Extremum Problems In High School

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Abstract

The importance of Extremum Problems is well established in the community of people dealing with mathematics. Extremum Problems are applicable to many of the most common subjects, and are susceptible to be of interest to most secondary students, while offering a broad field of mathematical activities (e.g., connecting many of the other domains to mathematics). Extremum Problems offer the opportunity of combining strict formal mathematical reasoning with intuition, thus smoothing the entry to the world of analysis.

However, Extremum Problems are not taking any significant place in Israeli secondary school studies. This fact may very well be observed in the school classrooms and at the Matriculation Exams, as this subject receives less attention than other parts of the curriculum.

Extremum Problems have not been significantly addressed in the mathematics education research literature either. The researchers that nevertheless mentioned this subject, did it as part of investigation of analysis as a whole, and Extremum Problems received quite little attention.

This research focuses on the divergence between the acknowledged importance of Extremum Problems to the mathematical education, and the downgraded implementation during secondary studies. The research investigates and presents the results of the teaching methods, and the ability of students to understand the material, using a multiple approach methodology: Classroom observation, examinations and interviews.

Classroom observation exposed two approaches to teaching the topic:

The analytical method, aiming at a mechanical systematic way of problem solving, and using standard analysis techniques.

The hybrid method, combining intuitive reasoning with analytical problem solving, and allowing for continuing connection with the content domain during problem solving.

Students, even the less talented, may reach a competency level to solve Extremum Problems, by using the hybrid method, while using a wide set of complementary techniques.

On the other hand, even excellent students, trained to solve complex problems, using analytical – and sterile – methods, may reach an erroneous (and meaningless) solution, due to minor technicalities.

This paper will also address some of the historical background and describe how the mathematical community handles the subject.

The thesis concludes with recommendations for the improvement of teaching techniques, and suggestion for further research on this subject.