

Experience of the user of interactive geometry and the project Intergeo

Mgr. Jitka Nováková

SPŠ-Tábor
SPŠ Komenského 1670
Tábor
Czech Republik

Tel: +420731511828

jitka.novakova@sps-tabor.cz

Abstract

The presentation is focused on the use of interactive geometry as a support in educational process. The interactive tools were used during lessons in mathematics and descriptive geometry. The presentation summarizes experience of the author collected during last four years at a secondary technical school. Examples on various topics (functions, limits, derivations, conics), developed by the author, will be presented. The exchange of prepared demonstrations among teachers using Intergeo platform makes the process of developing and using interactive tools very effective.

Keywords

Interactive geometry in mathematics, Interactive geometry in descriptive geometry, the user of the Intergeo project,

1 Introduction

In this contribution, I would like to make you acquaint with my experience in using the interactive geometry in teaching mathematics and descriptive geometry at a secondary school. I have been working with the interactive geometry for about four years. During this time, I made a set of pictures with the help of the program CABRI II and CABRI 3D, and I verified the pictures' suitability for teaching. Some of them were modified several times, some of them were stopped using at all because they did not bring the expected effect.

I am going to show a few examples of the variety of the usage of the interactive geometry, to express my opinion with this way of teaching and the opinion of the students. I am going to mention the experience with making the pictures for this type of teaching. At the end of my contribution I am going to speak about The Intergeo Project.

I am going to mention the advantages of the project for my work, but also I am going to show the problems which I met.

2 The use of interactive geometry in teaching

I divided the use of interactive geometry into several fields

- a) Graphical representation of a defined term
- b) Description of a construction
- c) Space models
- d) Answers to frequently asked questions
- e) Examples for the use of interactive black board

2.1 Graphical representation of a defined term

The graphical representation helps the students to understand better the meaning of a given definition. A classical example is the definition of the limit of a function (Fig. 1). Another possibility is to guide the students to formulate the definition of a given phenomenon by themselves. For example, the set up of the equation of ellipse (Fig. 2) or the derivation of the relationship between peripheral and central angle (Fig. 3).

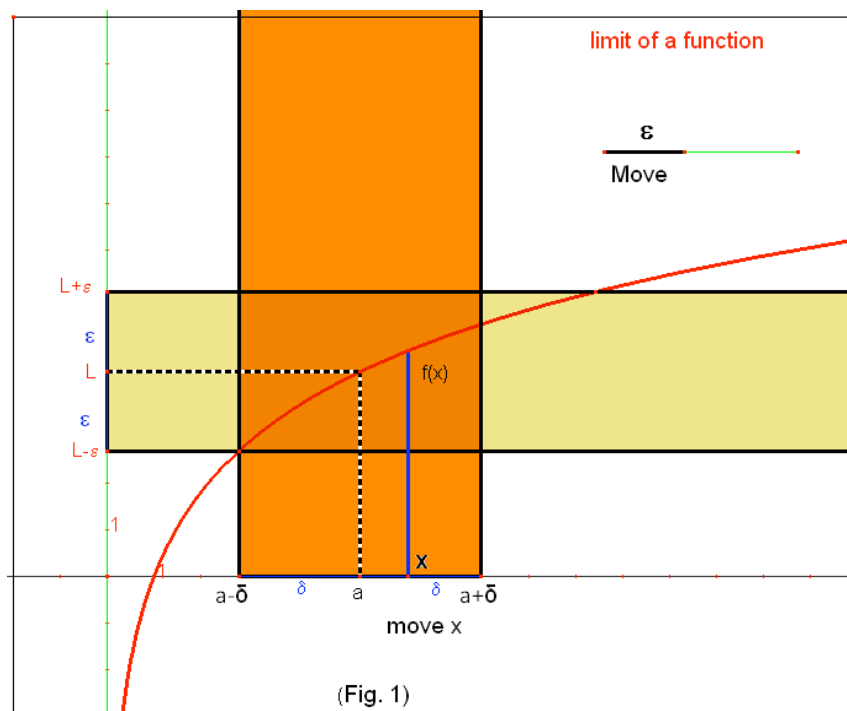


Fig. 1

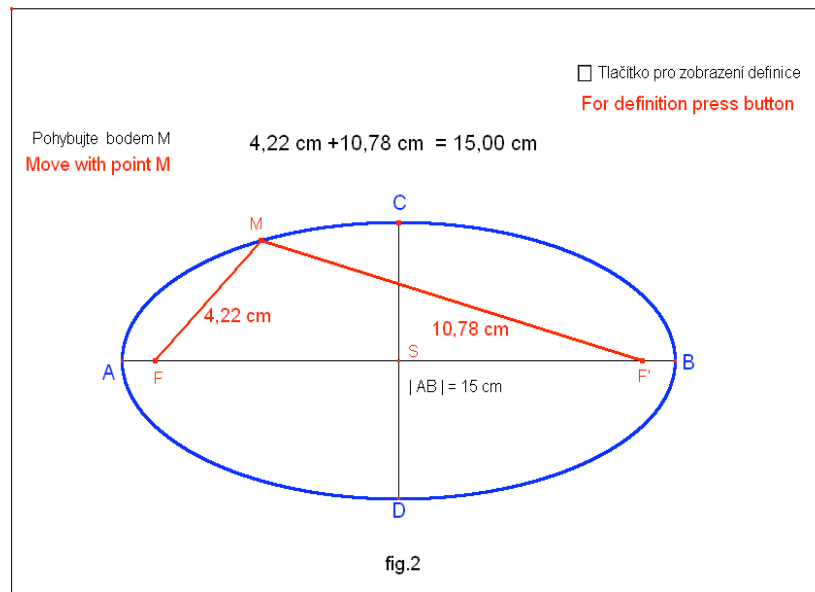


Fig. 2

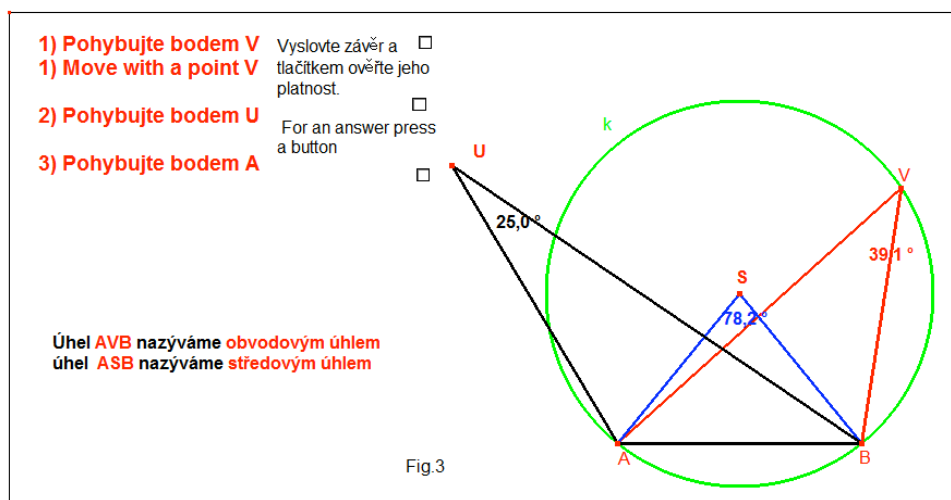


Fig. 3

2.2 Description of a construction

To describe a construction, I use the command “Krokovat konstrukci” (“Replay construction”). I project the resulting figure to students and then step-by-step present its construction. It is a big advantage to go a step back when the students do not understand the current step of the construction (Fig. 4 - triangle construction of ellipse).

