Math 101
Second Midterm Exam
April 30, 2011
12.30 - 14:30

Name : _____

ID# : _____

Department : _____

Section : _____

- The exam consists of 5 questions of equal weight.
- Read the questions carefully.
- **Solutions, not answers, get points.** Show all your work in well-organized mathematical sentences. Explain your reasoning carefully and in full.
- **What can not be read will not be read.** Write clearly and cleanly.
- Simplify your answers as far as possible unless otherwise stated.
- Calculators and dictionaries are not allowed.
- Turn off all electronic devices including your cell phones before the exam starts.

Please do not write below this line.

Q1	Q2	Q3	Q4	Q5	Total
20	20	20	20	20	100

[*20 points*] 1

1. Find the asymptotes, the critical points, maxima and minima, intervals of increasing/decreasing, points of inflection, intervals of concavity of the function $f(x) = (1 + x^3)^{1/3}$. Sketch the graph of f.

2a. Find the limit $\lim_{x\to 1}\left(\frac{1}{x-1}-\frac{1}{\ln x}\right)$

2b. Find the limit $\lim_{n\to\infty}\left(\frac{n}{n^2+1}+\frac{n}{n^2+4}+\cdots+\frac{n}{n^2+k^2}+\cdots+\frac{n}{n^2+n^2}\right)$. (Explain what you are doing).

3a. Find all functions $f(x)$ and all real numbers a such that $\int_x^a f(t)\,dt = 2 - 2\sqrt{x}$ for all $x > 0$. (Explain what you are doing).

3b. Find the area of the region bounded by the curves $x = y^2 - 4y$ and $x = 2y - y^2$ (Explain what you are doing).

4a. Find the volume of the solid generated by revolving the region bounded by the curves $y = 2x - x^2$ and $y = 0$ about the x-axis (Explain what you are doing).

4b. Find the volume of the solid generated by revolving the region bounded by the curves $y = 2x - x^2$ and $y = 0$ about the y-axis (Explain what you are doing).

[*10+10 points*] 5

5a. Find $\int \frac{x^2}{1-x^4} dx$. (Explain what you are doing).

5b. Evaluate $\int_0^2 \sqrt{4+x^2}\, dx$. (Explain what you are doing).