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SOLVING EQUATIONS CONTAINING A MODULUS USING GRAPHS

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Аннотация: *В данной статье рассматриваются методы решения уравнений содержащих модуль с помощью построения графиков.*

Annotation: *This article discusses methods for solving equations containing a modulus using graphing.*

It is known that the importance of solving examples and problems in teaching mathematics is incomparable. Solving examples and problems, on the one hand, strengthens theoretical knowledge, and on the other hand, creates mathematical modules for practical problems encountered in life, develops skills and abilities. searching for their solutions.

Module equations are one of the important chapters of elementary mathematics that students find a little more difficult to master.

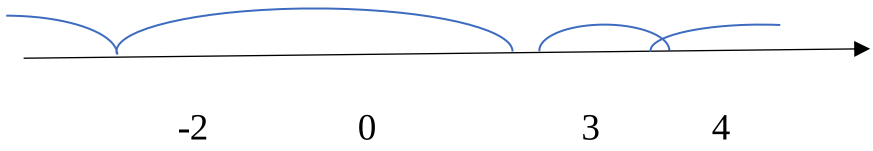
This article is devoted to this chapter. Let's look at the equations and mapping methods presented in the article. Let's give a few examples.

1 example: Solve this equation using a graph

$$|x-3|+|x+2|-|x-4|=3$$

Solution: To solve the example, we first make a table for the equation. To do this, we determine the instances where each module participates, i.e. x=3, x=-2, x=4 by setting

(x-3),(x+2) and (x-4) to zero. These points divide the axis of numbers into intervals using:



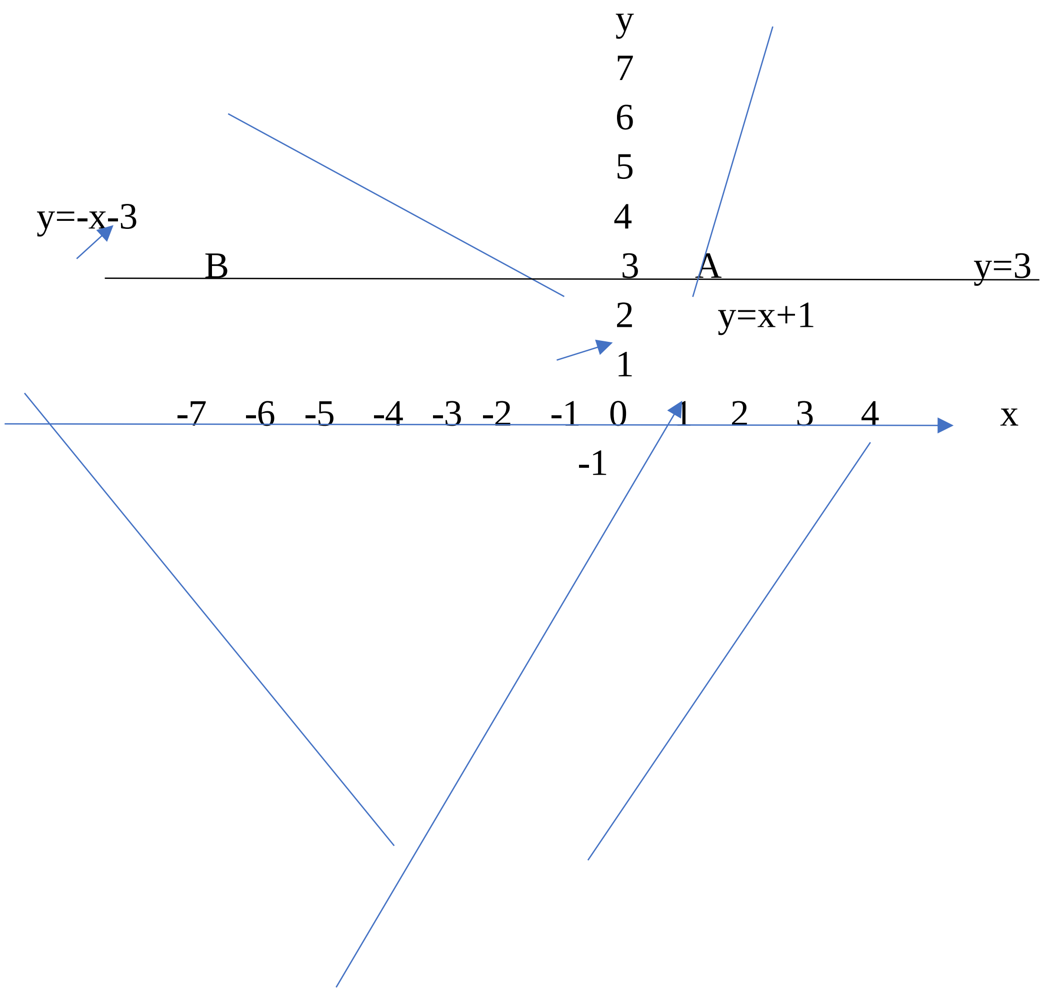
In the next step, we will create the following table.

