## 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 | $\mathbf{1 0 0}$ |  |

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

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 $4 x-9 \leq f(x) \leq x^{2}-4 x+7$, for all $0 \leq x$, find

$$
\lim _{x \rightarrow 4} f(x) .
$$

(b) (5 pts) $\lim _{x \rightarrow-\infty} \frac{-2 x^{3}+2 x+5}{6 x^{2}-5 x+3}$.

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:

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

## Problem 6.

(a) (5 pts) Compute $\ln \left(e^{\sqrt{2}}\right)$.
(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 $f(x)=x^{3}-6 x^{2}+9 x+2$ is increasing/decreasing and concave up/down.

Problem 8. Find the derivative of each of the following functions:
(a) $(5 \mathrm{pts}) \frac{\mathrm{e}^{x}}{\sin (x)}$
(b) $(5 \mathrm{pts}) 2 x^{3}+\sqrt{x}+3$

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 $x=2$.

