Mathematical Analysis I. Test 1. September 14, 2021. *Problem Set 1. Part 1*

Solutions for each part of the test have to be written on separate sheets! You can use a single sheet for several problems from one part of the test (i.e. you can write solutions 1, 2, 3, 4 on the same sheet). Do not forget to sign ***all*** *the sheets you submit. You can use the sheet with the tasks for solving problems as well.*

I am aware that using any electronic devices, books etc. during the test, as well as communicating with other students, is strictly prohibited. Only one **handwritten** informational sheet is allowed. Any violation of these rules immediately leads to test cancellation. Signature

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1. [1 point] Find the limit of a sequence $\lim\limits_{n\to+\infty} \sqrt{n^2+1} - n - 1$.

2. [1 point] Find the limit of a sequence $\lim\limits_{n\to+\infty} \dfrac{(3+n)^{50} - n^{50} - 150n^{49}}{n^{48} - 5n^2 + 3}$.

3. [2 points] Find the limit of a function $\lim\limits_{x\to 7} \left(\dfrac{2x^2 - 2x - 54}{x^2 - 9x + 14} - \dfrac{16x - 52}{x^2 - 4x - 21} \right)$.

4. [1 point] Let functions f and g be defined in some deleted neighborhood of point $x_0 = 3$. It is known that $\lim\limits_{x\to 3} f(x) = A$, $A \in \mathbb{R}$, and there is no finite limit $\lim\limits_{x\to 3} g(x)$. Can we conclude that there is no finite limit $\lim\limits_{x\to 3} f(x)g(x)$? Justify your answer.

Mathematical Analysis I. Test 1. September 14, 2021. *Problem Set 1. Part 2*

Solutions for each part of the test have to be written on separate sheets! You can use a single sheet for several problems from one part of the test (i.e. you can write solutions 5, 6, 7 on the same sheet). Do not forget to sign ***all*** *the sheets you submit. You can use the sheet with the tasks for solving problems as well.*

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5. [2 points] Find the limit of a function $\lim\limits_{x\to 0}\left(\dfrac{2-x}{2+3x}\right)^{\frac{1}{3x}}$.

6. [1 point] It is known that $\dfrac{x^3-5}{x+1} = \alpha x^2 + \beta x + \gamma + o(1)$, $x \to \infty$. Find all possible values of α, β and γ.

7. [2 points] Find the limit $\lim\limits_{x\to 45^\circ} \dfrac{1-\tan^2 x}{\sqrt{2}\cos x - 1}$.