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# KOÇ UNIVERSITY

## MATH 106 - CALCULUS I

Midterm I      November 16, 2011

**Duration of Exam: 90 minutes**

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**INSTRUCTIONS: CALCULATORS ARE NOT ALLOWED FOR THIS EXAM.** 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-Fri 12:30)      \_\_\_\_\_
- Section 2: E. Ş. Yazıcı(Mon-Wed-Fri 14:30)      \_\_\_\_\_
- Section 3: S. Küçükçifçi (Mon-Wed-Fri 10:30)      \_\_\_\_\_
- Section 4: E. Ş. Yazıcı(Mon-Wed-Fri 11:30)      \_\_\_\_\_
- Section 5: T. Etgü (Tue-Thu 12:30)      \_\_\_\_\_

PROBLEM	POINTS	SCORE
1	24	
2	8	
3	10	
4	16	
5	10	
6	17	
7	10	
8	7	
<b>TOTAL</b>	<b>102</b>	

1. Compute the following limits. Specify any infinite limits.

a) (8 points)  $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1} =$

b) (8 points)  $\lim_{x \rightarrow 3^-} \frac{x - 2}{|x - 3|} =$

c) (8 points)  $\lim_{x \rightarrow -\infty} x + \sqrt{x^2 - 4x + 1} =$

**2.** (8 points) Find all  $A$  which make the following piecewise defined function  $f$  continuous for all real numbers

$$f(x) = \begin{cases} Ax^2 + 2x & \text{for } x \leq 2 \\ A^2x - 2x + 2 & \text{for } x > 2 \end{cases}$$

**3.** (10 points) Show that there is a positive real number which is a solution to the equation  $x^4 - 3x^3 + x^2 - 2 = 0$ .

4. a) (6 points) Write the precise definition of  $\lim_{x \rightarrow a} f(x) = L$ . ( $\epsilon, \delta$  definition of limit)

b) (10 points) Prove that  $\lim_{x \rightarrow 0} x \cos(1/x) = 0$  by using the  $\epsilon, \delta$  definition of limit.  
(Hint:  $|\cos(1/x)| \leq 1$ )

5. (10 points) Evaluate  $\lim_{\theta \rightarrow 0} \frac{e^{\sin \theta} - 1}{\theta}$ .

6. Differentiate the following functions.

a) (9 points)  $g(t) = \frac{t}{\cos(t^4)}$

b) (8 points)  $f(x) = \left(\frac{1}{x}\right)^{\sqrt{x}}$

7. (10 points) Suppose that  $y = 3x - 5$  is tangent to  $y = f(x)$  at  $(0, -5)$  and;  $y = 4x + 2$  is tangent to  $y = g(x)$  at  $(1, 6)$ . Find the slope of the tangent line to the curve given by the equation

$$f(x)g(y) = -30$$

at the point  $(0,1)$ .

8. (7 points) Show that the derivative of an even differentiable function is an odd function.