The Second International Conference "Problems of Cybernetics and Informatics" September 10-12, 2008, Baku, Azerbaijan. Section #1 "Information and Communication Technologies" www.pci2008.science.az/1/35.pdf

ABOUT THE TEACHER'S WORK OF PREPROFILE PREPARATION OF PUPILS

Shirvani Bakmaev

Dagestan State Pedagogical University, Makhachkala, Russia, *abushka7@mail.ru*

The presented clause is devoted to form some logic action for pupil about disclosing structure of definition any mathematical objects, replacement of definition of concept equivalent and ways of the proof of theorems on the basis of drawing up and the decision of system of expedient problems on the proof by means of the organization of research activity of schoolchildren.

Schools and classes with the profound studying mathematics have served as harbingers of reorganization the average mathematical formation by way of introduction in the country for profile training in 10-11 classes (grades). Democratization of school has opened before the teacher new prospects in disclosing the individual pedagogical opportunities, both in business of training of pupils, and in improvement of the maintenance of formation.

The choice which is done by pupils of a structure in many respects depends on their preprofile preparation which are carried out by the teacher within the limits of certain system of the organization of creative activity at schoolboys on class and out-of-class employment. It provides work of the teacher on formation at pupils of such skills as: "logic action on disclosing structure of definition of mathematical object", "replacement of definition of concept with its equivalent, etc." In these purposes the teacher uses following means:

- acquaintance and training of pupils to different methods of drawing up of problems during which decision at them not only the separate concept is formed, but also reveals the maintenance and structure of educational actions "leading under concept" and "deducing of consequence", which knowledge is a basis of search of the decision of problems;
- a deepening and improvement of the maintenance of an offered teaching material;
- training of pupils to search of various proofs of theorems, or their modification.

As it is possible to realize these features we shall show on examples from our operational experience in 8-9 classes at studying a geometrical material.

So, after passage of special cases of a quadrangle (parallelogram) we shall organize following work on drawing up problems. It is known, that the parallelogram has such basic (necessary) properties (Fig. 1).

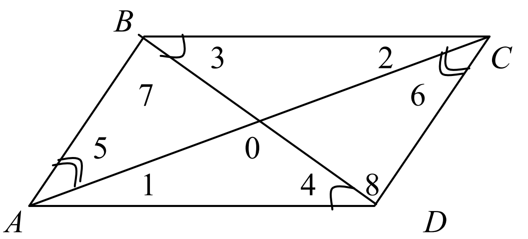

Fig. 1

I. Parallelism of the opposite parties:

1. $BC \parallel AD$ ($\angle 1 = \angle 2$ or $\angle 3 = \angle 4$)
2. $AB \parallel CD$ ($\angle 5 = \angle 6$ or $\angle 7 = \angle 8$).

II. Equality of the opposite parties:

3. $AB = CD$ 4. $BC = AD$.

III. Equality of opposite corners:

5. $\angle A = \angle C$ 6. $\angle B = \angle D$.

IV. Division of diagonals in a point of their crossing half-and-half

7. $AD = 0C$ 8. $0B = 0D$.

It is obvious, that the parallelogram has set of necessary properties. However we consider only those from them which are known for the pupil from the textbook.

Pupils do a conclusion of definition of a parallelogram, that the parallelogram is characterized (is allocated from set of quadrangles) with two concrete properties. And, each of these properties is necessary for existence of a parallelogram and any does not follow from another, i.e. they are independent from each other.

Now it is interesting to offer a class a following problem: "whether there will be quadrangle ABCD a parallelogram if any two properties from eight set forth above are inherent in it?"

Offering it, simultaneously we focus attention of pupils to formal drawing up of problems, not penetrating in their essence, and records of their conditions in a symbolical kind: {m; n}, where m and n = 1, 2, 3, 4, …, 8 and m and $m \neq n$. Pupils excitedly are accepted to work.

After some specifications and exception of recurrences of a kind {m; n} and {n; m} (it is the same problem), they receive: (7·8) : 2 = 28 problems.

