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Research Paper

Solution of Geometric Construction Problems with using the Programs the Geometer's Sketchpad

Education

KEYWORDS : Information culture; Information and communication technology (ICT); Computer animation.

Kaskatayeva Bahytkul Rahimzhanovna	Doctor of pedagogical Sciences, associate Professor, associate Professor of Kazakh State Womens Teacher Training University
A.B.Kokazhaeva	associate Professor of Kazakh State Womens Teacher Training University
Z.M.Toleuhanova	Senior Lecturer of Kazakh State Womens Teacher Training University
A.U.Dauletkulova	associate Professor of Kazakh State Womens Teacher Training University

ABSTRACT

The article describes the content and methodology of solving geometric problems on the build with the help of the program «The Geometer's Sketchpad». The possibilities of the program in the field of analysis, research, build, evidence. Outlines the benefits of the program compared with traditional style perform geometric constructions.

Introduction.

The Geometer's Sketchpad® is the world's leading software for teaching mathematics. Sketchpad® gives students at all levels—from third grade through college—a tangible, visual way to learn mathematics that increases their engagement, understanding, and achievement. Make math more meaningful and memorable using Sketchpad.

Elementary students can manipulate dynamic models of fractions, number lines, and geometric patterns. Middle school students can build their readiness for algebra by exploring ratio and proportion, rate of change, and functional relationships through numeric, tabular, and graphical representations. And high school students can use Sketchpad to construct and transform geometric shapes and functions—from linear to trigonometric—promoting deep understanding.

Sketchpad is the optimal tool for interactive whiteboards. Teachers can use it daily to illustrate and illuminate mathematical ideas. Classroom-tested activities are accompanied by presentation sketches and detailed teacher notes, which provide suggestions for use by teachers as a demonstration tool or for use by students in a computer lab or on laptops.

For students the information and communication technologies are both the object of study and as a tool of subject and pedagogical activity, and as a means of training and methodological support of educational process in the school.

The problem of preparing students for the development of information culture of students stems with increasing the functional value of information ... [1].

Preparation of future teachers of mathematics has been and remains difficult. Today the computer just works wonders, using its vast possibilities. Today has created many different training programs. These include

computer program «The Geometer's Sketchpad», authored by Nicholas Jackiw.

«The Geometer's Sketchpad» is a set of tools that provides all the necessary tools for constructing drawings and their research. It allows you to open and verify geometric facts. The program allows you to "liven up"

the drawings, smoothly changing the position of the initial point. This program is invaluable with the first steps in the study of geometry.

A special place in geometry take the task of drawing, which is difficult in its decision, the build. The lesson typically, such tasks spent a lot of time, the quality of the builds students is very low. It is quite another matter, if such tasks to solve in the«The Geometer's Sketchpad». All measurements are accurate, build fast, and students and teachers care only about the algorithm for solving the problem, which is then checked with the source data changes.

The effectiveness of mathematical problems and exercises largely depends on the degree of creative activity of students in their decision.

In fact, one of the main task assignments and exercises is to strengthen the mental activity of students in the classroom.

Geometric problems on the build first of all, awakens the thought of students, makes it work, develops, improves. Speaking about enhancing the thinking of the disciples, we must not forget that when solving geometric problems on drawing students not only perform the build, conversion and remember the wording, but are also given clear thinking, ability to reason, to compare and contrast facts, find similarities and differences, to draw correct conclusions.

The four basic steps of solving geometric problems (analysis, drawing, proof, research) we have added a fifth: after the problem has been solved, you should create a computer animation illustrating and explaining the process of solving problems.

When drawing a computer animation one of the possible ways is using «The Geometer's Sketchpad».Tasks on the build - tasks, in which with the help of a compass, ruler and elementary geometric constructions are built geometric shapes.

Methodology of solving geometric problems on the build with the help.

During this work we will try to perform basic geometric constructions are not using the traditional tools for drawing and using computer technology, namely the Russian version of the popular American training program on the geometry of «The Geometer's Sketchpad» (Russian version of "Living geometry"), developed by Key Curriculum Press.

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Objective: the solution of some problems on the build using «The Geometer's Sketchpad».

Objectives:
1. Solve some problems on the build using "Live geometry".
2. To explore possible solutions to these problems.
3. To analyze the features of the program "Living geometry when performing geometric constructions.

