



Middle East Technical University - Northern Cyprus Campus

**MAT 101 - Mathematics for Social Sciences**

Summer 2008/2009

**Midterm Examination 1**

28<sup>th</sup> July 2009

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Instructor: Assist. Prof. Dr. Bertuğ AKINTUĞ

Duration: 115 minutes

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Surname: \_\_\_\_\_

Name: \_\_\_\_\_

Student Number: \_\_\_\_\_

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	TOTAL
10 pt.	10 pt.	10 pt.	10 pt.	14 pt.	8 pt.	10 pt.	16 pt.	12 pt.	<b>100 pt.</b>

**Please READ the following remarks before you start the exam.**

- You are not allowed to exchange anything.
- Show all your calculations.
- No partial credit will be given for unsupported answers.

1 (10 pt.) Let  $\mathbf{A} = \begin{bmatrix} -4 & 2 \\ 0 & 6 \end{bmatrix}$  and  $\mathbf{B} = \begin{bmatrix} 4 & 3 \\ 1 & 0 \end{bmatrix}$ ,

find  $\mathbf{B}\mathbf{B}^T - \frac{1}{2}\mathbf{A}$ , where  $\mathbf{B}^T$  denotes the transpose of matrix  $\mathbf{B}$ .

2 (10 pt.) Let  $\mathbf{A} = \begin{bmatrix} 0 & 2 & -1 \\ 1 & -1 & 0 \\ 1 & -2 & 1 \end{bmatrix}$ ,

- a) check if the matrix  $\mathbf{A}$  is invertible.
- b) If it is invertible, find the inverse matrix  $\mathbf{A}^{-1}$ .

**3 (10 pt.)** Solve the following system by using the method of matrix reduction.

$$x - y + 2z = 3$$

$$3x + y + z = 5$$

4 (10 pt.) Answer the following.

(a) If  $f(x) = (x^2 + 2x)$  and  $g(x) = (3x - 1)$ , find  $(f \cdot g)(x)$ .

(b) If  $f(x) = \sqrt[3]{x^2}$  and  $g(x) = \sqrt{x-1}$ , find  $(f \circ g)(x)$ .

(c) Find the inverse of the function  $f(x) = 2^{(3x)}$ .

5 (14 pt) Given the case-defined function

$$g(x) = \begin{cases} x^2 - 1 & \text{if } -1 \leq x < 2 \\ 4 & \text{if } x = 2 \\ x + 1 & \text{if } x > 2 \end{cases}$$

(a) Graph the function  $g(x)$ .

(b) Give the domain and range of  $g(x)$ .

(c) Check if  $g(x)$  is continuous at  $x = 2$ .

**6 (8 pt)** By using transformation techniques (shifting and reflection), sketch the graph of  $y = 2 - |x + 2|$  starting from the graph of  $y = |x|$ .

7 (10 pt) Solve for  $x$  :

(a)  $2^{(2x+1)} = 5^x$

(b)  $\log(2x - 1) = \log(x + 1) + 1$

8 (16 pt) Evaluate the limit, if it exists.

(a)  $\lim_{x \rightarrow \infty} \frac{3x^2 - x + 2}{x^3 + 5}$

(b)  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x^2 - 3x}$

(c)  $\lim_{x \rightarrow -4^+} \frac{x}{x + 4}$

(d)  $\lim_{x \rightarrow \infty} \frac{2x^3 + 3x^2 + x}{5x^3 + x^2 + 2}$

9 (12 pt) Answer the following.

(a) Find the derivative  $f'(x)$  if  $f(x) = \frac{\sqrt{x+1}}{x}$

(b) Find the derivative  $f'(x)$  if  $f(x) = (2x^4 + x^2 - 8)^3$

(c) Find the slope of the curve  $y = \sqrt[3]{(2x^2 + x)^2}$  at  $(-1, 3)$