Mathematical Analysis I VERSION A February, 02 2010 at 1:30 P.M.

Surname, Name, Matriculation number:

Degree Course: Surname of Professor:

Warning: *The written exam is composed of 3 exercises. The solutions (computations, explanations and conclusions) must be written in detail on separate sheets of paper, that must be handed in at the end, with the candidate's name written on top. The present question sheet must be also returned.*

Exercise 1. *(11 marks)* Consider the function

$$f(x) = \frac{e^{x+1}}{x^2 + 3|x| - 2}$$

a) Find the domain of the function and all possible asymptotes of f, if they exist.

b) Study the sign of the function.

c) Find all possible points where f is not differentiable, if they exist, and compute the derivative function of f.

d) Find the monotonicity intervals and all possible maximum and minimum points of f.

e) Draw a qualitative graph of f.

f) Find the number of intersection points between $y = f(x)$ and the straight line $y = \bar{y}$, when $\bar{y}$ varies in the interval $(-\infty, 0)$.

Exercise 2. *(10 marks)* Consider the function

$$f(x) = |x - 2| \sin(x - 3).$$

Compute the area of the region enclosed by the x axis and the graph of $f(x)$, for

$$3 - \frac{\pi}{2} \leq x \leq 3 + \frac{\pi}{2}\ .$$

Exercise 3. *(9 marks)* Given $f(x) = \log(x - 1) - \cos(x - 2) - x + 3$. Compute:

$$\lim_{x \to 2} \frac{f(x)}{[\sin(x - 2)]^3}.$$

Mathematical Analysis I VERSION B February, 02 2010 at 1:30 P.M.

Surname, Name, Matriculation number:

Degree Course: Surname of Professor:

Warning: *The written exam is composed of 3 exercises. The solutions (computations, explanations and conclusions) must be written in detail on separate sheets of paper, that must be handed in at the end, with the candidate's name written on top. The present question sheet must be also returned.*

Exercise 1. *(11 marks)* Consider the function

$$f(x) = \frac{e^{x-1}}{x^2 + 4|x| - 1}$$

a) Find the domain of the function and all possible asymptotes of f, if they exist.

b) Study the sign of the function.

c) Find all possible points where f is not differentiable, if they exist, and compute the derivative function of f.

d) Find the monotonicity intervals and all possible maximum and minimum points of f.

e) Draw a qualitative graph of f.

f) Find the number of intersection points between $y = f(x)$ and the straight line $y = \bar{y}$, when $\bar{y}$ varies in the interval $(-\infty, 0)$.

Exercise 2. *(10 marks)* Consider the function

$$f(x) = |x + 2| \cos(x + 3),$$

Compute the area of the region enclosed by the x axis and the graph of $f(x)$, for

$$-3 \leq x \leq -3 + \pi.$$

Exercise 3. *(9 marks)* Given the function: $f(x) = \cos(x + 1) - \log(2 + x) + x$. Compute:

$$\lim_{x \to -1} \frac{f(x)}{\sinh^3(x + 1)}.$$

Mathematical Analysis I VERSION C February, 02 2010 at 1:30 P.M.

Surname, Name, Matriculation number:

Degree Course: Surname of Professor:

Warning: *The written exam is composed of 3 exercises. The solutions (computations, explanations and conclusions) must be written in detail on separate sheets of paper, that must be handed in at the end, with the candidate's name written on top. The present question sheet must be also returned.*

Exercise 1. *(11 marks)* Consider the function

$$f(x) = \frac{e^{x+2}}{x^2 + 5|x| - 3}$$

a) Find the domain of the function and all possible asymptotes of f, if they exist.

b) Study the sign of the function.

c) Find all possible points where f is not differentiable, if they exist, and compute the derivative function of f.

d) Find the monotonicity intervals and all possible maximum and minimum points of f.

e) Draw a qualitative graph of f.

f) Find the number of intersection points between $y = f(x)$ and the straight line $y = \bar{y}$, when $\bar{y}$ varies in the interval $(-\infty, 0)$.

Exercise 2. *(10 marks)* Consider the function

$$f(x) = |x + 5| \sin(x + 4),$$

Compute the area of the region enclosed by the x axis and the graph of $f(x)$, for

$$-4 - \frac{\pi}{2} \leq x \leq -4 + \frac{\pi}{2} \ .$$

Exercise 3. *(9 marks)* Given the function $f(x) = \log(x - 2) - \cos(x - 3) + 4 - x$. Compute:

$$\lim_{x \to 3} \frac{f(x)}{\sin^3(x - 3)}.$$

Mathematical Analysis I VERSION D February, 02 2010 at 1:30 P.M.

Surname, Name, Matriculation number:

Degree Course: Surname of Professor:

Warning: *The written exam is composed of 3 exercises. The solutions (computations, explanations and conclusions) must be written in detail on separate sheets of paper, that must be handed in at the end, with the candidate's name written on top. The present question sheet must be also returned.*

Exercise 1. *(11 marks)* Consider the function

$$f(x) = \frac{e^{x-2}}{x^2 + 7|x| - 4}.$$

a) Find the domain of the function and all possible asymptotes of f, if they exist.

b) Study the sign of the function.

c) Find all possible points where f is not differentiable, if they exist, and compute the derivative function of f.

d) Find the monotonicity intervals and all possible maximum and minimum points of f.

e) Draw a qualitative graph of f.

f) Find the number of intersection points between $y = f(x)$ and the straight line $y = \bar{y}$, when $\bar{y}$ varies in the interval $(-\infty, 0)$.

Exercise 2. *(10 marks)* Consider the function

$$f(x) = |x - 5| \cos(x - 4),$$

Compute the area of the region enclosed by the x axis and the graph of $f(x)$, for

$$4 \leq x \leq 4 + \pi \ .$$

Exercise 3. *(9 marks)* Given the function $f(x) = \cos(x + 3) - \log(x + 4) + x + 2$. Compute:

$$\lim_{x \to -3} \frac{f(x)}{[\sinh(x + 3)]^3}.$$