Interval / Funksiya	$(-\infty;-2)$	$(-2;3)$	$(3;4)$	$(4;+\infty)$
$\|x-3\|$	$-(x-3)$	$-(x-3)$	$+(x-3)$	$+(x-3)$
$\|x+2\|$	$-(x+2)$	$+(x+2)$	$+(x+2)$	$+(x+2)$
$\|x-4\|$	$-(x-4)$	$-(x-4)$	$-(x-4)$	$+(x-4)$
$\|x-3\|+\|x+2\|-$ -$\|x-4\|=3$	-x+3-x-2+x-4=3 x=-6	-x+3+x+2+x-4=3 x=2	x-3+x+2+x-4=3 3x=8,x=8/3	x-3+x+2-x+4=3 x+3=3,x=0
Solutions on a given interval	-6	2	∅	∅

As can be seen from the table, all functions in the left range have a (-) sign, and all functions have a (+) sign in the right range. In other intervals, each function changes its condition to its values

Now the students may have a question, why solutions are found in the intervals (3,4) and (4;+∞), but the general conclusion is marked with the sign ∅. In this case, every solution found does not belong to the considered interval. So only x= The numbers -6 and x=2 are the solutions of the given equation.

In the next step, we show the solutions of the given equation using graphs. For this y=|x-3|+|x+2|-|x-4| and y=3, we draw the graphs of the functions in the appropriate intervals using the constructed graphs.



As can be seen from the drawing, y=|x-3|+|x+2|-|x-4| and y=3 have values at the points A(2;3) and B(-6;3) with abscissas x=4 and x=-6, so the numbers x=-6 and x=2 are solutions of the equation .

2- **example**: $|4x-1| = \frac{1}{3x-1}$ Solve this equation using a graph

Solution: this equation is equivalent to the system

$\begin{cases}(4x-1) = \frac{1}{3x-1} \\ 3x-1 > 0\end{cases}$ va $\begin{cases}-(4x-1)(3x-1) = 1 \\ 3x-1 > 0\end{cases}$ from the first system

$$\begin{cases}(4x-1)(3x-1)=1\\ x>\frac{1}{3}\end{cases}\Leftrightarrow\begin{cases}12x^2-7x+1=1\\ x>\frac{1}{3}\end{cases}\Leftrightarrow$$

$$\begin{cases}12x^2-7x=0\\ x>\frac{1}{3}\end{cases}\Leftrightarrow\begin{cases}x_1=0, x_2=\frac{7}{12}\\ x>\frac{1}{3}\end{cases}\Leftrightarrow x_2=\frac{7}{12}$$

