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Using Microsoft Excel to solve and illustrate mathematical problems

Abstract

At the University of Kaposvár in BSc and BA education we introduced a new course for the first year students. This course has two objectives.

The first year students have significant differences in mathematics. My colleague Klingné Takács Anna writes about this problem in his article. We use Microsoft Excel to solve and illustrate mathematical problems in Calculus and Excel Solver in Optimization. I will write about why we use Excel and I would like to demonstrate how we harmonise the traditional education of the mathematics and the opportunities provided by the Excel.

Change in numbers of mathematics classes

Let's have a look how the number of periods have changed compared to the one before the introduction of the Bologna process. Now there is Finance and Agricultural rural development to offer for the students at Kaposvár University at the Faculty of Economic Science. I compare the number of maths classes to the number of maths classes at 5 year long university courses with similar content. Before 2006 undergraduate students studied for 5 year at Business and management course and Agribusiness course. Subjects and number of subjects per week taught by Mathematics Department it can be seen in the first two lines of my table. Since the beginning of Bologna process Finance and Agricultural rural development courses are run. The latter two can be seen in lines 3 and 4.

	1. semester	2. semester	3. semester	4. semester	Sum of numbers of lessons
Business and management 5 years university level programme	Calculus (Analysis) Number of lessons: 3+4 Lecture+ practise	Probability and statistics Number of lessons: 3+3	Linear algebra Number of lessons: 3+2	Optimization Number of lessons: 2+2	22
Agribusiness 5 years university level programme	Mathematics Number of lessons: 2+2	Economic mathematics Number of lessons: 3+2	Introduction to the optimization Number of lessons: 2+2	—	13
Finance BA	Calculus I. (Analysis) Number of lessons: 2+2	Calculus II. (Probability) Number of lessons: 2+2	Optimization Number of lessons: 2+2	—	12
Agricultural rural development BSc	Calculus Number of lessons: 2+2				4

Significant decline can be seen.

The new optional course-units

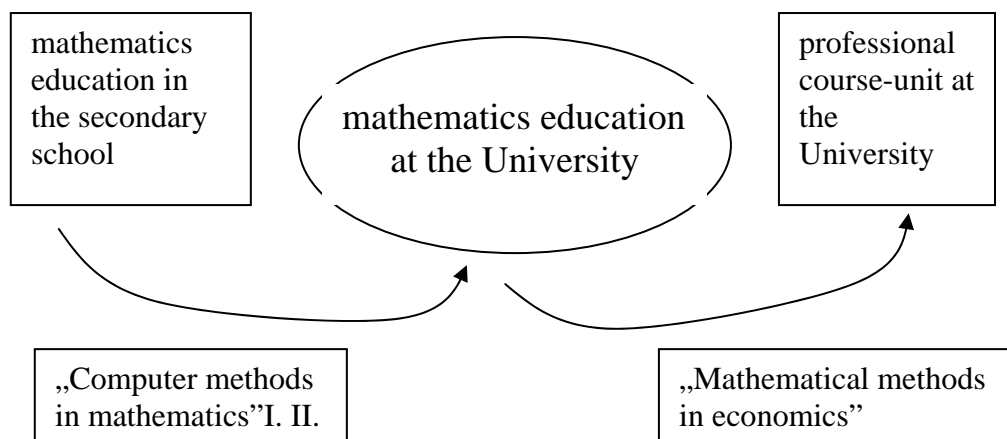
Along with the decline of numbers we can sense the following problems too.

- There is a big difference in the knowledge of incoming students.
- They can't use their acquired knowledge later while studying professional-unit.
- Their ability to use a computer appropriately is not enough (with some exceptions).

To overcome this difficulty we are beginning to develop some optional course-units that can be fitted in the direction of university to solve this temporary problem.

We offer Computer methods in Mathematics to fill in the gap existing between the secondary school and the university education.

We also offer Mathematical methods in economics to have a closer link between mathematics education at university and professional course-unit at the university.



Let's have a closer look at the aim of the above mentioned subjects.

Computer methods in mathematics I.

The aim of this training is to revise some units of the secondary education curriculum to ensure sufficient practise in it, to use Microsoft Excel, where it's possible in order to solve and illustrate maths problems.

The problems, in which we use the Excel:

Calculation and draw of elements of the sequences, draw functions graphs, geometrical illustration of Newton quotient, derivative

Computer methods in mathematics II.

The aim of teaching the subject to present computer methods wich help acquire Calculus, Analysis, Optimization. It includes solving tasks by

Excel or LINV („home made program”) during the course. It also includes comparing and analysing traditional mathematics and computer methods.

The problems, in which we use the Excel:

Linear approximation and approximation by Taylor series of the functions.

Calculation of factorial and binomial coefficient. Permutations with and without repetitions, combinations with and without repetitions

Modeling the random effects, frequency, relative frequency. Probability distribution (discrete and continuous)

Matrix operations: multiplication, inverse. Determinant, solution to a system of linear equations with computation inverse matrix and with Cramer's rule

System of linear equations, linear and nonlinear programming (LP, NLP) problems, transport optimization, sensitivity analysis

Mathematical methods in economics

The aim of teaching this subject is to apply previously learnt mathematical methods via economics tasks and to enlighten the close relation between mathematics and the professional course-units.

