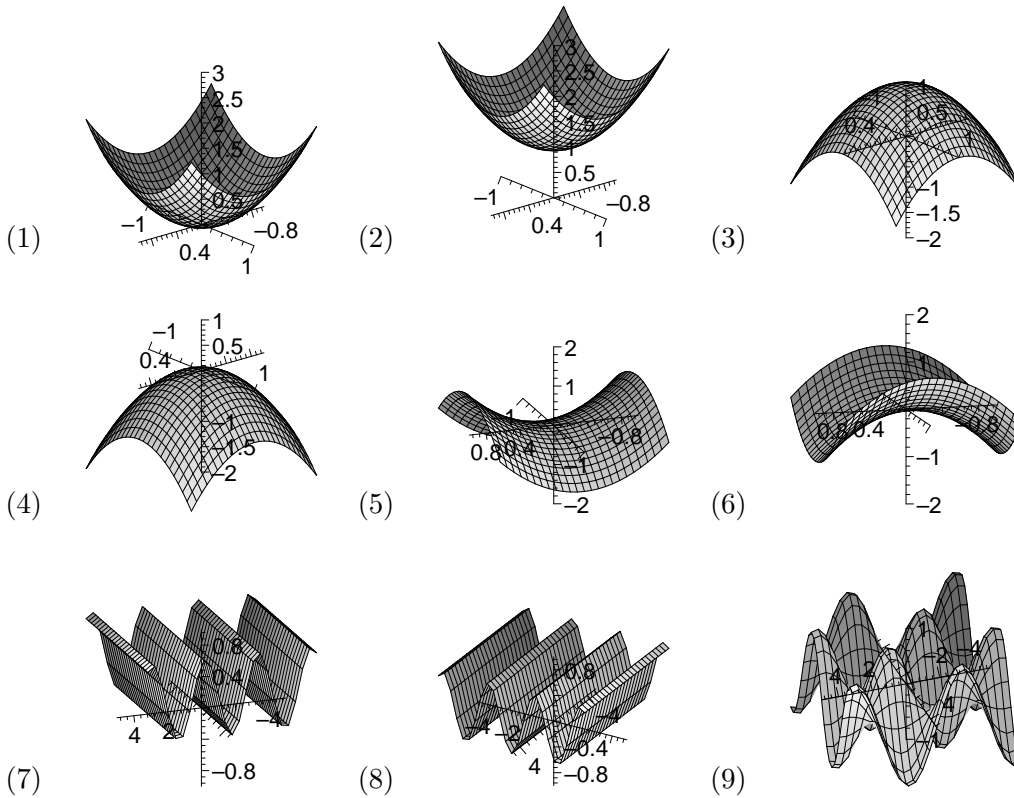


Sample Exam 2, Math 32, Fall 2006

The following questions are included only to indicate the style of questions that will appear on Exam 2.

- Find the first partial derivatives of the function $f(x, y) = x \cos(3xy^7)$. No explanation necessary, but show all your work.
- Find the graph below that best matches each of the equations (a)–(c), and briefly **JUSTIFY** each answer. In particular, explain why your choice is better than all other possible choices.



(a) $z = 1 - x^2 - y^2$. (b) $z = x^2 - y^2$. (c) $z = \sin^2(x)$.

- (17 points) Let $h(u, v) = f(x(u, v), y(u, v))$, and suppose that

$$\begin{array}{lll} x(2, 5) = -1, & x_u(2, 5) = 7, & f_x(-1, 3) = -4 \\ y(2, 5) = 3, & y_u(2, 5) = -5, & f_y(-1, 3) = 11. \end{array}$$

Calculate the value of $h_u = \frac{\partial h}{\partial u}$ at $u = 2, v = 5$.

- Let $f(x, y) = xe^{x-y}$. Find an equation for the tangent plane to $z = f(x, y)$ at $(x, y) = (3, 2)$.

5. Let $f(x, y) = y \sin x + \cos x$.

- (a) Let $\mathbf{u} = \langle .6, .8 \rangle$. Note that \mathbf{u} is a unit vector (you do not need to check this). Calculate $D_{\mathbf{u}}f\left(\frac{\pi}{2}, 3\right)$, the directional derivative of f at $\left(\frac{\pi}{2}, 3\right)$ in the direction of \mathbf{u} .
- (b) If we want $f(x, y)$ to **decrease** as quickly as possible, in which direction should we travel away from $\left(\frac{\pi}{2}, 3\right)$? Briefly **explain** your answer.

6. Let $f(x, y)$ be a differentiable function, and suppose that f is described by the following table.

(x, y)	f	f_x	f_y	f_{xx}	f_{xy}	f_{yy}
$(1, -4)$	0	0	1	0	1	1
$(3, 5)$	-3	0	0	2	-2	3
$(-2, 7)$	1	4	1	1	0	2
$(4, 1)$	6	0	0	1	-3	2
$(0, -5)$	5	0	0	-1	1	-2

Suppose also that $f_x(x, y) \neq 0$ for all (x, y) not listed in the table.

- (a) List all of the critical points of f and briefly **EXPLAIN** why these are the **only** possible critical points of f .
- (b) Classify the critical points you found in part (a) (as local maximum, etc.). Show all your work.