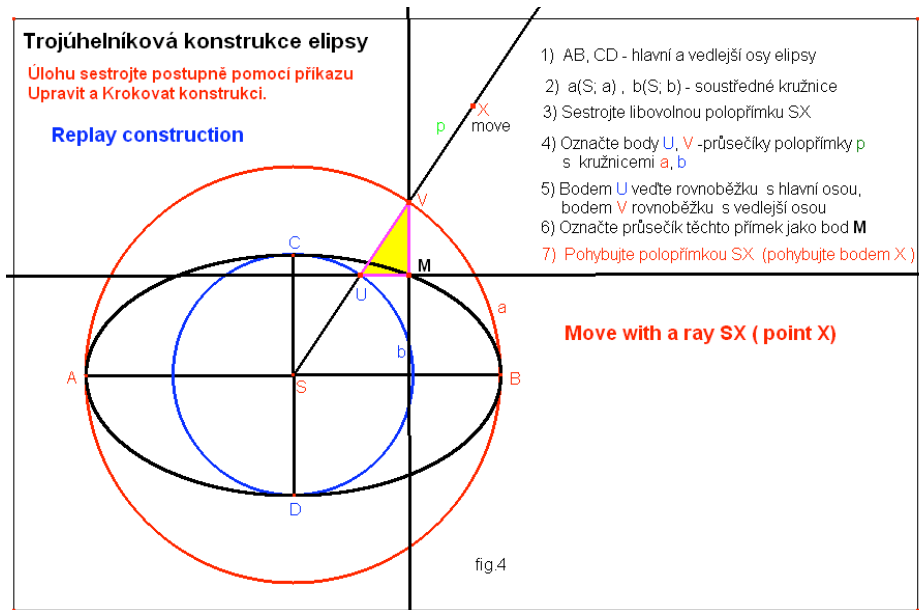


Fig. 4

2.3 Space models

The program CABRI 3D enables to change the view direction on a given body. Students then better understand the link between the body and its mapping on to a plane. I always try to use all the available visual aids and create graphical models. With the help of the three-dimensional computer modeling, I can construct the models precisely according to my imagination, independently of their availability in mathematical collections of my school. As an example,

I can mention the model of the **slope (grade) cone (conus)** in the field of topographical surfaces. (Fig. 5)

