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Mathematics

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THE PROGRAMM MATHCAD IN THE PROCESS OF TEASHING MATEMATICS

Գ.Հ. Սահակյան

MATHCAD ԾՐԱԳԻՐԸ ՄԱԹԵՄԱՏԻԿԱՅԻ ԴԱՍԱՎԱՆԴՄԱՆ ԳՈՐԾԸՆԹԱՑՈՒՄ

Աշխատանքում դիտարկվում է Mathcad մաթեմատիկական փաթեթի կիրառումը «Ֆունկցիաների հետազոտումը և նրանց գրաֆիկների կառուցումը» թեմայի ուսումնասիրման ընթացքում:

Բանալի բառեր՝ ֆունկցիայի հետազոտում, Mathcad-ի կիրառությունները

Г.Г. Саакян

ПРОГРАММА MATHCAD В ПРОЦЕССЕ ОБУЧЕНИЯ МАТЕМАТИКИ

В работе рассматривается применение математического пакета Mathcad в процессе изучения темы “Исследование и построение графиков функций”.

Ключевые слова: исследование функций, применения Mathcad

The paper discusses the use of the mathematical package Mathcad in the process of studying the topic “Research and graphing functions”.

Key words: function research, Mathcad applications

Modern information technologies make it possible to speed up and increase the effectiveness of the learning process, to make it more visual, convenient for the assimilation of the material in question. Numerous articles on the use of IT in math classes only mention the use of programs that are part of Microsoft Office ([1], [3], [4]). However, the use of a number of mathematical programs, such as, for example, Mathcad, MatLab, in our opinion, will allow us to make the lessons quite effective. From this point of view, the Mathcad mathematical package has the necessary resource for illustrating various mathematical concepts, as well as for calculating the quantities and expressions used in mathematics. On the other hand, Mathcad has a fairly convenient interface, which allows you to get acquainted with the principles of work in its environment in a very short time. Using a mathematical package will also save time needed to calculate various mathematical expressions (derivative, integral, etc.) and thereby increase the time it takes to analyze the results, which is ultimately more important than the process of calculating them.

The topic “Research and graphing functions” is one of the most important topics studied in mathematics lessons both by students in high school and by students of certain specialties in higher educational institutions. The process of studying the behavior of a function requires knowledge of such concepts as the domain of definition of a function, parity, oddness, periodicity of a function, intersection points with coordinate axes, critical points, extremum points, etc. For most of the functions under consideration, finding these points becomes impossible, since the equations obtained for their determination cannot be solved analytically. The **Solve** function in Mathcad ([2]) in most cases allows you to determine their approximate values.

Consider how you can implement the process of researching and plotting a function first, using the example of a quadratic function (Fig. 1).

$f(x) := x^2 - 5x + 4$

$f(x)\ \text{solve}\ ,x \rightarrow \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ $\quad x1 := 1$ $\quad x2 := 4$

$f(0) = 4$

$\frac{d}{dx} f(x) \rightarrow 2 \cdot x - 5\ \text{solve}\ ,x \rightarrow \frac{5}{2}$ $\quad f\left(\frac{5}{2}\right) = -2.25$

$\frac{d}{dx} f(x) > 0\ \text{solve}\ ,x \rightarrow \frac{5}{2} < x$

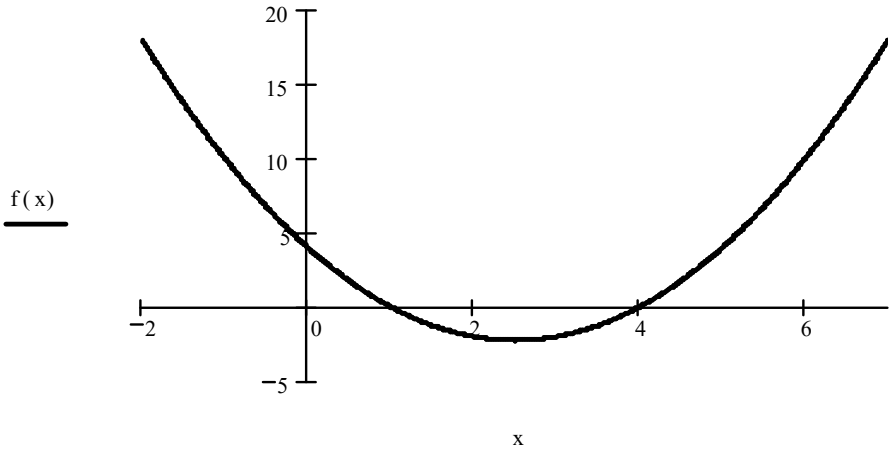

Fig. 1. The graph of the function $f(x) = x^2 - 5x + 4$.

Here, the function is defined in the first line, and the abscissa of the intersection points with the OX axis are found in the second using the Solve function. The third line is the ordinate of the intersection with the OY axis. Next is the critical point ($x_k = 5/2$), and then the region of increasing function ($x > 5/2$).

The definition of the function in the first line allows you to immediately build the graphs of functions $f1(x) = |f(x)| = |x^2 - 5x + 4|$, as well $f2(x) = f(|x|) = x^2 - 5|x| + 4$ (Fig. 2). The latter will allow you to compare the graphs of functions $|f(x)|$ and $f(|x|)$ and with the graph of the function $f(x)$, thereby answering the question, how to build graphs of functions $|f(x)|$ and using the graph of the function $f(x)$.