I: 1. {1;2}. <u>2. {1;3}</u>. 3. {1; 4}. 4. {2; 3}. <u>5. {2; 4}</u>. 6. {1; 5}. 7. {1; 6}.
8. {2; 5}. 9. {2; 6}. 10. {1; 7}. 11. {1; 8}. 12. {2; 7}. 13. {2; 8}.

II: 1. {3; 4}. 2. {3;5}. 3. {3; 6}. 4. {4; 5}. 5. {4; 6}. <u>6. {3; 7}</u>.
<u>7. {3; 8}</u>. <u>8. {4;7}</u>. <u>9. {4; 8}</u>.

III: 1. {5; 6}. 2. {5;7}. 3. {5; 8}. 4. {6; 7}. 5. {6; 8}.

IV. 1. {7; 8}.

Research of these problems leads to such interesting conclusions:

1. Conditions 22 of them give a parallelogram. Some of them are known for the pupil (I-1, II-1, III-1, IV-1).
2. A degree of difficulty of the received problems the most various. For example: 6 problems (II-4, III-2, III-3, III-4, III-5) any of pupils could not solve for a long time.
3. Conditions of problems I-2, I-5, II-6, II-7, II-8, II-9 do not define a parallelogram, and with the quadrangles possessing properties I-2, I-5, " equal sided a trapeze ", pupils get acquainted a little bit later.
4. For the decision of problems III-2, III-3 III-5 the additional knowledge connected with the entered corner and the area of a triangle are necessary for pupils. By their consideration pertinently to bring the pupil a following attention to the question: " And whether there is in general a quadrangle - not a parallelogram with such properties? ".
5. After certain time separate pupils gave an example such quadrangle - deltoid (Fig. 2).

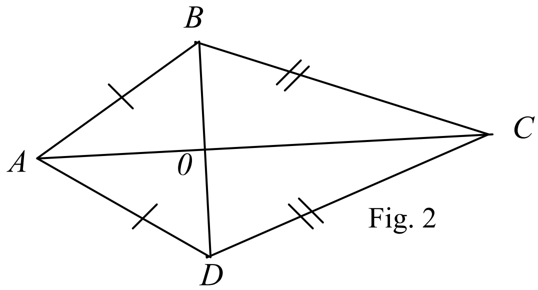

Fig. 2

Here there is an opportunity to pay attention of pupils on that unbiased fact, which acquired knowledge during training, as well as in a science, form a necessary basis of consecutive, continuous studying of considered geometrical objects.

6. Problems III-3, III-4 represent good illustrations on application of the proof of the mathematical statement by a method by contradiction. We shall result the decision of one of them (III-3). In parallelogram ABCD (Fig. 3), $\angle A = \angle C$, $0B = 0D$. It is required to prove, that ABCD - is a parallelogram.

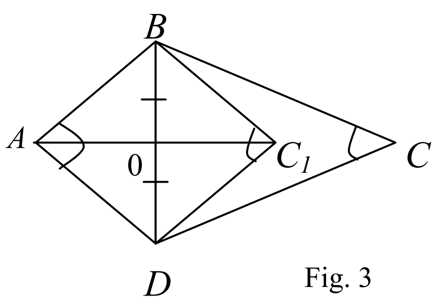

Fig. 3

The proof. We shall admit, that the given quadrangle we is not a parallelogram. From such assumption follows, that $0A \neq 0C$. (we Shall consider a case when $0A < 0C$). Then on $0C$ there will be point C_1 such, that $0C_1 = 0A$ and quadrangle ABC_1D will appear a parallelogram.

And, as consequence $\angle A = \angle C_1 = \angle C$ that cannot be as it is known, that $\angle C_1 > \angle C$. Means, our assumption is false also quadrangle *ABCD* - a parallelogram. (the case $0A > 0C$ is denied similarly).

Certainly, not all problems differ from each other under the maintenance (necessary properties).

Problems I-2 and I-5 (in the same way, as well as pairs I-6 and I-8, I-7 and I-9, I-10 and I-12, I-11 and I-13, II-2 and II-3, II-4 and II-5, II-6 and II-7, II-8 and II-9, III-2 and III-4, III-3 and III-5 - differ only a plot. However, presence of such quantity of the same problems will allow the teacher to apply with success them at interrogation, final recurrence, and as on independent and examinations.

