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TROUBLESHOOTING STEPS AND SOLUTION INSPECTION METHODS

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Abstract

Taking into account the characteristic feature of mathematics (abstractness of concepts and logical confirmation of ideas), the content of the educational material, the content of the mathematics course studied in general secondary schools, academic lyceums and vocational colleges can be divided into two parts: theoretical material and mathematical problems. From the methodological point of view (from the point of view of the form of knowledge), theoretical material as concepts and their definition, ideas (theorems, properties, signs, etc.), algorithms (rules, formulas, etc.), various mathematical methods (direct and it is given by direct proof, by the method of coordinates and vectors, equations and inequalities, proof by inverse, etc.).

In mathematics textbooks of general secondary education school, academic lyceum and vocational college, the content of the educational material is given in interconnection, and the theoretical material is determined by the structural principles of the deductive theory or by meaningful ideas interpreted in a specific subject of science.

Mathematical problems (exercises) can also be divided into two groups depending on the method of use in the course of the lesson.

The first group of problems (exercises) is aimed at forming concepts, directly applying the learned theoretical knowledge, strengthening algorithms, explaining the content of mathematical methods and directly applying them. Solving such problems does not require analysis and generalization, and they are solved relatively easily. Problems (exercises) of this type are important in elucidating some feature of the concept, in showing particular conditions of application of the algorithm or method.

The second group of problems (exercises) includes problems that organize educational mathematical activities studied at the level of general secondary schools, academic lyceums and vocational colleges. In this, the problem is posed, methods of organizing and understanding the solution, searching for a solution to the problem (analyzing the condition of the problem; comparing the condition of the problem with known mathematical proofs and methods of solving problems; drawing up ways and plans for solving the problem, implementing the plan), obtaining the results of solving and analyzing it is important to do.

Solving problems first builds mathematical concepts in students. Creates new knowledge and strengthens existing knowledge in the process of implementation. Problems are concrete material in the formation of knowledge, and it creates an opportunity to connect theory with practice, teaching with life.

The process of solving problems has a positive effect on the mental development of students, because it requires mental operations: analysis and synthesis, concretization and abstraction, comparison,

generalization. For example, when solving any problem, the student analyzes: separates the question from the condition of the problem; synthesizes when making a solution plan, in this he uses concretization (draws the condition of the problem, "imagination"), then abstraction (based on the concrete situation, chooses a solution); as a result of solving different problems many times, the student generalizes the knowledge about connections between the numbers given in this type of problems, as a result of which the method of solving this type of problems is generalized.

General secondary school AL and KHK are divided into three types depending on the function of mathematical problems in the mathematics course.

1. Problems that perform a didactic function, the knowledge acquired by students in a concrete lesson is enough to solve these problems.
2. Issues that perform the function of knowledge – to solve these issues, in addition to the knowledge acquired by students in a specific lesson, knowledge and skills acquired in previous topics are also required.
3. Problems that perform a developmental function, in order to solve these problems, knowledge and skills obtained from previous chapters, previous classes, as well as knowledge obtained in a specific lesson or previous topics are required.

So, when analyzing the system of problems (exercises) for each topic:

a) to determine how many problems (exercises) are necessary to perform the above-mentioned functions in order to reveal, clarify, and deepen the content of the studied material:
b) to determine whether questions (exercises) corresponding to the basic study material are grouped (they are given mixed with questions intended to cover the basic study material);
c) determining how other issues (exercises) are connected with the issues (exercises) intended to cover the basic material:
g) to determine the existence of problems (exercises) that demonstrate the application of the studied theoretical material;
d) it is determined whether there are issues (exercises) that create positive motivation as a result of teaching the subject.

As a result of the analysis of the system of problems (exercises), the problems to be solved in the class and the problems to be given as homework are determined.

The concept of a textual problem, a textual problem is an expression (description) of a situation (situations) in natural language, in which it is required to give a quantitative characteristic to a component of this situation, to determine whether there are some relationships between its components, or to determine the type of this relationship.

Any text problem consists of two parts: conditions and requirements (questions).

The condition provides information about objects and some quantities characterizing the given objects, about the known and unknown values of these objects, and about the relationships between them.

Methods of solving text problems. Solving a problem means fulfilling the requirements of the problem (answering its question) through a logically correct sequence of actions and operations on the numbers, quantities, relations that exist directly or indirectly in the problem.

Arithmetic and algebraic methods are distinguished as the main methods of solving problems in mathematics. The answer to the question of the problem in the arithmetic method is found as a result of performing arithmetic operations on numbers.

Different arithmetic methods of solving the same problem differ in the basis of the selection of arithmetic operations between givens, between givens and unknowns, between givens and sought-afters, or in the sequence of performing these relations in selecting operations.

Algebraically, the answer to the question of the problem is found as a result of creating and solving an equation, an inequality, a system of equations (inequalities).

Depending on the choice of unknown(s) to be designated by letter(s), different equations can be created for the same problem. In this case, it is possible to talk about different algebraic solutions of this problem.

Arithmetic solving of textual problems is a complex activity, the meaning of which depends on the specific problem and the skill of the solver. However, it can be divided into several stages.

1. Understanding and analyzing the content of the issue.
2. Searching for a plan to solve the problem.
3. Execute a resolution plan. Expressing the conclusion about fulfilling the requirement of the problem (answering the question of the problem).
4. Checking the solution and correcting it if there is an error. To express a concise conclusion about fulfilling the requirement of the problem or answering the question of the problem.

It should be noted that the steps mentioned in the concrete process of solving the problem do not have a fixed limit and are not always completely fulfilled. For example, sometimes in the process of understanding the problem, the solver may notice that the given problem seems familiar to him and he knows how to solve it. In this case, the search for the solution is not divided into separate steps, and justifying each step in the first three steps saves the solver from checking after solving. However, a complete, logically completed solution necessarily includes all steps.

Knowing the possible ways to perform each of the steps allows you to make the process of solving any problem understandable, appropriate and, therefore, more successful.

The main goal of the first stage of solving is for the solver to understand the entire situation expressed in the problem, to understand the condition of the problem, its demand or question, and the content of all the terms and symbols present in the text.

In understanding the content of the problem and creating a basis for the search for the solution of the problem, restatement of the text of the problem - replacing the given expression of the situation with another expression that preserves all relations, connections and quantitative characteristics, but describes them more clearly - helps a lot. This tool is especially effective for breaking text into meaningful chunks.

Directions for restatement can be as follows:

Ways to find a solution plan and execute it. One of the more common ways of looking for a plan to solve a problem with arithmetic methods is to analyze the problem in terms of (given or restated) text.

The analysis of the problem on the text can be carried out in the form of a chain of reasoning, which can start both from the statements of the problem and from its questions.

When analyzing the problem from the given to the question, it is necessary to distinguish two pieces of information in the text of the problem and to determine how the unknown can be found based on the given information and what arithmetic operations can be found based on the knowledge of the connection between them (such knowledge should be acquired during the first stage of solving).

Methods of checking the solution of the problem. The check goes into the final step of the solution, as a result of which it is determined whether the completed solution is correct or incorrect.

On the basis of a series of mental or practical activities, a conclusion in the form of the following reasoning should be drawn during the investigation: "...because the problem is solved correctly (incorrectly)".

1. Guessing. The essence of this method is to predict the correctness of the solution result with some level of accuracy. Use the guessing method only if the result of solving the problem does not correspond to the predicted result "Is the solution of the problem correct?" answers the question.

2. Comparison of the conditions of the problem with the obtained result. The essence of this method is as follows: the found result is included in the text of the problem, and based on considerations, it is determined whether a conflict will arise in it

3. Solving the problem in different ways. Let there be a result when solving the problem in a certain way. If the same result is obtained when solving it by another method, then it can be concluded that the problem was solved correctly.

Issue 1:

An expression written in the order of increasing or decreasing degrees of the variable is called the standard form of the polynomial, and the degree of the polynomial to the highest degree of the variable is called. This

$$f_n(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_2 x^2 + a_1 x + a_0$$

Expression x in relation to

$n-$ is the standard form of a degree polynomial. Here

$a_n, a_{n-1}, \ldots, a_2, a_1, a_0$ s are fixed numbers and the coefficients of the polynomial, a_0 and it is called a free term.

To find the sum of coefficients of a polynomial

$f_n(x)$ at $x=1$ it is enough to take:

$$f_n(1) = a_n + a_{n-1} + \ldots + a_2 + a_1 + a_0.$$

If x the sum of the coefficients in front of even levels of A with, the sum of the coefficients in front of the odd degrees B if we denote by, $f_n(1) = A + B$ will be In that case $f_n(-1)$ x is equal to the result of subtracting the sum of the coefficients before the odd degrees from the sum of the coefficients before the even degrees of: $f_n(-1) = A - B.$ while $f_n(0)$ is equal to: $f_n(0) = a_0.$

Let's solve the tests based on what has been said.

1. Solving. A polynomial in standard form

$f(x)$ let it be To find the sum of its coefficients $f(x)$ at

$x=1$ we can say:

$$f(1)=(1-1)^2\cdot(1+1)^3+3\cdot 1-1=0\cdot 2^3+3-1=2.$$

Answer: 2.

2. Solving. A polynomial in standard form

$f(x)$ with, x the sum of the coefficients in front of even levels of A with, the sum of the coefficients in front of the odd degrees B marked with, $f(1)$ and $f(-1)$ we find:

$$f(1)=A+B=\left(1^3-1+1\right)^3+1=2,\quad f(-1)=\left[(-1)^3+1+1\right]^3-1=1-1=0.$$

So $\begin{cases} A+B=2 \\ A-B=0. \end{cases}$ From this system of equations B we find:

$$\begin{cases} A+B=2 \\ -A+B=0 \end{cases} \Rightarrow 2B=2 \Rightarrow B=1.$$

Answer: 1.

Issue 2.

Write the number 4 as a fraction with a denominator of 6.

Solving. For this, first we need to find such a number that when divided by 6 will result in 4. This number is the product of 4 and 6:

$4\cdot 6=24.$

So, $4=\frac{24}{6}.$

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