

Math 242 Test 2

09 - Nov - 2005

Instructor: Bill Hart

Name:

Time Allowed: 50 minutes.

TA's Name:

Instructions: Write your answers in pen. You may write on both sides of the sheet. If you require additional paper during the exam, please raise your hand.

For **all** questions, show all your computations and give *sufficient indication* of how they relate to the solution. In particular, *long answer* questions will not receive credit unless your solutions include detailed explanations.

Submit all rough work. Place a single diagonal line through any rough work which you do not consider to be part of your final solution.

All students should aim to complete BOTH the long answer questions and as many of the short answer questions as they have time for. Complete, correct solutions may attract more marks than a larger number of incomplete or incorrect solutions.

Section A : FIVE Short Answer Questions - TWENTY FIVE POINTS TOTAL

Section B : TWO Long Answer Questions - TWENTY POINTS TOTAL

Section A

Short Answer Questions

Question 1: (5 Points)

Evaluate

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

Question 2: (5 Points)

Use linear approximation to estimate

$$\sqrt{3(2.1)^2 + 6(1.9)^2}.$$

Short Answer Questions (continued)

Question 3: (5 Points)

Use the multivariable chain rule to compute $\frac{\partial w}{\partial s}$ where $w = \sqrt{u^2 + v^2 + z^2}$ and where $u = 3e^t \sin s$, $v = 3s$ and $z = 4e^t$.

Question 4: (5 Points)

Compute the directional derivative of f at P in the direction of \mathbf{v} where $f(x, y) = x^2 - 2xy + 3y^2$, $P = (1, 2)$ and $\mathbf{v} = (1, 1)$.

Short Answer Questions (continued)

Question 5: (5 Points)

The function $f(x, y) = x^3 + 6xy + 3y^2 - 6x - 6y$ has critical points at $(0, 1)$ and $(2, -1)$. Classify these critical points.

Section B

Long Answer Questions

Question 6: (10 Points)

Find the global maximum and minimum values attained by $f(x, y)$ on the plane region R where $f(x, y) = 3xy + x^2 - y^2$ and where R is the triangular region with vertices at $(0, 0)$, $(1, 0)$ and $(0, 1)$.

Long Answer Questions (continued)

Question 7: (10 Points)

Use the method of Lagrange multipliers to find the maximum and minimum values, if they exist, of $f(x, y, z) = x^2 - y^2 + z^2$, subject to the constraints $x + y + z = 1$ and $x - 2y + 3z = 3$.