

Mathematical Therapy (for Adults)

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It is sometimes claimed that kids enter the school being mathematically highly creative and then their creativity dramatically decreases, most likely because of the boring schematic teaching process. The present author does not have any contact with teaching mathematics at the school level, but he has some experience in teaching mathematical logic and mathematics at the university level, for the students of humanities. After about four decades of such an activity he realized that his role is comparable to that of a therapist. Thus, it is not of first importance how much new material you present to the students – much more important is the fact that you should change their attitude towards mathematics. They should forget about being frightened by mathematics and start to like (or even admire) the subject. This is by no means an easy task and it can be achieved only when you choose a proper (accurate and at the same time attractive) way to present mathematical notions, theorems, methods, proofs, etc.

We share with the audience a few reflections concerning our *Mathematical Puzzles* course, offered mainly to students of cognitive science at the Adam Mickiewicz University in Poznań, Poland. These reflections have been already presented at a few conferences in Poland in the years 2013—2015 and we try to summarize them in this talk.

Contrary to the usual mathematical exercises, mathematical puzzles are often connected with that which is unexpected, which contradicts our every-day experience. Thus, such puzzles are instructive, as far as a critical attitude towards informal intuitions is concerned. They teach us that we should be cautious in relying on intuitions, which are sometimes very illusory.

The puzzles are divided into thematic groups, including such topics as: the Infinite, numbers and magnitudes, movement and change, shape and space, orderings, patterns and structures, algorithms and computation, probability, logic. Many of them are connected with paradoxes, i.e. results which seem counterintuitive but are nevertheless true, which can be shown by resolving the paradox in question. We have collected several dozens of such puzzles, accompanied by solutions and commentaries and we hope to publish this material under the title *The Odyssey of the Mathematical Mind*.

Observing the students' activity during our course, we have noticed that it is much more easier for them to acquire small, concise chunks of dissipated knowledge rather than to listen to lengthy expositions of entire theories seldom illustrated with examples.

We claim that *paradox resolution* is very instructive as far as the development of correct mathematical intuitions is concerned. Obviously, one should use several standard (normal, typical, natural) exercises in teaching mathematics – they doubtlessly serve as proper tools for stabilization of intuitions. However, to see clearly the limitations of our mathematical intuitions, we should also investigate the objects which – for several reasons – are called *pathological* in mathematics. Such objects eventually become domesticated, thus leading to new mathematical domains.