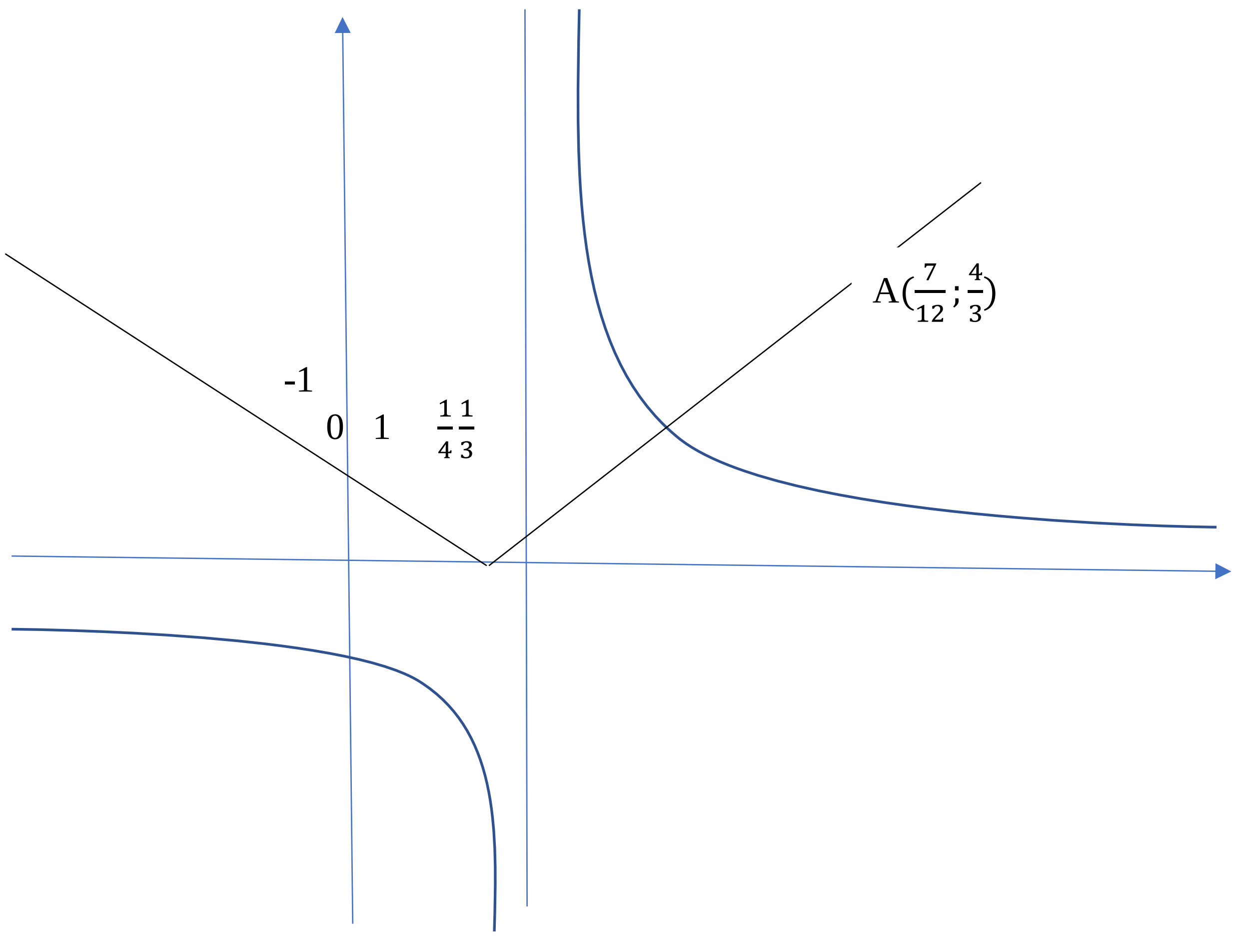
from the second system

$$\begin{cases}-(4x-1)(3x-1)=1\\ x>\frac{1}{3}\end{cases}\Leftrightarrow\begin{cases}12x^2-7x+1=-1\\ x>\frac{1}{3}\end{cases}$$

$$\begin{cases}12x^2-7x+2=0\\ x>\frac{1}{3}\end{cases}\Leftrightarrow\begin{cases}x<0\\ x>\frac{1}{3}\end{cases}\Leftrightarrow\emptyset$$

So, the equation $x_2=\frac{7}{12}$ has a solution

Let's depict the graphs of functions $y=|4x-1|, y=\frac{1}{3x-1}$.



As can be seen from the figure, the graphs of the functions intersect at the point A$\left(\frac{7}{12};\frac{4}{3}\right)$whose abscissa is $x_2=\frac{7}{12}$, that is, there is a solution of $x_2=\frac{7}{12}$

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