Math 11 Fall 2010 Midterm Exam II

Tuesday, November 9, 2010

Instructor (circle one): Barnett Van Erp

PRINT NAME: ______________________________

Instructions: This is a closed book, closed notes exam. You have two hours, do all problems. There are 60 points total, and points for each problem are indicated.

Use of calculators is not permitted.

You must justify all of your answers to receive credit.

The Honor Principle requires that you neither give nor receive any aid on this exam.

GOOD LUCK!

FERPA waiver: By my signature I relinquish my FERPA rights in the following context: This exam paper may be returned en masse with others in the class and I acknowledge that I understand my score may be visible to others. If I choose not to relinquish my FERPA rights, I understand that I will have to present my student ID at my instructors office to retrieve my examination paper.

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1. [8 points]

(a) Find the locations of all local maxima, minima, and saddle points of the function $f(x, y) = (y^2 - x^2)e^y$ in the plane. (Be sure to state the type of each point found.)

(b) [BONUS] Does the function have an absolute maximum or absolute minimum, and why?

2. [10 points]

   Find the locations and values of the absolute minimum and absolute maximum of $f(x, y) = xy - y$ over the domain $x^2 + 2y^2 \leq 3$. [Hint: in order to solve the equations you will want to eliminate λ as a first step.]

3. [10 points] Let D be the planar domain bounded by $x = 1$ and $x = 2$, $y = 0$ and $xy = 1$.

(a) Write down a form for the above double integral $\iint\limits_D y \sin xy \, dA$ using iterated integrals with only the ordering $dx\,dy$ (i.e. Type II integral).

(b) Evaluate $\iint\limits_D y \sin xy \, dA$

4. [12 points] Given below are three solid regions. In each case, analyze the region and write down a corresponding iterated integral. The function $f(x, y, z)$ is unknown in each case, so you only need to write down the correct bounds for the iterated integral.

   (a) Let E be the solid region bounded by the paraboloid $z = (x-1)^2 + (y-1)^2$ and the plane $2x + 2y + z = 6$. Write $\iiint_E f(x, y, z)dV$ as an iterated integral of the form

$$\int_{\dots}^{\dots} \int_{\dots}^{\dots} \int_{\dots}^{\dots} \dots \; dz\, dy\, dx.$$

   (b) Let E be the tetrahedron ("pyramid") with four vertices $(0, 0, 0)$, $(0, 1, 0)$, $(1, 1, 0)$ and $(1, 1, 1)$. Write $\iiint_E f(x, y, z)dV$ as an iterated integral of the form

$$\int_{\dots}^{\dots} \int_{\dots}^{\dots} \int_{\dots}^{\dots} \dots \; dy\, dx\, dz.$$

(c) Let E be the solid region bounded by the surfaces $y = x^2$, the plane $2x + z = 2$, the xz-plane, and the xy-plane. Write $\iiint_E f(x, y, z)dV$ as an iterated integral of the form

$$\int_{\cdots}^{\cdots} \int_{\cdots}^{\cdots} \int_{\cdots}^{\cdots} \ldots \; dy\, dz\, dx.$$

5. [10 points] Let E be the solid region above the cone $z = \sqrt{3x^2 + 3y^2}$ and below the sphere $x^2 + y^2 + z^2 = 4$. Evaluate the triple integral $\iiint_E z\,dV$.

6. [10 points] Possibly by converting to an appropriate coordinate system, evaluate the iterated integral

$$\int_0^4 \int_0^{\sqrt{z}} \int_0^{\sqrt{z-y^2}} \sqrt{x^2+y^2}\, dx\, dy\, dz.$$