INTELLIGENCE OF THE SYSTEM OF MATHEMATICAL PACKAGES IN E-LEARNING MATHEMATICS

Saxobidinova Ozodaxon Isamidinovna, Engineer of Scientific Department at Gulistan State Pedagogical Institute
e-mail: sahobidinova@mail.ru
Kurbanova Husniya Shuhrat qizi, Teacher-trainee at Gulistan State Pedagogical Institute
e-mail: husniyakurbanova20@gmail.com

Abstract. In this paper, We discuss the role of intelligent, systems in education, where the subject is seen teaching mathematics. The paper argues the benefits of mathematical software packages, including system MathCAD, in e-learning of the discipline. At the same, particular emphasis is placed on presenting some examples, which examines the known problems of mathematical analysis.

Keyworlds: including system, particular emphasis, systems in education, mathematical software packages, perform convenient functions, mathematical calculations, algorithm creation, modeling, data analysis, research and visualization, scientific and engineering graphics, application development.

ELEKTRON MATEMATIKANI O‘QITISHDA MATEMATIK PAKETLAR TIZIMINING INTELLEKTUALLIGI

Annotatsiya. Ushbu maqolada matematikani o‘rgatishda ta’limdagi aqlli tizimlarning roli muhokama qilingan. Maqolada intizomni elektron o‘rganishda matematik dasturiy ta’minot paketlari, jumladan MathCAD tizimi afzalliklari haqida bahs yuritiladi. Shu bilan birga, matematik tahlilning ma’lum muammolarini o‘rganuvchi ba’zi misollar keltirishga alohida e’tibor beriladi.

Kalit so‘zlar: tizim, xususan, ta’lim tizimidagi tizimlar, matematik dasturiy ta’minot paketlari, qulay funktsiyalarni bajarish, matematik hisoblar, algoritm yaratish, modellashtirish, ma’lumotlarni tahlil qilish, tadqiqot va vizualizatsiya, ilmiy va muhandislik grafiklari, ilovalarni ishlab chiqish.

ИНТЕЛЛЕКТУАЛЬНОСТЬ СИСТЕМЫ МАТЕМАТИЧЕСКИХ ПАКЕТОВ В ЭЛЕКТРОННОМ ОБУЧЕНИИ МАТЕМАТИКЕ

Аннотатция. В данной статье рассматривается роль интеллектуальных систем в образовании, где рассматривается предмет обучения математике. В статье аргументированы преимущества пакетов математических программ, в том числе системы MathCAD, в электронном обучении дисциплине. При этом

особый акцент сделан на приведении некоторых примеров, в которых рассматриваются известные проблемы математического анализа.

Ключевые слова: в том числе система, особый акцент, системы в образовании, пакеты математических программ, выполнение удобных функций, математические расчеты, создание алгоритмов, моделирование, анализ данных, исследования и визуализация, научная и инженерная графика, разработка приложений.

Introduction. A new system of personnel training was developed for the development of the country, and a firm conclusion was reached that the quality and efficiency of training in continuous education is determined by the professional, moral and moral training of the young generation. It is important to improve the mechanisms of developing spiritual culture in mature youth on the basis of raising physically healthy, spiritually and mentally developed, independent thinking, loyal to the motherland, with a firm outlook on life, deepening democratic reforms and increasing their social activity in the process of developing civil society [1].

The situation in the field of development and application of modern information and communication technologies is changing very quickly. Coming today, there are several flaws determined in the recent technologies which we considered outstanding news in the beginning. Operating systems have been developed for computers that allow to work on tasks in a package style in multiprogram mode. The task scheduler, supervisor, and I/O manager are the main components of the operating system. The operating system provides a set of ready-made programs for organizing the exchange of information. Mathematical systems are mainly used to perform convenient functions: mathematical calculations, algorithm creation, modeling, data analysis and research and visualization, scientific and engineering graphics, application development, etc [4].

In recent years, mathematical modeling has become a topical issue. The reason for this is that mathematical models in learning, along with a more accurate description of processes, cause new effects and require new methods and creativity in solving such problems. The number of scientific works dedicated to the study of such processes has become a reality. The latest achievements and results of mathematical models in our country and abroad are analyzed based on a new approach and these approaches need to be studied.

Mathematical modeling has entered the everyday life of not only scientists and researchers, but also ordinary citizens. The use of information and communication technologies significantly expands the possibilities of modeling, which allows the creation of “virtual reality”. Mathematical modeling methodologies, as well as the concept of “virtual reality” are important for the acquisition of modern knowledge and their use not only in the natural and technical fields, but also in the study of “humanitarian” knowledge in social fields. A package of practical programs is a complex of interrelated programs designed to solve any problem in a specific field. The advantage of the application package is that the library programs can be used independently, while the package programs are designed to be used in various combinations with each other. Programmers develop an algorithm for solving a

