KOÇ UNIVERSITY
MATH 102 - CALCULUS
Midterm II December 16, 2008
Duration of Exam: 75 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: T. Etgü (11:00) —–
Section 2: T. Etgü (15:30) —–
Section 3: S. Ünver (9:30) —–

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Problem 1. Compute the following integrals:

(i) (7 pts.) \( \int_0^1 2x^3 \, dx \)

(ii) (7 pts.) \( \int_0^{\pi/6} \cos(2x) \, dx \)

(iii) (8 pts.) \( \int 2x^3 \sqrt{3x^4 - 1} \, dx \)

(iv) (8 pts.) \( \int \frac{\cos(x)}{\sin^2(x)} \, dx \)
Problem 2. Compute the following limit using L’Hopital’s theorem. (10 pts.)

\[
\lim_{x \to 1} \frac{\sin(x^2 - 1)}{x - 1}
\]
Problem 3. Let $f(x) = x^3 - 3x^2 - 9x + 5$

(i) (7 pts) Find the local maximum and minimum points of $f(x)$ and the intervals where $f$ is increasing/decreasing.

(ii) (7 pts.) Find the inflection point(s) of $f(x)$ and the intervals where $f$ is concave up/down.

(iii) (11 pts.) Sketch a graph of $y = f(x)$. 


Problem 4. Compute the derivative of

\[ \int_{0}^{x} \cos(t^2 - 3) \, dt \]
**Problem 5.** Find the area that is bounded by the graph of \( y = -x^2 + 3x + 2 \), and the lines \( y = x - 1, \ x = 0, \ x = 3 \). (25 pts.)