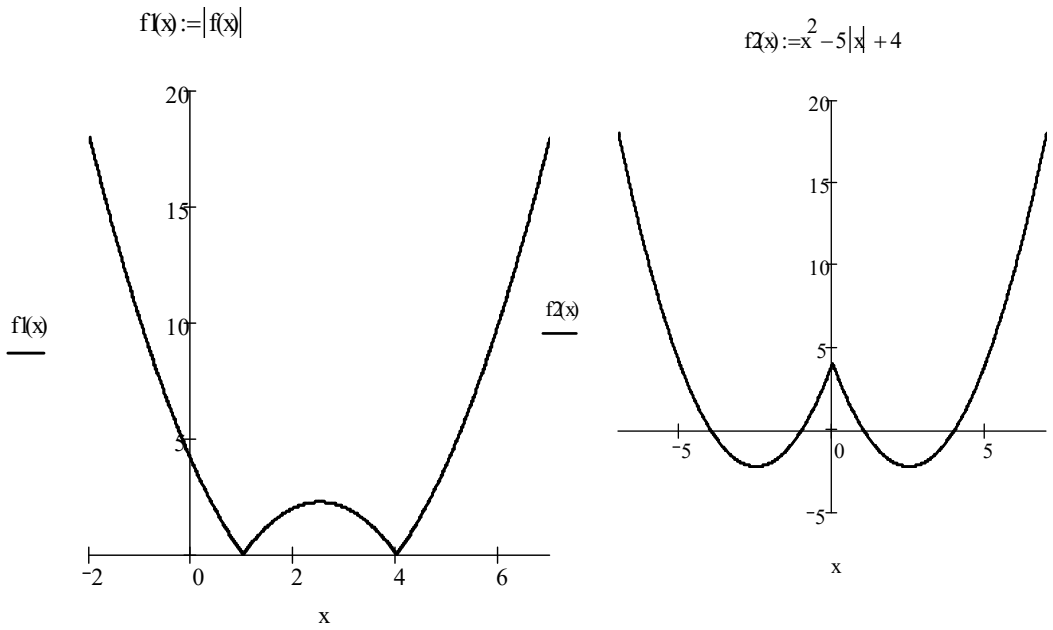

Fig.2. The graphs of the functions $f1(x) = |x^2 - 5x + 4|$ and $f2(x) = x^2 - 5|x| + 4$

We now consider the process of investigating and plotting a function of a slightly more complex function

$$f(x) = x^4 - 10x^3 + \frac{125}{4}x^2 - \frac{125}{4}x + 9.$$

Figure 3 shows the process of plotting this function. Note that the Matcad program manages to find both the zeros of this function and the critical points (in the second and third lines in the figure), which is not so easy for manual calculations.

$$f(x) := x^4 - 10 \cdot x^3 + \frac{125}{4} \cdot x^2 - \frac{125}{4} \cdot x + 9$$

$$f(x) \text{ solve}, x \rightarrow \begin{pmatrix} 1 \\ 4 \\ \frac{1}{2} \\ \frac{9}{2} \end{pmatrix} \qquad x1 := 1 \qquad x2 := 4 \qquad x3 := \frac{1}{2} \qquad x4 := \frac{9}{2}$$

$$\frac{d}{dx} f(x) \text{ solve}, x \rightarrow \begin{pmatrix} \frac{5}{2} \\ \frac{5}{2} + \frac{5}{4} \cdot \sqrt{2} \\ \frac{5}{2} - \frac{5}{4} \cdot \sqrt{2} \end{pmatrix}$$

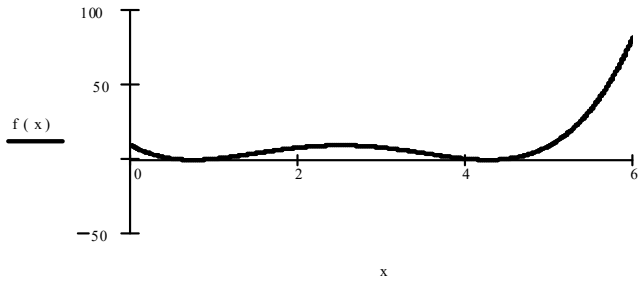

Fig 3. The graph of the function $f(x) = x^4 - 10x^3 + \frac{125}{4}x^2 - \frac{125}{4}x + 9$.

In conclusion, consider an example of constructing a piecewise function. To plot the piecewise functions it is convenient to use the "**If**" function (Fig, 4)

$$h(x) := \text{if}\left(x < -2, -x + 5, \text{if}\left(x \geq -2 \wedge x \leq 2, x, x^2\right)\right)$$

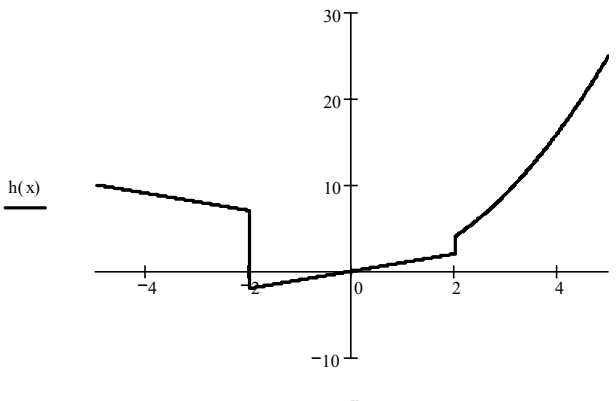

Fig 4. The graph of the function $h(x)$.

Figure 4 shows the graph of the function $h(x)=\begin{cases} -x+5, & x<-2 \\ x, & -2\le x\le 2 \\ x^2, & x>2 \end{cases}$.

Literature

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Հոդվածը տպագրության է երաշխավորել խմբագրական խորհրդի անդամ, ֆ.մ.գ.դ. Ա. Մ. Խաչատրյանը: