Midterm II

Math 210 November 9, 2001

Problem 1: Let $f(x,y) = xe^{xy^2}$.

a) Find the directional derivative of f at the point $P = (0,2)$ in the direction of the vector $v = \langle 3, 4 \rangle$.

b) In what direction does f increase fastest at the point $P = (0,2)$?

Problem 2: Find maximun and minimum value of $f(x,y) = 2x^2 + y^2$ on the circle $x^2 + y^2 = 9$.

Problem 3: Find the volume of the tetrahedron bounded by the coordinate planes and the plane $3x + 3y + z = 3$.

Problem 4: Let L be a square lamina with vertices at $(0,0)$, $(4,0)$, $(4,4)$ and $(0,4)$. Its density function is $\rho(x,y) = y$. Is it possible for the point $(2,1)$ to be the center of mass of L? Explain.

Problem 5: Change the order of integration:

$$\int_0^3 \int_{\frac{2}{9}x^2}^{\frac{2}{3}x} f\,dydx$$

Problem 6: Calculate the Jacobian of the transformation:

$x = u + 2v - 3w$
$y = 2u - w$
$z = v$

Problem 7: Evaluate:

$$\int\int\int_R \frac{x}{x^2 + y^2}$$

where R is the region in the first octant bounded by the sphere $x^2+y^2+z^2 = 9$ and the planes $x = 0$, $y = 0$ and $z = 0$.