MATH 217: MIDTERM1 (SPRING 2007)

Name:_____

Section: _____ TA:_____

Score:

Problem 1._____

Problem 2._____

Problem 3._____

Problem 4._____

Problem 5._____

Total:_____

**Instruction**: Show all work. No work = no credit, even if you have a correct answer. References and calculator are not allowed.

Problem 1 (20 points): Consider the function $f(x) = x^3 + 3x^2 - 9x + 1$ defined on $(-\infty, \infty)$.

(a) Determine in which intervals the function is increasing, decreasing, concave up and concave down.

(b) Determine all local maximal and minimal values of $f$. Justify why they are local maximal or minimal values.

Problem 2 (5 points): Use L'Hospital's rule to evaluate

$$\lim_{x \to 0} \frac{\sin x - \sin 3x}{\sqrt{1+x} - 1}$$

Problem 3 (20 points): Evaluate the following indefinite integrals:
(a) (6 points) $\int (2x + \frac{1}{x^2} + \sqrt[3]{x})dx$

(b) (6 points) $\int (\cos(2x) - \sec x \tan x + 3)dx$

(c) (8 points) $\int x^2(2 + x^3)^9 dx$

Problem 4 (15 points): Find the area between the graph of the function $f(x) = \frac{2x}{(x^2+1)^2}$ and the $x$-axis over the interval $[0, 1]$. Then find the average value of the function on this interval.

Problem 5 (10 points): Evaluate the following limit by writing it as a definite integral and then evaluate that integral. Make sure you show some justification for the definite integral you are using.

$$\lim_{n\to+\infty} \frac{\sin(\frac{\pi}{n}) + \sin(\frac{2\pi}{n}) + \cdots + \sin(\frac{n\pi}{n})}{n}$$