

MATHEMATICAL ANALYSIS I

Exam, version 5.

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1. **(2+5p.)** Limit of a sequence: definition, examples. The theorem on arithmetic operations with limits of sequences. Find the minimal and maximal values of the function $f(x) = \frac{x-1}{x^2-2x+2}$ on the interval $[0, 2]$.
2. **(3+4p.)** The extrema: local and global, the algorithm of finding the extrema at a segment. Write the equation for the tangent line to the graph of the function $f(x) = \ln(5-x^2)$ at the point $x = -2$.
3. **(2+5p.)** The integration-by-parts formula for indefinite integral. Calculate the definite integral $\int_0^1 \frac{1}{x + \sqrt[3]{x}} dx$.
4. **(2+5p.)** Write the formulae for the area of a figure bounded by a graph and the length of the curve given by the graph. Calculate the limit $\lim_{x \rightarrow 0} \frac{1 - \cos x - \ln \sqrt{1+x^2}}{x^4}$.
5. **(2+5p.)** Formulate the Lagrange mean value theorem. Find the integral $\int \frac{x+2}{x^4-3x^2+2} dx$.