Mathematical Analysis I VERSION A July, 15 2010

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. (10 marks) Consider the function

$$f(x) = \frac{1-x}{x+2}\sqrt{x+1}.$$

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

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

c) Draw a qualitative graph of f.

Exercise 2. (10 marks)
Determine, depending on the parameter $\alpha \in \mathbf{R}$, the principal part with respect to the function $u(x) = x$, for $x \to 0$, of the function

$$f(x) = e^{2x-\alpha x^2} - \sin(2x) - \sqrt{1-\alpha x^2}.$$

Exercise 3. (10 marks)
Compute the definite integral

$$\int_{-1}^{2} x \log(1 + |x-1|)\, dx.$$

Mathematical Analysis I VERSION B July, 15 2010

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Exercise 1. (10 marks)
Consider the function

$$f(x) = \frac{1+x}{2-x}\sqrt{1-x}.$$

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

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

c) Draw a qualitative graph of f.

Exercise 2. *(10 marks)*
Determine, depending on the parameter $\alpha \in \mathbf{R}$, the principal part with respect to the function $u(x) = x$, for $x \to 0$, of the function

$$f(x) = e^{3x+\beta x^2} - \sin(3x) - \sqrt{1+\beta x^2}.$$

Exercise 3. *(10 marks)*
Compute the definite integral

$$\int_{-2}^{1} (x+1)\log(1+|x|)\,dx.$$