Mathematical Analysis I. Midterm Examination 2021. *Problem Set 2. Part 1*

Name _____ **Group Number** _____

Solutions for each part of the examination have to be written on separate sheets! You can use a single sheet for several problems from one part of the examination (i.e. you can write solutions 1, 2 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 examination, 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. [5 points] Represent a function $f(x) = \dfrac{x-1}{x^2+7x+10}$ in the neighbourhood of $x_0 = -3$ using Taylor formula with $o\left((x+3)^m\right)$.

2. [6 points] Find the limit $\lim\limits_{x\to 0} \dfrac{\operatorname{arctan}(\sinh x) - \ln(1-x) - e^{2\tan(x/2)} + 1 - x}{(1+x)^{2x} - \sqrt[3]{1+6x^2}}$. *Hint: it is better not to use l'Hôpital's rule here. Use Taylor's formula with* $o\left(x^3\right)$.

Mathematical Analysis I. Midterm Examination 2021. *Problem Set 2. Part 2*

Name _____ **Group Number** _____

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3. [4 points] Find the derivatives y'_x and y''_{xx} at point $t_0 = 1$ if function $y = y(x)$ is given by parametric equations $x(t) = -\sqrt{1-t^2}$, $y(t) = \arccos t - \sqrt{1-t^2}$.

4. [4 points] Find $y^{(m)}(x)$ if $y = (x^2 + 4x)\sin x \cos 3x$, $m \geqslant 3$.

Mathematical Analysis I. Midterm Examination 2021. *Problem Set 2. Part 3*

Name _____ **Group Number** _____

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5. [3 points] Find the first and the second differentials of a function $h(x) = (5x^2 + x - 4)\, e^{2x}$.

6. [4 points] Find the limit $\lim\limits_{x \to 1} \left(\dfrac{14}{1 - x^{14}} - \dfrac{8}{1 - x^8} \right)$.

7. [4 points] Find the first and the second derivatives of a function $x = x(y)$ that is inverse to a function $y(x) = 7x + x^5$.