KOÇ UNIVERSITY
MATH 102 - CALCULUS
Midterm II May 5, 2006
Duration of Exam: 90 minutes

INSTRUCTIONS: No calculators may be used on the test. No books, no notes, and 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. Küçükçifci ——
Section 2: T. Albu (9:30) ——
Section 3: E.Ş. Yazıcı (15:30) ——
Section 4: T. Albu (12:30) ——
Section 5: E.Ş. Yazıcı (11:00) ——

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<tr>
<th>PROBLEM</th>
<th>POINTS</th>
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Problem 1. Evaluate the following indefinite and definite integrals:

(a) (10 pts) \[ \int \frac{x^3}{\sqrt{x^4 + 4}} \, dx = \]

(b) (10 pts) \[ \int_0^1 \sqrt{2x} (\sqrt{x} + \sqrt{2}) \, dx \]

(c) (10 pts) \[ \int \sin x \cos x \, dx \]

(d) (5 pts) \[ \int_1^{-1} x^2 (x^3 + 1)^4 \, dx \]
Problem 2. Calculate the following limit or show that it does not exist:

$$\lim_{x \to 0} \frac{1 - \cos 3x}{1 - \cos 5x} =$$

Problem 3.

(a) (5 pts) Find the area between the curve $y = x^2$ and the x-axis between 1 to 3.

(b) (5 pts) Find the volume of the solid formed by revolving the area you obtain above (problem (3-a)) about the x-axis.
Problem 4. Find the absolute extremum of the function \( f(x) = \frac{2x}{(x+2)^2} \) on \([-1,3]\).

Problem 5. The revenue of a manufacture’s product is given by the function

\[
R(q) = 20q - \frac{q^2}{4}
\]

where \( q \) is the number of units. At What production level will there be a maximum revenue? What is the maximum revenue?
Problem 6. A function $f(x)$ satisfies the properties given below.

1-) Domain of $f : \mathbb{R}$

2-) $f(0) = 1$; $f(1) = 0$; $f(-1) = 0$; $f(2) = 1$.

3-) $\lim_{x \to \infty} f(x) = 2$; $\lim_{x \to -\infty} f(x) = -1$

4-) $f'(1) = 0$ and $f'(0)$ is undefined

5-) The sign table of $f'(x)$ is as follows

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<th>0</th>
<th>1</th>
<th>$\infty$</th>
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<tr>
<td>$f'$</td>
<td>+</td>
<td>+</td>
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6-) The sign table of $f''(x)$ is as follows

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<th>$\infty$</th>
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<tbody>
<tr>
<td>$f''$</td>
<td>+</td>
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a-) State the local maximum points, local minimum points, inflection points and the intervals where the graph is concave up or concave down.

b-) Sketch the graph of a function which satisfies the properties given.