Geometric construction is a way of solving the problem in which the answer is get a graphical way. Build perform the drawing tools with maximum precision and accuracy, since it depends on the accuracy of the solution. The geometry section, which examines geometric constructions, called constructive geometry. The main concept of constructive geometry is the concept to construct the geometric figure. This concept is accepted without definition, the specific meaning known from practice, where it means: to draw, to hold (line), mark (point) [2].

Construction problem consists in the fact that these instruments are required to construct the figure, if given some other figure and shows some relations between the elements of the desired shape. Each figure satisfying task, called the solution of tasks.

Find the solution of geometric construction problems - specify an ending sequence of basic structures, then the desired shape is considered to be built by the axiom of constructive geometry.

A list of the main builds, and, consequently, the progress of solutions depend on a common set of tools. It should be noted that this approach is in determining location decisions are not rational. Sometimes it is better to enlarge the build steps.

Considered as a build step, whole blocks of the main builds. These blocks represent the solution of elementary problems on the build. Going to call them elementary constructions. Then we can give the following definition.

Solve the problem in the drawing - it means to indicate the end sequence of basic and elementary drawing, after which the desired pattern can be considered built in force general axioms of constructive geometry. Sometimes the conditions of the problem to build to can be a few figures. To solve the problem - it means to find all its solutions. Let us explain this definition.

Shapes satisfying the condition of the tasks vary in size, shape and position on the plane. Shapes, differing in size or shape, will be considered different. With a location this is the case.

Problem is considered solved if:
a) the figures $F_1, F_2, \ldots$ constructed satisfy the problem;
b) it is proved that any form that satisfies the problem statement coincides with one of them.

This objective may have different solutions [3].
The stages of the build

When solving problems main difficulty is the question of how to find the solution. The resolution of this question will be easier if you follow a certain scheme of reasoning. This scheme consists of four phases: analysis, construction, proof, research. Note that this classical scheme is not, of course, necessary and immutable.

1. Analysis. In the analysis a search for solving the problem as follows: assume the problem is solved, built (by hand) the desired shape attach to it the data based on those relations that are specified in the problem statement. Notice that the construction of the desired shape f is reduced to the construction of the other figures F1 , drawing F1 reduces to the construction of F2, and so on, After a finite number of steps, you can come to some figure of Fn, the construction of which is known.
   If the auxiliary drawing will not be able to find the progress of solutions, it is advisable to enter into a drawing additional shapes to make additional construction, to make geometric transformations, etc.
2. The drawing consists of specifying a finite sequence of basic builds (or previously solved problems), which is sufficient to produce the desired shape was built.
   The drawing is usually accompanied by graphics of each step with the help of these tools.
3. The evidence is intended to establish that built figure indeed satises tasks.
   The proof is based on the assumption that each construction step can be performed.
4. Research. When the analysis is usually limited to finding any solution, offering the possibility of building activities. For a complete solution to find out:

1) you can always use your favorite way;
2) how to build the desired shape when the method is not suitable;
3) How many solutions has the task
   These questions form the content of the study. Thus, the study aims to - to create conditions for the solubility and determine the number of solutions.

We discuss each step of the construction and the possibility of uniqueness.

The question remains: if there are other solutions . Solution to this problem coincides with one of the already obtained solutions [4].

We will show the solution of tasks on the drawing with the use of package "Living geometry".

Problem solving ancient geometric problems, which are addressed in the school geometry course. Difficulties in solving such problems a lot:

1) finding ways to solve the problem by linking the desired item and data of the problem;
2) the execution of construction;
3) proof of the correctness of execution of structures;
4) study of the problem, that is, asking the question of whether the data for the solution of any problem, and if so, how many solutions.

Thus, in mathematical class not so much to solve such problems. Yes, and the process of building with a pencil, ruler, compass very inaccurate.

Another thing, the solution of such problems in the computer program "Live geometry", in which to build a model for such problems, you can always.

Decision of geometrical problems with a program «The Geometer's Sketchpad».
Task 1.

Construction of the triangle on the two sides and the angle between them. Analysis: The problem reduces to the construction of an angle equal to the given angle. Construction of a ruler and compass:

1. Construct an angle equal to the given angle.
2. On the sides of the angle to postpone the length specified interval.

3. The points are connected by a straight line.

Given the two sides of a predetermined length and angle between them.

The conclusion: the problem has a unique solution if the angle is acute, obtuse, or straight. If the angle is deployed, the problem has no solution.

Task2.
Build a triangle. Given three sides.

