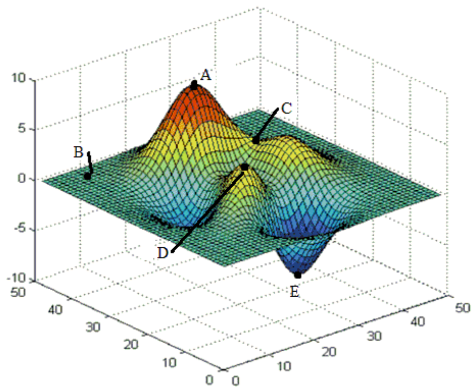
234 Quiz 7

Section: *Name:*

5 pts for each. 20 minutes. Bonus on back.

1. $f(x, y) = x^3 + y^3 + 3xy$. Find all critical points and classify them into local maxima, local minima and saddle points
2. $f(x, y, z) = x + 2y + 4z$ has a smallest value on the surface $xyz = 1, x > 0, y > 0, z > 0$. Find the value. (Hint: Lagrange multiplier. Argue x, y, z are nonzero so that $1/x$ is safe. Discuss $\nabla g = 0$ also(so g?))

(Bonus 1: 2pts) In the figure, $B(8, 42, 0)$ and for all $(x, y), x \leq 8, y \geq 42$, the function value is 0(namely the function is all zero on the left-upper corner of B). Both B and E are interior local minimum points. Consider the quadratic form $Q(\Delta x, \Delta y) = \frac{1}{2} f_{xx}(a, b)\Delta x^2 + f_{xy}(a, b)\Delta x \Delta y + \frac{1}{2} f_{yy}(a, b)\Delta y^2$. Which kind of form could Q be at B? How about Q at E? Explain.



(Bonus 2: 2pts) (a) Explain briefly why $\nabla f \parallel \nabla g$ at the point where f achieves one extremum on $g = C$. (b). Consider the second regular problem. I'm wondering how to find the maximum value. By solving $\nabla f = \lambda \nabla g, g = C$ and $\nabla g = 0, g = C$, I get one point only. We have seen that it's the minimum value point. I'm wondering where the maximum point goes. Please help me.