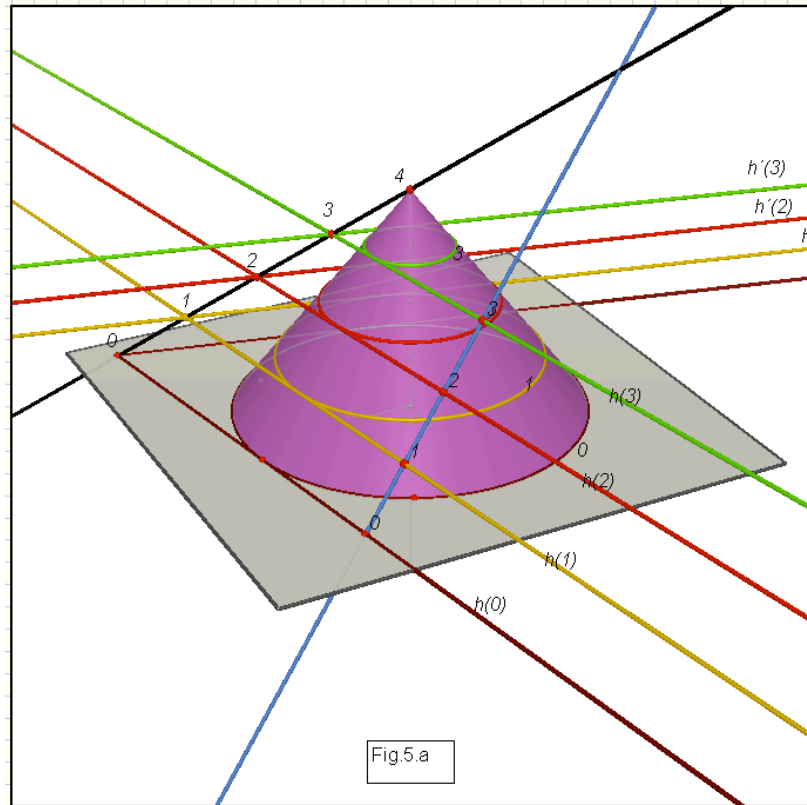


Fig. 5a

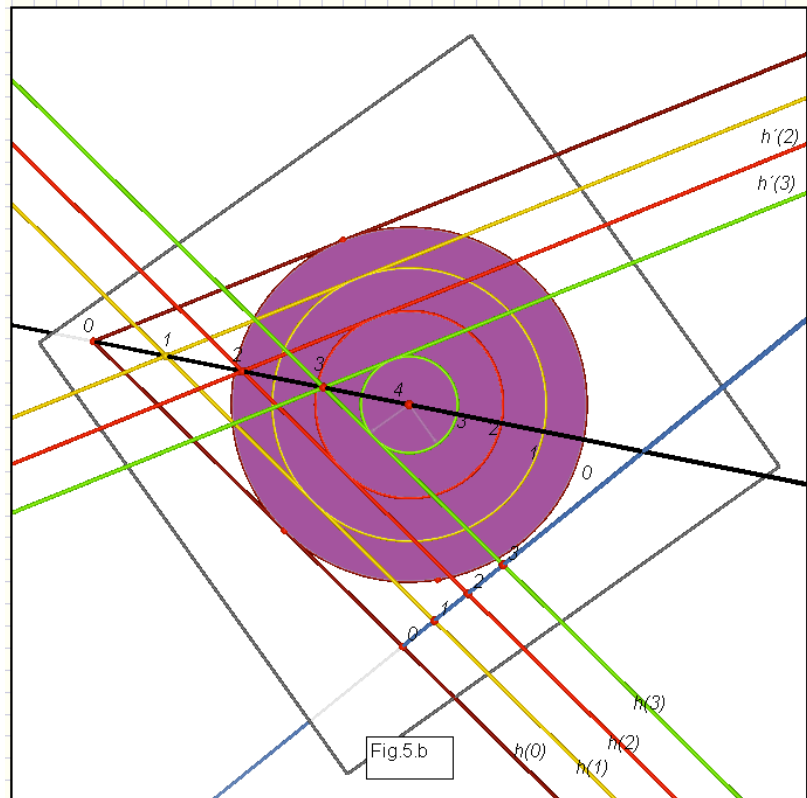


Fig. 5b

2.4 Answers to frequently asked questions

I am teaching twenty years and I know that students ask the same questions when they study some topics.

I have thus graphical answers to these questions. For example, in analytical geometry of conic sections, the students first learn the equation of ellipse and understand that the major axis is greater than the minor one. They expect the same rule to hold true for hyperbola. I can easily show the dependence of the shape of hyperbola on the size of its axes by means of an interactive picture (Fig. 6).

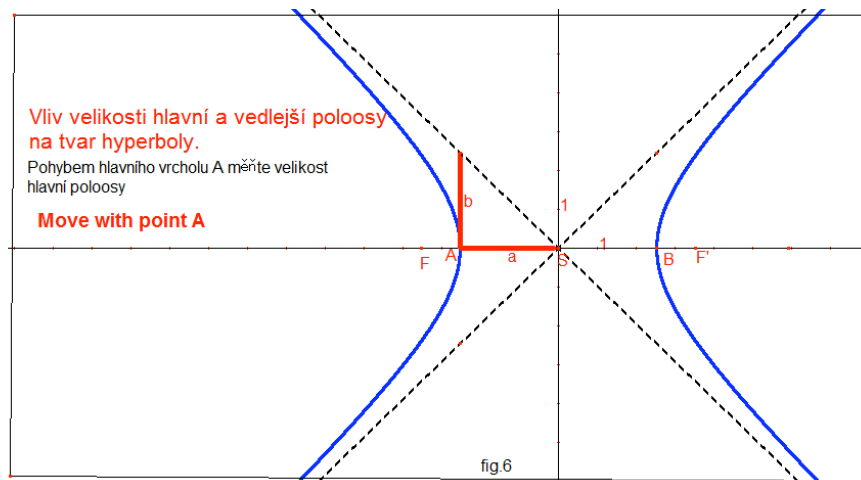


Fig. 6

2.5 Examples for the use of interactive black board

I started to use the interactive black board, specifically the Smart board, this school year. The figures are thus subjected to first testing. I created drawings in CABRI II which show elementary constructions in Monge's projection. I present them step by step on the Smart board and students finish by hand the rest of a given construction. After closing the ink layer, the figure is ready for further use and, moreover, I can easily vary the formulation of a given example. It is much faster to prove the knowledge of the students. (Figs. 7, 8)

