## KOÇ UNIVERSITY MATH 102 - CALCULUS Midterm I November 2, 2009

## Duration of Exam: 90 minutes

**INSTRUCTIONS:** No calculators may be used on the test. No books, no notes, 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. Ünver (MW, 9:30)	
Section 2: S. Ünver (MW, 15:30)	
Section 3: Y. Arkun (TT, 12:30)	

PROBLEM	POINTS	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	15	
7	10	
8	10	
9	15	
TOTAL	100	

**Problem 1.** Compute the following limits by showing all your work. If the answer is  $^{+}_{-}\infty$ , specify which one.

(a) (5 pts.)  $\lim_{x \to 2^{-}} \frac{x^2 + x - 6}{x - 2}$ (b) (5 pts.)  $\lim_{x \to 0} \frac{\sqrt{1 + x} - 1}{x}$  **Problem 2.** Compute the followings limits by showing all your work. If the answer is  $^{+}_{-}\infty$ , specify which one.

(a) (5 pts) If we know that  $4x - 9 \le f(x) \le x^2 - 4x + 7$ , for all  $0 \le x$ , find

$$\lim_{x\to 4} f(x).$$

(b) (5 pts)  $\lim_{x \to -\infty} \frac{-2x^3 + 2x + 5}{6x^2 - 5x + 3}$ .

**Problem 3.** Show that there is an  $\alpha$  such that  $-1 \leq \alpha \leq 2$  and  $\alpha^4 - 2\alpha^2 + 6\alpha + 4 = 0$ .

**Problem 4.** Find the equation of the line that is tangent to the curve  $y = x^3$  at x = 1.

**Problem 5.** Find the points at which the following function is discontinuous, **showing** all your work:

$$f(x) = \begin{cases} e^x, & \text{if } x < 0\\ x^2, & \text{if } x \ge 0 \end{cases}$$

## Problem 6.

- (a) (5 pts) Compute  $\ln(e^{\sqrt{2}})$ .
- (b) (5 pts) Compute  $\log_{10} 1.25 + \log_{10} 80$ .
- (c) (5 pts) Solve the following equation for x :

$$\ln(x) + \ln(x - 1) = 1.$$

**Problem 7.** Find the intervals on which the function  $f(x) = x^3 - 6x^2 + 9x + 2$  is increasing/decreasing and concave up/down.

**Problem 8.** Find the derivative of each of the following functions:

(a) (5 pts) 
$$\frac{e^x}{sin(x)}$$
  
(b) (5 pts)  $2x^3 + \sqrt{x} + 3$ 

**Problem 9.** Using the definition of the derivative determine whether the function f(x) given by

$$f(x) = |x - 2| - 4$$

has a derivative at x = 2.