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KOÇ UNIVERSITY

MATH 200 - Multivariable Calculus and Matrix Algebra

Final Exam June 1, 2009

**Duration of Exam: 120 minutes**

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**INSTRUCTIONS:** Calculators are not allowed. No books, no notes, no questions and no talking allowed. You must always **explain your answers** and **show your work** to receive **full credit**. Use the back of these pages if necessary. **Print (use CAPITAL LETTERS) and sign your name, and indicate your section below.**

**Surname, Name:** _____

**Signature:** _____

**Section (Check One):**

Section 1: S. Küçükçifçi (Mon-Wed 11:00) ___
Section 2: S. Küçükçifçi (Mon-Wed 15:30) ___

| PROBLEM | POINTS | SCORE |
|---|---|---|
| 1 | 16 | |
| 2 | 16 | |
| 3 | 16 | |
| 4 | 18 | |
| 5 | 18 | |
| 6 | 16 | |
| **TOTAL** | **100** | |

**1.** (16 points) Let $M$ be the matrix $\begin{bmatrix} 3 & 2 & 1 \\ 0 & -1 & 3 \\ 0 & 5 & -4 \end{bmatrix}$.

(a) Evaluate the determinant of $M$ by elementary row operations.

(b) Evaluate the determinant by cofactor expansions (that is by using the formula).

**2.** (16 points) Compute $A^{10}$ using the diagonalization of the matrix $A$, where

$$A = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}.$$

**3.** (16 points) (a) Find $dy/dx$ if $x^3 + y^3 = 6xy$.

(b) Find the directions in which the directional derivative of $f(x, y) = ye^{-xy}$ at the point $(0, 2)$ has the value 1.

**4.** (18 points) Find all the local maxima, local minima, and saddle points of the function $f(x, y) = x^2 + y^2 + x^2y + 4$.

**5.** (18 points) Use Lagrange multipliers to find the maximum and minimum values of the function $f(x, y, z) = 2x + 6y + 10z$ subject to the constraint $x^2 + y^2 + z^2 = 35$.

**6.** (16 points) (a) Evaluate $\int_R \int (x+2)dA$, where $R$ is the finite region bounded by the parabolas $y = 2x^2$ and $y = 1 + x^2$.

(b) Reverse the order of the integration of the integral $\int_0^1 \int_x^1 e^{x/y} dy dx$. (Do not evaluate the integral.)