Topics in Analysis

We plan (up to) 7 sessions (for 14 students) which will take place in the first 7 weeks of the semester. (This should leave enough time for more preparations for the IMC 2011.)

Participants interested in one of the following talks should let me know on **Feb. 28, 11 am**, where I suggest meeting in my office for the distribution of the talks.

PART I: More on power series

Talk 1: Abel's theorem and it's uses. Abel's theorem provides a criterion for uniform convergence of a power series. It can be very helpful in evaluating complicated power series.

References: K. Königsberger, *Analysis 1*, (Ch. 15.3/(4)), Springer 2003; IMC problems (e.g. 2010)

Talk 2: Cotangent and the Herglotz trick. This talk will show another example of how to determine the value of a complicated power series.

References: M. Aigner, G. Ziegler, *Proofs from the book*, (Ch. 19) Springer, 2001

PART II: A praise of inequalities

Talk 1/2: Some classical inequalities. This talk should present selected classical inequalities which show up in the IMC problems. Examples are inequalities relating means, Hölder & Minkowski and Jensen's inequality, but also inequalities such as the one of Carleman. Due to the vast amount of material, it might be favorable to split this talk into 2 sessions (if we find 2 teams who are interested).

References: G. Hardy, J. E. Littlewood, G. Pólya, *Inequalities* (2nd ed.), Cambridge 2001; IMC problems.

Talk 3: Estimates of Gronwall-type. In many problems the questions arises whether one can estimate a function given that the latter satisfies a differential inequality. One classical example how to handle such a situation is the Gronwall inequality.

References: IMC problems

PART III: A glimpse of complex analysis

Talk 1: Holomorphic functions and their properties. This talk should provide a crash course in the basics of complex analysis. One should lay down the definition of holomorphic functions and explain the maximum principle and its uses.

References: S. Hildebrandt, *Analysis 2*, (Ch. 3.1 and 3.4.), Springer 2003; ICM Problems

Talk 2: Residue calculus. This talk should provide a crash course in residue calculus. The latter is useful for the evaluation of certain (improper Riemann) integrals.

References: S. Hildebrandt, *Analysis 2*, (Ch. 3.8.), Springer 2003; ICM Problems