Similar work is spent by us and with a private kind of a parallelogram - a rhombus. In a deepening of knowledge of pupils their acquaintance with various ways of the proof of the same theorems, consideration with them other theorems interconnected with given, etc. has an important role.

So, at the proof of the theorem of an average line of a triangle it is possible to offer pupils three more ways, distinct from resulted in the textbook. It is given (Fig. 4): $\Delta\ ABC,\ AE = EC;\ CD = DB$.

It is required to prove, that $ED \parallel AB$ and $ED = \frac{1}{2}AB$.

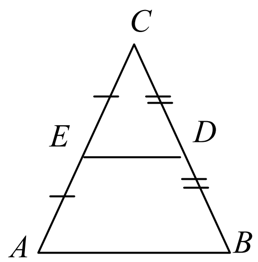

Fig. 4

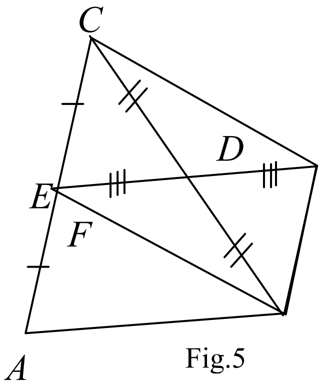

Fig.5

1-st way: On continuation ED we shall postpone DF = ED and it is combinable *F* and *B* according to points C and E (Fig. 5). Quadrangle ECFB - a parallelogram (CD = DB and ED = DF), therefore FB=CE = AE. It turns out, as quadrangle AEFB too a parallelogram (AE || BF, AE = BF). Hence, EF || AB, EF = AB and ED = $\frac{1}{2}AB$.

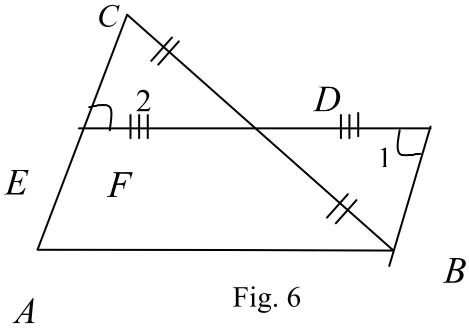

Fig. 6

2-nd way: Having postponed for continuation ED piece DF = ED and having connected *F* with *B*, we shall receive ΔDFB = = Δ *DEC* (1-st. attribute). Means, EC = EB = AE, $\angle 1 = \angle 2$. Hence, CE || FB, i.e. quadrangle AEFB – is a parallelogram

3-rd. way. From points D and C we shall lead the straight lines parallel accordingly AC and AB. We shall designate a point of crossing of the lead straight lines through F and straight line DF with AB through K. Quadrangle ACFK - a parallelogram, AC = KF, CF = AK and under theorem of Fales AK = KB. $\Delta CFD = \Delta KDB$ (2-nd attribute), means KD = DF = AE and quadrangle AEDK too a parallelogram, and consequently, ED = AK and ED = $\frac{1}{2} AB$.

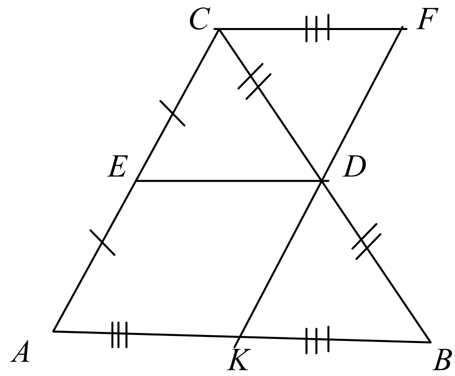

Fig.7

It is possible to continue and offer pupils converse theorems, as problems.

The theorem 1. It is given: ΔABC, $MN = \frac{1}{2} AC$, $MN \| AC$. It is required to prove, MN - an average line ΔABC.

