ALGORITHMIC METHODS ARE GOOD AT SOLVING INEQUALITIES

Azimova Dilnoza Orifovna
Teacher of the department of Exact Sciences
Bukhara State Pedagogical Institute
dilnozazimova92@gmail.com

Absrakt: In this article, the steps of solving inequalities, i.e., its algorithm, are briefly explained to the readers. This article is very useful for school teachers, students, and independent learners of mathematics. Here are some brief comments about all the cases that should be paid attention to when solving inequalities.

Keywords: example, solution, equation, inequality, algorithm, student, step, law.

Every teacher wants a student to explain this sequence point by explaining the steps of solving the problem as the student solves the problem. For this, the teacher must first provide an example of problem-solving. In order for each student to complete the example independently, the teacher should show (write down) the law of solving it in clear and finite steps together with the students in the lesson. The student reads (masters) it and performs the example at the same time. Mastering the topic (solving the concern) in such a way is called an algorithmic method.

Of course, learning to perform examples using an algorithmic method depends on a number of conditions. The algorithm should be as short as possible and certainly understandable.

Because it appears as a plan, scheme, or factor that has just been heard and is not yet fully assimilated in their memory for the students to complete the example. The short instruction algorithm is easily and quickly remembered. After solving a few problems, there is no need to read or look at the algorithm.

Reading and applying the example in an algorithmic way allows you to remember the solution in full, clearly, and firmly [1].

[2–15] the article is devoted to the analysis of the effectiveness of interactive technologies as a means of improving the quality of the educational process. Today, it is noted that the use of interactive methods is widely introduced in the educational process, which requires humanization, democratization, and liberalization of the educational process. Interactive methods are aimed at achieving high results in a short period of time without spending a lot of time and physical effort. They teach the student theoretical knowledge, acquire skills and competencies in certain types of activities, form moral qualities, and control the student's knowledge, and it is said that assessment requires great skill and dexterity.

If the algorithm for completing the example is not fully implemented or explained by the reader, and the algorithm is heavy, the execution of the examples on this topic can only be slowed down. When writing a learner problem-solving algorithm, it is desirable to state the instructions to be followed by the learner as inclinations rather than commands.

Now you will be presented with an example of solving inequalities algorithmically. For this, the algorithm is written on the board or displayed on the computer screen (displayed using a video projector)

Example. We create an algorithm for solving this inequality

$$\frac{x(3x+1)}{(x-2)(1-2x)}>0$$

using the method of intervals.

The reader should be familiar with the method of intervals for solving such inequalities and with solving systems of inequalities. Inequalities of this form can be solved in two ways:

Method 1. Bringing it to its equivalent

$$\begin{cases} x(3x+1)(x-2)(1-2x)>0, \\ (x-2)(1-2x)\neq 0. \end{cases}$$

system.

Method 2. Interval method support. In the method, do not forget to exclude the points $x=2$ and $x=0{,}5$ from the solution. The algorithm for method 1 can be formulated as follows:

1. Solving the inequality

$$(x-2)(1-2x)\neq 0,$$

we get the roots $x\neq 2$ and $x\neq 0{,}5$ (the condition that the denominator of the fractional expression is not equal to zero).

2. By writing the right side of the inequality in the form of linear multipliers, we preserve its sign (because it is enough if the sign of the inequality is fulfilled):

$$x(3x+1)(x-2)(1-2x)>0.$$

3. To make the coefficients in front of the variable in the linear multipliers in the inequality +1, we remove the coefficients different from it outside the parentheses:

$$3\cdot(-2)\cdot x\left(x+\frac{1}{3}\right)(x-2)\left(x-\frac{1}{2}\right)>0 \text{ or } -6x\left(x+\frac{1}{3}\right)(x-2)\left(x-\frac{1}{2}\right)>0.$$

4. We divide both sides of the inequality by -6 (in the case of a negative number, the sign of the inequality changes to the opposite)

$$x\left(x+\frac{1}{3}\right)(x-2)\left(x-\frac{1}{2}\right)<0.$$

5. On the axis of numbers, we mark the values of the variable for which the linear multipliers on the left side of the inequality are equal to zero (since the inequality is strict, these points are marked with empty circles, and the points where the inequality has meaning when it is not strict are marked with painted circles) (Fig. 1).

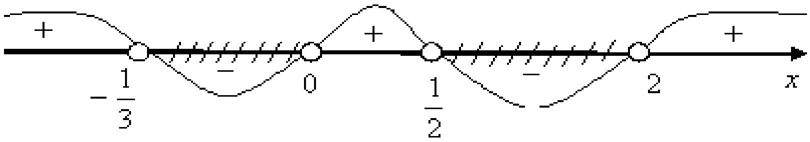

Figure 1

6. Starting somewhere in the upper part of the direction of the axis of numbers, we draw a line from each designated point (entering and exiting as shown in Figure 1). The lower part of the number axis means that the value of the expression on the left side of the inequality is positive, and the upper part is positive (we cross out the desired area).

7. We write the answer: $x \in \left(-\frac{1}{3}; 0\right) \cup \left(\frac{1}{2}; 2\right)$.

We will give the steps for solving another example of the algorithmic method as an example.

Solve this inequality

$$\frac{(x-2)^2(x-3)^3}{x^2-25} \le 0.$$

Solving. We also use the method of intervals to solve this inequality. The solution algorithm can be expressed as follows.

1. Since $(x-2)^2 \ge 0$ and taking into account that $x=2$ is a solution to the inequality, we write it in the following form:

$$\frac{(x-3)^3}{x^2-25} \le 0.$$

2. Taking into account that the sign is preserved when increasing the value of the expression to an odd degree, we write the last inequality in the following form:

$$\frac{x-3}{x^2-25} \le 0$$

3. The denominator should not be zero. $x^2-25 \ne 0$ from the inequality $x \ne 5$ and $x \ne -5$.

4. We write the right side of the inequality in step 2 in the form of linear multipliers

$$(x-3)(x-5)(x+5) \le 0.$$

5. On the axis of numbers, we determine the values of the variable for which the linear multipliers on the left side of the inequality are equal to zero (Fig. 2).

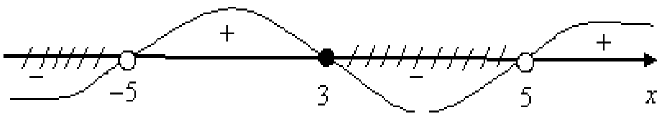

Figure 2

The values of the variable $x=5$, $x=3$, $x=-5$) for which the expression in the given inequality does not make sense are marked with empty circles.

6. Starting from the right side, through the line passing through the points ($x = 5$, $x = 3$, $x = -5$), the inequality is fulfilled (we mark the areas where it is not fulfilled).

7. We write the answer as $x \in (-\infty;-5) \cup [3; 5)$, according to figure 2. This is not a complete answer. In step 1, it was noted that $x = 2$ is a solution to the inequality. So $x \in (-\infty;-5) \cup \{2\} \cup [3; 5)$.

In conclusion, it can be said that solving inequalities in an "algorithmic" way helps students to correctly sequence their knowledge on the subject and to correctly organize the skills of solving independent inequalities. As a result, it ensures that the student does not have additional questions on the topic. This is a great achievement for a teacher.

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