

Exam Date and Time: MONDAY, May 12, 9 AM -12 PM
Exam Room: BEL 328

Review Questions

Partial Derivatives

What is a function? What is a graph?

What is the domain of a function?

What is a partial derivative? What does it represent geometrically? How do you find a tangent plane?

What is the general chain rule?

What is the Gradient Vector? What is a directional derivative?

How do we get the minimum and maximum values for a function over a domain?

What is a Lagrange multiplier? How does it help with max-min problems?

Multiple Integrals

Can you evaluate a double integral?

Give several forms of dA .

Give an example of a integral that is easier to integrate in polar coordinates.

Give several forms of dV .

What is the formula for surface area?

How do you switch from a 2-D domain of type I to a 2-D domain of type II?

How do you switch the order of integration for a 3D domain?

Practice Exam

1 One leg of a right triangle is increasing at a rate of $1/3$ m/s while the other is decreasing at a rate of $1/10$ m/s. If the first leg is 10 and the second leg is 20 what rate is the area changing? (Hint: Use Chain Rule.)

2. a) Evaluate the integral $\int_{x=-1}^2 \int_{y=x}^{x^2} f(x, y) dy dx$, where $f(x, y) = x^2y + y^3$.

b) Now change the domain to be D , the points inside a disk of radius 5 centered at the origin.

c) Evaluate $\int \int_D f(x, y) dA$

3. Compute the following limits or show they do not exist:

a) $\lim_{(x,y) \rightarrow (0,0)} \frac{3x^2+y}{x+y}$

b) $\lim_{(x,y) \rightarrow (0,0)} \frac{x^3+y^2}{\sin x \cos y + 1}$

c) $\lim_{(x,y) \rightarrow (0,0)} \frac{(x^2-y^2)^6}{x^2+y^2+2xy} + 5$

4. a) Let $f(x, y, z) = z^3 + 5x + 3xy$. Compute the directional derivative in the direction of $\langle 12, 3, 4 \rangle$

b) Let $g(x, y) = x^2 + 7y$ at $(1, 2)$ find a direction where the directional derivative is 0.

c) Draw the level curves for $g(x, y)$. What do you notice about your answer from part b).

5. Find the absolute minimum and maximum values of

$f(x, y) = 7 \cos\left(\frac{\pi x}{10}\right) \cos\left(\frac{\pi y}{4}\right) + 2$ on the domain

$D = \{(x, y) \mid -\frac{5}{\sqrt{2}} \leq x \leq \frac{5}{\sqrt{2}}, \frac{4}{3} \leq y \leq \frac{8}{3}\}$

6. What is the maximum and minimum value of $f(x, y) = xe^{2y+1}$ if x and y are solutions to the equation $x^2 + y^2 = 4y$
7. a) What is the domain of $f(x, y) = \sqrt{x+y} + \ln(x^2 - y)$?
b) Where is this function differentiable?
c) Give the linearization of f at $(2, 1)$.
8. For $f(x, y) = -x^3 + 6xy + y^2$ find and classify all critical points.
9. 16.7 # 31.
10. p. 1086 # 13.