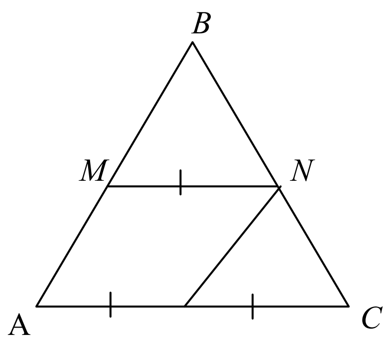

Fig.8

The proof:

1-st way. We shall postpone a piece $AD = \frac{1}{2} AC = DC$ (Fig. 8). Then - a parallelogram (MN || AD, *AM*=*MD* and MN = AD). $\Delta MBN = \Delta DNC$ (2-nd.attribute) BN = NC, DN = BM = AM. Hence, MN – is an average line.

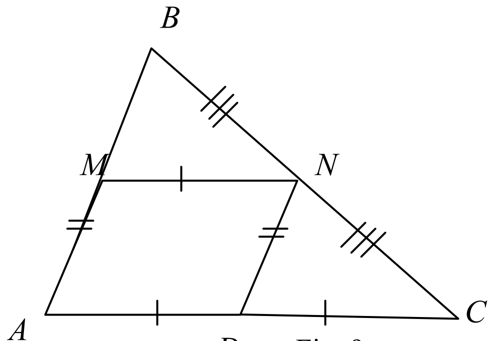

Fig. 9

2-nd way. We shall lead ND || AM (Fig. 9), AMND - parallelogram MN = AD = DC, ND = AM and CN = NB, AM = MB (theorem Fales). Hence, MN – is an average line.

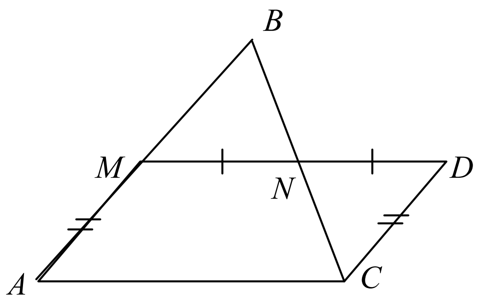

Fig. 10

3-rd way. We shall postpone on straight line MN piece ND = MN (Fig. 10), then MD = AC, AMDC - a parallelogram (CD =AM and CD || AM) and $\Delta MBN = \Delta NDC$ (2-nd attribute) CD = MB, BN = NC. Hence, MN – is an average line

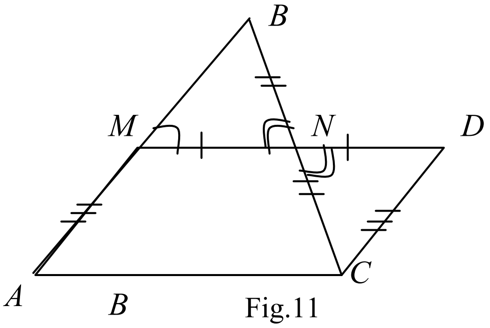

Fig.11

<u>4-th way</u>. We shall designate a point of crossing of straight line CE parallel AB, and straight line MN through D (Fig. 11). AMDC - a parallelogram, then CD = AM and MD = AC = 2MN = 2ND. $\Delta MBN = \Delta NCD$ (2-nd. An attribute) and NC = NB, CD = MB = AM. Hence, MN - is an average line.

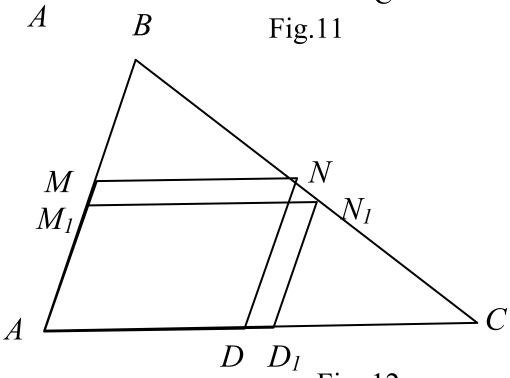

Fig. 12

<u>5-th way</u>. We shall admit MN - is not an average line. Then it is located or above, or below MN. Let M_1N_1 - an average line. Then M_1MNN_1 - a parallelogram (MN = M_1N_1 and $MN \parallel M_1N_1$), i.e. $M_1M \parallel N_1N$, that cannot be, since, they are crossed in a point B (Fig. 12).

