MATHEMATICAL ANALYSIS I

Exam, version 4.

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1. (2+5p.) List five remarkable limits. Find the minimal and maximal values of the function $f(x) = \dfrac{x-1}{x^2-2x+2}$ on the interval $[0, 2]$.

2. (3+4p.) Theorem about the derivative of the inverse function: formulation, examples. Write the equation for the tangent line to the graph of the function $f(x) = \ln\left(5 - x^2\right)$ at the point $x = -2$.

3. (2+5p.) The integration-by-parts formula for definite integral. Calculate the indefinite integral $\displaystyle\int \frac{1}{x - \sqrt[3]{x}}\, dx$.

4. (2+5p.) Write the formulae for the area of a figure bounded by a graph an the length of the curve given by the graph. Calculate the limit $\displaystyle\lim_{x\to 0} \frac{1 - \cos x - \ln\sqrt{1+x^2}}{x^4}$

5. (2+5p.) Formulate the Lagrange mean value theorem. Find the integral $\displaystyle\int \frac{x+2}{x^4 - 3x^2 + 2}\, dx$