Université d'Ottawa · University of Ottawa
Faculté des sciences
Mathématiques et de statistique
Faculty of Science
Mathematics and Statistics

Calculus III for Engineers
MAT 2322A - Fall 2011
Midterm I
Professor: Victor G. LeBlanc
Time limit: 80 minutes. Closed books. No calculators.

Name:________________________________ ID Number:______________________

Instructions

- This exam has 8 pages and you have 80 minutes to complete it.
- This is a closed book exam. Furthermore, all calculators, cell phones, pagers or any other electronic or communication devices are forbidden.
- Read each question carefully before answering.
- Questions 1 to 3 are multiple choice questions. These questions are worth 2 points each and no partial marks are possible. **Please write your answers in the corresponding boxes in the grid below entitled "Answers to multiple choice Qs".**
- Questions 4 to 6 are long answer questions. Questions 4 and 6 are worth 6 marks each, and question 5 is worth 7 marks, so organize your time accordingly. **A correct answer requires a full, clearly-written and detailed solution.** Answer each question in the space provided, using backs of pages or the extra pages at the end if necessary.
- Do not unstaple the test.
- Good luck!

Answers to multiple choice Qs

1	2	3

Grid below is used for grading
(do not write in this grid)

MCQ	4	5	6	Total
/6	/6	/7	/6	/25

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1. If $f(x,y)$ is a differentiable function such that $\vec{\nabla} f(1,2) = \vec{i}$, only one of the following curves can be the level curve for f through the point $(1,2)$. Which one?

A. $y = 1 + x$

B. $y = \dfrac{2}{x}$

C. $y = 1 + e^{x-1}$

D. $x = 1$

E. $y = 2e^{x-1}$

F. $y = 2 + (x-1)^2$

2. If $f(x,y) = x^2 - y^2$, then which of the following numbers corresponds to the global maximum value of f subject to the constraint $x^2 + 4y^2 = 1$?

A. $\dfrac{5}{4}$

B. $\dfrac{-1}{2}$

C. That global maximum value does not exist

D. $\dfrac{1}{4}$

E. 1

F. 0

3. If $z = f(x, y)$ and $x = x(u, v)$, $y = y(u, v)$, which of the following formulas corresponds to the chain rule for the partial derivative $\frac{\partial z}{\partial u}$?

A. $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial x}\frac{\partial x}{\partial u} + \frac{\partial z}{\partial y}\frac{\partial y}{\partial u}$

B. $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial y}\frac{\partial y}{\partial u}$

C. $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial u}\frac{\partial u}{\partial v} + \frac{\partial z}{\partial v}$

D. $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial x}\frac{\partial x}{\partial u} + \frac{\partial z}{\partial y}\frac{\partial y}{\partial v}$

E. $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial x}\frac{\partial x}{\partial u}$

F. $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial x}\frac{\partial x}{\partial v}\frac{\partial v}{\partial u} + \frac{\partial z}{\partial y}\frac{\partial y}{\partial u}$

4. Find and classify the critical points of the function $f(x, y) = xy(12 - 4x - 3y)$.

5. Find the global maximum and the global minimum of the function $f(x, y) = xy$ on the region

$$A = \{ (x, y) \in \mathbb{R}^2 \mid x^2 + y^2 \leq 9 \}.$$

6. Compute the following double integrals $\iint_R (y^3 + 3yx^2)\, dA$, for each of the regions R described below:

(a) R is the rectangle $0 \leq x \leq 1$, $0 \leq y \leq 2$.

(b) R is the triangle in the plane with vertices at $(0,0)$, $(1,0)$ and $(0,1)$.

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