Means, our assumption false and *MN* - is an average line.

Property of an average line of a trapeze it is finished by two converse theorems.

The theorem 1. If the piece, which ends lay on lateral faces of a trapeze, is parallel to the bases and equal to their half-sum it is an average line of a trapeze. (It is proved by a method by contradiction) (Fig. 13.1).

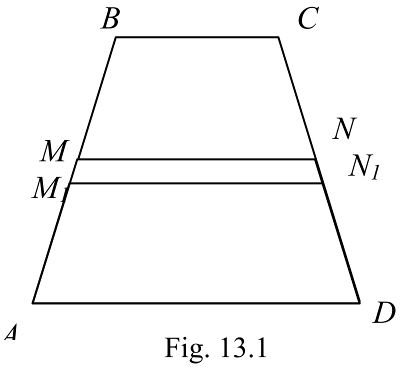

Fig. 13.1

1) $MN \parallel BC$

$$MN = \frac{BC + AD}{2}$$

It is required to prove, MN - an average line.

<u>The proof.</u> If to assume, what not MN, and M_1N_1- an average line it will appear, that M_1MNN_1 - a parallelogram and $M_1M \parallel N_1N$, that cannot be since M_1M and N_1N are crossed. Means, MN - an average line. Hence, MN - is an average line.

The theorem 2. If the piece, which ends lay on lateral faces of a trapeze, halves one of lateral faces and is parallel to the bases it is an average line of a trapeze. (the proof is simple) (Fig. 13.2).

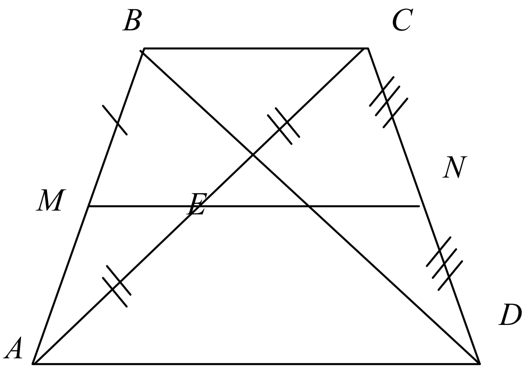

Fig. 13.2

2) $MN \parallel BC$

$\underline{AM = MB}$

It is required to prove, CN=ND.

<u>The proof.</u> We shall lead AC. Then AE = *EC* (theorem Fales). Under same theorem CN = ND

Similar work is spent and with other geometrical figures, and it is directed not only on formation of concepts and skill to prove mathematical statements, but also on development of creative abilities and interest of pupils to mathematics, that in turn promotes the realized choice of a structure of training.

Literature

1. Adamar J. The process of psychological research in mathematics; - Moscow.: «Sov. Radio», 1970.
2. Aleksandrov P.S. The world of the scientist // Science and life, 1994.
3. Beskin N.M. Methodic of geometric. – Moscow – Saint - Petersburg: Uchpedgiz, 1947.
4. Kolmogorov A.N. Mathematics the science and profession. add. - G.A. Galperin. Moscow: Science, 1988.
5. Gusev V.A. How to help the pupil love mathematics? Moscow: Avangard, 1994.
6. Krutezkii V.A. The physiologic of mathematical abilities of pupils. Moscow: Prosvechenie, 1968.
7. Lerner I.Y. Didactical methods of education. Moscow: Prosvechenie, 1981.
8. Magomedbecov P.K., Tchelyabov I.M., About one method of making tasks -theorems (to the question of reversing theorems) // methodical articles for mathematics. Add. P.K. Magomedbecov. Makhachkala: Dagutchpedgiz, 1978.
9. Piya D. Discovery in mathematics. Moscow: Science, 1976,
10. Postnicov A.G. The culture of studying mathematics. Moscow: Knowledge, 1975.
11. Puankare A. The art in mathematics (transl. from French.) Juriev. 1909.