Analysis using the ruler, you can build a ray AB and a segment of a given length. (Figure 3)

[AL) and its segment AB = c of a given length.

Construct a circle with center at A And radius AC = b.
Construct a circle with center at B And radius BC = a.
Drawing on «The Geometer's Sketchpad» (Figure 4):

The problem has two solutions;
Study: 1) a + b > c (Figure 5)
Research: 2) a + b ≤ c (Figure 5)

Conclusion:
The triangle can be built, if the sum of two sides is greater third party. Thus is formed the ability of future mathematics teachers use in their work, computer information technology.

Geometer's Sketchpad, allows you to easily create scalable and editable drawings, to make all necessary measurements. The program provides activities in the field of analysis, research, construction, evidence of problem solving.

Sketchpad is convenient to measure length, area, and angles with the selected precision, to create tens of teaching and research «live» drawings.

Using the program you can also find examples, manual search which would take a lot of time or simply impossible. Opportunities to work with the program «The Geometer's Sketchpad» is extremely varied. Judicious use of the program has advantages over the traditional style of performing geometric constructions.

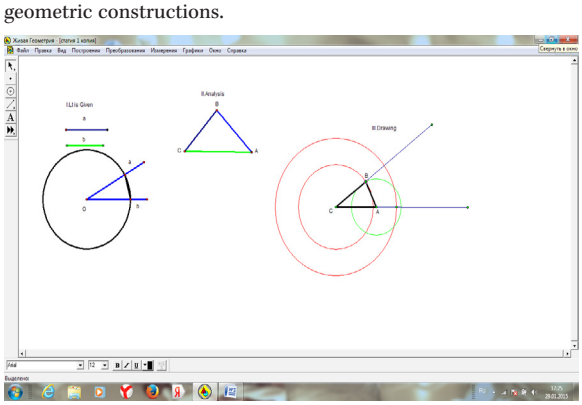

Figure 1

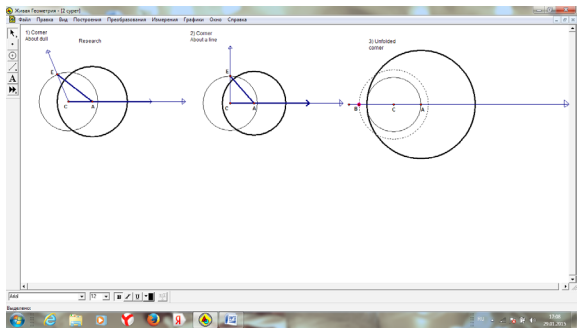

Figure 2

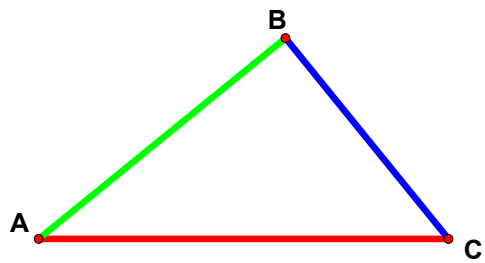

Figure 3

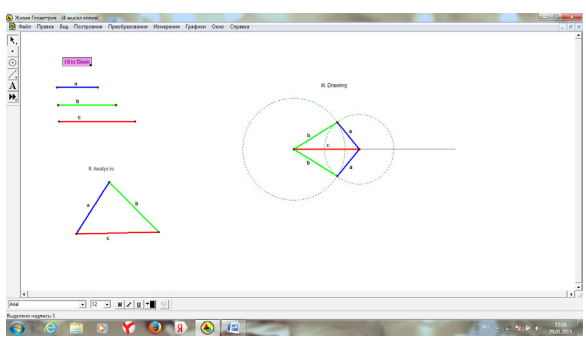

Figure 4

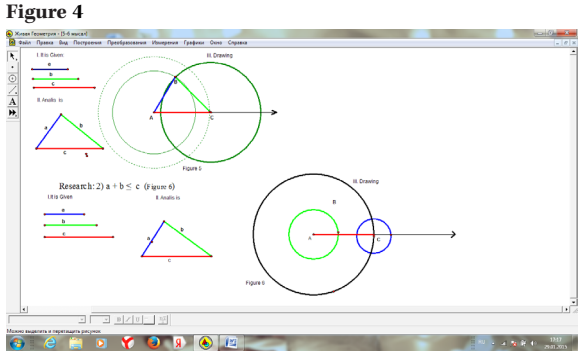

Figure 5

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