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AN UNCONVENTIONAL WAY OF USING COMPUTERS IN MATHEMATICAL EDUCATION — ADVERTISING MATHEMATICS

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Abstract. This article shows an unconventional way of enhancement of students' motivation in mathematics, an unconventional way of using computers in mathematical education. It gives an overview of facts known about logarithmic spirals and their appearance in nature, art and technics. These facts are reported in the form comprehensible for anybody irrespective to his mathematical skills and knowledge. Then a presentation (video promotion) based on this facts is created, keeping the principles of proper advertisement, using only Microsoft Power Point, and pictures and music freely available at internet. As a by-product, some interactive web pages relating to logarithmic spirals and their usage are acknowledged in the article.

Introduction

There is an endless list of different ways of using computers in mathematical education, including varied types of specialized mathematical software. We would like to mention one not so conventional way, which manages with internet and Microsoft Power Point software only. That means, this choice is accessible practically for everyone. And yet it is a valuable way of presenting mathematics to students.

1. Mathematics and Motivation

Time after time probably any teacher faces up to students' lack of interest in mathematics. It need not be a teacher's mistake. We can blame mathematical formalism for it. With so many visual and acoustical activities infilling students' lives, demanding passive approach of them only, fundamental mathematics still insist on that old-fashioned set of 3P (paper, pencil and practice), and active approach. And it seems to be harder and harder for students to fulfill this requirement. Nowadays, children practically unlearn to write (because they can type or phone), they unlearn to read (because they can listen or watch). And, from their perspective, they do not need to count, when calculators and computers do.

In spite of this gloomy situation, there are possibilities how to bring the youth of today to mathematics. Just try to understand their new ways of perception.

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2. Favourite Activities

Contemporary children love musical video clips, and SMS's, they are used to absorbing information which is short and fast. (All the human population live shorter and faster than ever before, just compare contemporary and 20 years old movies or commercials.) Simply said, our children are able to extract maximum from a short, terse information. If they understand it.

Further, they prefer acoustical and visual modes of expression to written ones.

A beautiful example of short and terse information in acoustical and visual form is a commercial. So, let's create a video promotion of mathematics!

3. Principles of a Proper Advertisement

At first, we must remember main fundamentals of advertising. Any proper commercial contains:

- no big talking
- shortness
- clearness
- graphical interpretation
- something familiar
- something attractive
- nothing complicated
- a bit of real life
- and a bit of provocation

Second, we must devise a strategy for the mathematical side of the advertisement. We shall show that formalism is not an essential way of presenting mathematics. We'll try to get rid of spare formulae, terms and numbers. We'll show that mathematics is a close friend with many other disciplines. So, we can add another three items to our list:

- no formalism
- just a little bit of terms and numbers
- and a lot of beautiful applications

4. Choosing a Suitable Topic

Now, we must select a suitable topic. Good-looking, with easy interpretation and nice applications. One of the best topics is "A Logarithmic Spiral". It is suitable for a variety of reasons. First, it connects together many different branches of human activities, and so there is a chance that anybody finds this topic "familiar". Second, it has nice graphical interpretations. And, last but not least, we can define it without mathematical terms:

Definition 4.1. Just imagine that you have your neck fixed in a given position, which is unfortunately not the straight one. (For example, you have a neck-ache and you cannot turn your head for a while.) You are mushrooming in a forest and you catch sight of a big mushroom in a moss. You don't want to lose it, so you focus on the mushroom, don't move your eye from it, and try to walk closer to the mushroom (no cheating, no side steps!). If you are not a lucky boy, your chin is imprisoned just above one of your shoulders, then your feet trace out a circle around the mushroom, and you will never reach it. So, sit down somewhere, take a rest, and wait until the neck-ache disappears. If you are lucky, your chin is not imprisoned above any of your shoulders, then your feet trace out a logarithmic spiral and you will successfully reach the mushroom, sooner or later.

So, we know how to construct a logarithmic spiral. The spiral is given by a center (the mushroom in our definition), and an angle (the deviation of a neck). For the purpose of our presentation, we need some drawings of a logarithmic spiral. Therefore, we could use some help of computer algebra systems (CAS). This presentation uses Maple, but it can be replaced by any other one.

One of the most photogenic logarithmic spirals is the one given by parametric expression

$$\begin{aligned} x &= \ e^{\frac{t}{5}} \cdot \cos(t) \\ y &= -e^{\frac{t}{5}} \cdot \sin(t), \quad t \in (-\infty, \infty). \end{aligned}$$

The angle of this spiral is $\arctan 5$, which is approximately $78,7^\circ$. For details see Fig 1. This shape (or some closely similar) likely comes to our mind as an idea of a logarithmic spiral.

Another interesting logarithmic spiral is the one given by an angle 60°, with a parametric expression

$$\begin{aligned} x &= \ e^{t \cdot \cot(60^\circ)} \cdot \cos(t) \\ y &= -e^{t \cdot \cot(60^\circ} \cdot \sin(t), \quad t \in (-\infty, \infty). \end{aligned}$$

Walking along this spiral towards its center is exactly twice slower then walking the line (i.e., if you see a mushroom 10 meters away, you have to walk 20 meters along the spiral to pick it).

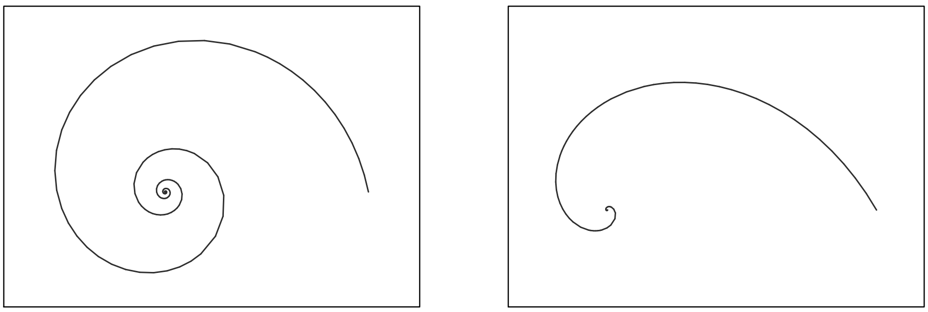

Figure 1. A segment of a logarithmic spiral given by an angle $78,7^\circ$ (left), and 60° (right).

In our presentation, we shall use another two logarithmic spirals, given by an angle 40°, and by an angle very close to 90°. Their parametric expressions are

$$\begin{aligned} x &= \ e^{t \cdot \cot(40^\circ)} \cdot \cos(t) \\ y &= -e^{t \cdot \cot(40^\circ)} \cdot \sin(t), \quad t \in (-\infty, \infty) \end{aligned}$$