

MATHEMATICAL ANALYSIS I

Exam retake, version 2.

- (2+5p.)** Theorem about the derivative of a composition of functions (the chain rule): formulation, examples. Find the minimal and maximal values of the function $f(x) = \frac{x-1}{x^2+1}$ on the interval $[1, 3]$.
- (3+4p.)** Monotonicity and convexity: definitions, necessary and sufficient conditions in the terms of derivatives. Write the equation for the tangent line to the graph of the function $f(x) = \log_3(x^3 + 1)$ at the point $x = 2$.
- (2+5p.)** The change of variables formula for definite integral. Calculate the indefinite integral $\int \frac{x^2}{2^x} dx$.
- (2+5p.)** Write the formulae for the volume of the bodies of revolution of the curve $y = f(x)$ w.r.t. the axis Ox and Oy . Calculate the limit $\lim_{x \rightarrow +\infty} \left(\frac{2 \arctan x}{\pi} \right)^{\sin \frac{1}{x}}$
- (2+5p.)** Write the Taylor formula of the order n with the residual term in the Lagrange form. Find the integral $\int \frac{x^2 + 2x}{x^4 + x^2 - 2} dx$