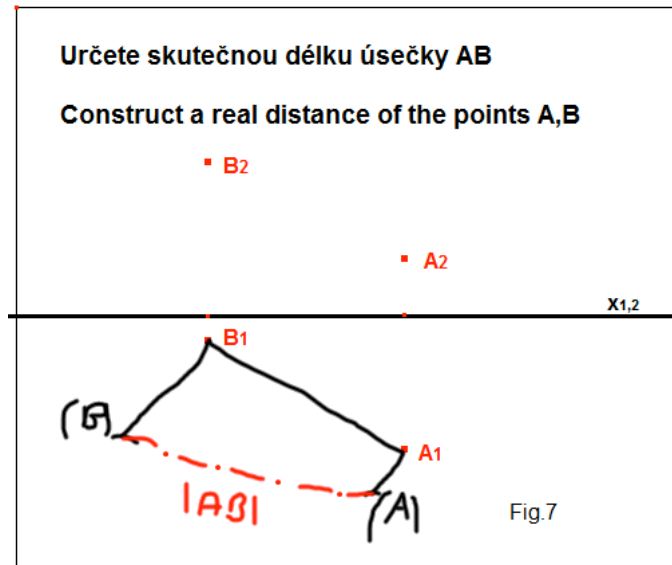


Fig. 7

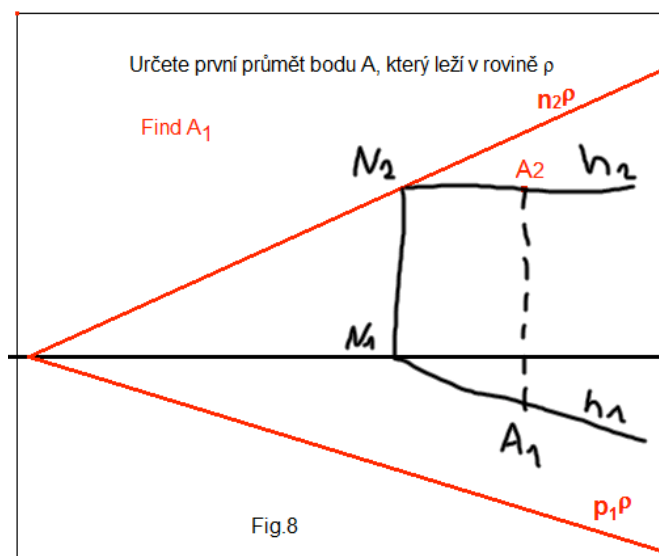


Fig. 8

3 My opinions on the use of interactive geometry in teaching mathematics and descriptive geometry

- The figures are descriptive and clear
- After four years, I can confirm students' better understanding to the taught topics in several areas
- This style of teaching is more interesting for students. One keeps longer their concentration during classes.

- It is easy to correct a mistakenly constructed line without damaging the rest of a figure (on contrary to the classical black board constructions)
- Figures prepared in advance enable one to interact with students instead of losing time by making the drawings on black board

4 Opinion of students

I present the students' opinions as formulated during lectures and translated during English classes with their teacher.

- The figures are illustration and clear, we can better orient in them
- We understand better the relationship between a written definition and its graphical explanation
- We appreciate the back-step option when constructing a figure
- Descriptive geometry is more enjoyable
- We have realized the importance of using correct terminology when working with CABRI
- Some colours of lines are difficult to see when projecting the figures on to large areas (for example, light green used for common constructions)

I was very pleased that the students often expressed just in other words what I see as the contribution of interactive geometry for teaching mathematics and descriptive geometry.

5 Experience acquired by making pictures for educational purposes

- Check good visibility of lines and their titles when presenting them on larger areas.
- Include brief hints in the figures to explain how to work with them; this helps others to uses them and you can ``forget" about what the figure ``can do".
- Make sure in advance which points in the figures will be movable and which will depend on them.
- Do not be frustrated by possible difficulties at the beginning of generating the figures. You will probably modify the figures several times; there is always something to improve.
- Sometimes it will become clear only during a lecture that a figure does not have the expected effect and the use of classical black board will be more useful.

6 The Intergeo project

The generation of figures is time-consuming. As I already mentioned, most of the figures are modified several times before they become suitable for teaching. It is thus of great help to have a possibility to obtain approved, ready-for-use figures within the Intergeo project. I am using some of them directly in a form as downloaded from Intergeo while other are hints for my own creativity. There are also works by other contributors which helped me to overcome problems I could not solve by myself. I thus take part in the Intergeo project and I uploaded a few of my results.

Subsequent comments by the users of the project are a welcome backward reference thanks to which I can correct possible deficiencies in the figures. I am thus convinced of the usefulness for every teacher to take part in the Intergeo project. The only obstacle for involving a wide range of teachers in the project is a good knowledge of English language. Despite the fact that a part of the instructions is translated (into Czech language for me), other commands are in English only. That may be the fact why some interested people are discouraged. Also the inserting of the extra contributions into the program needs a lot of efforts (at least from my point of view). If it were possible to insert a contribution with a short author's commentary and to let a professional to take care of the rest, the number of the inserted contributions would definitely raise.

Summarizing, I would like to encourage all the teachers who have not yet found the courage to use computers during their classes. At the beginning, the preparation of these classes is time consuming but it increases the level of the lectures and the interest of students. The Intergeo project is a useful help in preparations. Thus, "Do not worry, be happy with the interactive geometry and the Intergeo project!"