We find out how mathematics is related to the material covered in maths classes and when maths is used in professional course-units.

We realized that we have already covered the same thing under a different name.

The system of the examining in the education in the mathematics

Freshmen's camp, pre-test

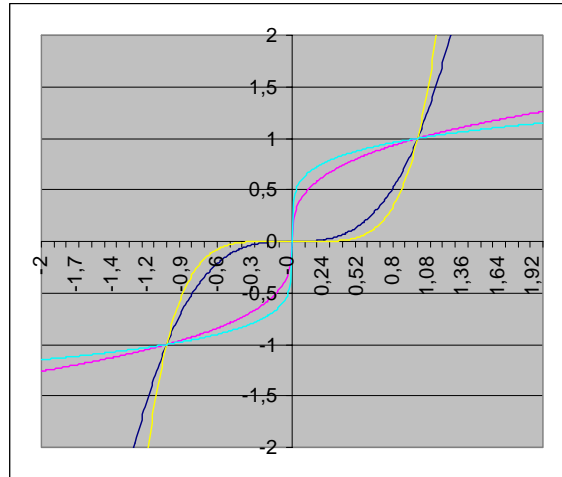
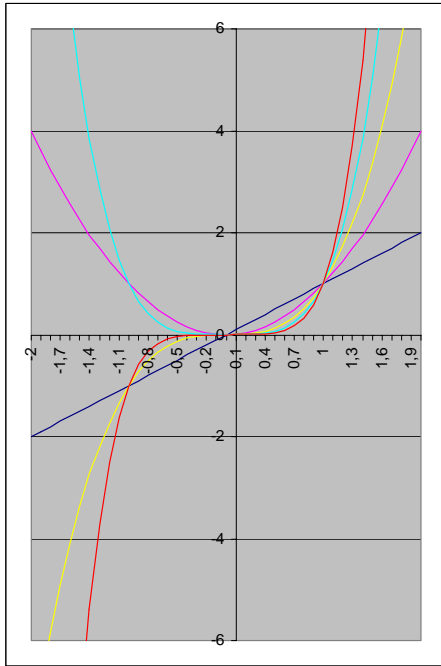
The reasons are as follows: Most problems come from the fact that the students cannot apply their knowledge gained in secondary school in tasks not from the fact that they haven't covered enough material on the first course. They acquired the necessary material in the secondary school, met the requirements however they are not able to apply the theory in new tasks. That's why we make our students sit for a test based on secondary school material before the end of the first semester an especially pointed one on the pasts which university built mathematics on. In case one cannot get over 80% they are offered „Computer methods in maths” where they have the opportunity to re-learn material needed. The model of the examination and education structure run during the preparatory camp for freshmen. Having passed pre-test they can do their university course test. In case they failed the pre-test they are offered „Computer methods in mathematics” and do the pre-test again in order to get ready for the university course test.

Same examples of the graph representation of the function in Excel:

The other aim of „Computer methods in mathematics” is to solve tasks in Excel and to illustrate certain phenomena.

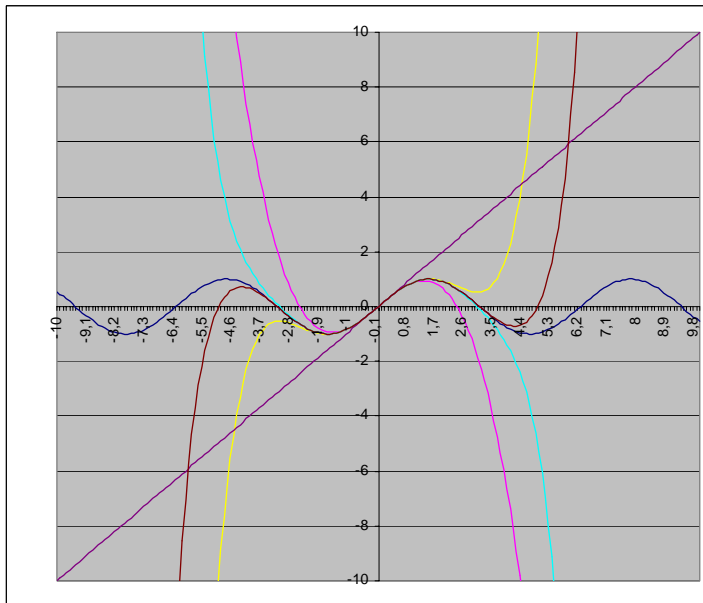
Why do we use Excel?

It is available for everybody. Even though a lot of excellent mathematical software exist students cannot access them having finished their studies at university. Theachers of professional units (finances ,economics) also use Excel.



Root and power functions. Can be seen that these functions are inverse functions.

Power functions



$\sin(x)$ and Taylor approximations, polynomials of degree 1, 3, 5, 7.