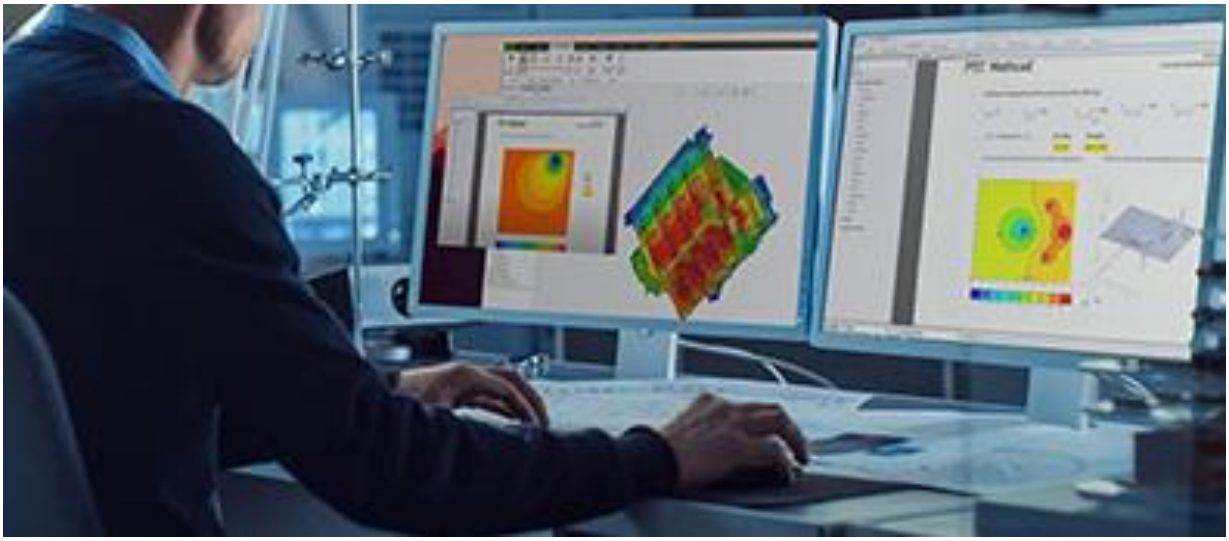
small problem and write a corresponding program, usually called a module. A set of modules makes up the functional (task) complement of the package [5].

It is important that the user's language of communication with the application package is simple, flexible and convenient. Currently, many modern operating systems have been created, including Matlab, Mathcad, Mathematica, Maple, etc. Using Matlab, Mathcad, Mathematica, Maples which provide great opportunities for problem solving or problem description [2]-[3].

It should be noted that the achievements in the field of creation of the user interface of the Personal Computer (PC) are so extensive that they led to a sharp change in the methodological approach to the research of circuits. The use of computer science led to the creation of virtual laboratories as an alternative to traditional educational laboratories. A virtual laboratory, in general, is a numerical calculation program with an interface that simulates the actions (work) of a researcher in a real laboratory. With the help of numerical methods of calculations on modern personal computers with high speed and a large amount of memory, even complex models can be studied with an accuracy that is not inferior to the accuracy of the results obtained in experiments on real objects.

In the current modern stage, the support and adjustment of new pedagogical, information and communication technologies, and the wide use of modern teaching methods and active methods are envisaged to explore students' interests, precautions and equipment. Practical and cross-disciplinary issues help these packages help solve visual problems and provide detailed information on mathematical problems in the study.

The company of Inc. Volfram Research of the United States created the Mathematica system was proposed by the physicist Stefan Wolfram in 1987 and in this year, the first version of the Mathematica system was submitted to public judgment.



Picture 1. The working space screen of MAPLE and MathCAD interface

The Mathematica software system was voted by the American public as one of the 10 greatest technical and mathematical inventions of the year 1988. Although the first version of Mathematica was designed mainly for Macintosh type computers,

soon (after 6 months) a new version of Mathematica was released, which works in the environment of the MS-DOS operating system. In 1991, Mathematica 2 version of the system was offered, and in 1996, Mathematica 3.0 versions were offered.After that, this software system is more than 20 operating systems, namely Microsoft Windows. Windows NT. OS/2 was adapted to work in Linux, Unix and other operating system environments [2-7].

The MAPLE system is a computer system designed for accurate, fast and efficient solution of analytical and numerical solutions of various fields: economic, mechanical, mathematical, physical, engineering problems. MathCad is a unique collection of modern numerical methods of computer mathematics. It includes experiences, rules and mathematical calculation methods accumulated as a result of the development of mathematics over the years [2].

Solving equations and inequalities To solve equations in Maple, there is a universal solve(eq, *x*) command, where eq is an equation, *x* is a variable. Example of solving the equation:

```
solve(a*x^2 + b*x + c = 0, x);
```

Example of solving the inequality:

```
solve(5*x > 2*x - 1, x);
```

For the numerical solution of the equation there is a function fsolve(eq, *x*).

Example:

```
fsolve(x^5 - 4*x + 2 = 0, x);
```

Solve equations numerically [edit]

The following code numerically calculates the roots of a high-order polynomial:

```
f := x^53-88*x^5-3*x-5 = 0

fsolve(f)

-1.097486315, -.5226535640, 1.099074017
```

The same command can also solve systems of equations:

```
f := (cos(x+y))^2 + exp(x)*y+cot(x-y)+cosh(z+x) = 0:

g := x^5 - 8*y = 2:

h := x+3*y-77*z=55;

fsolve( {f,g,h} );

{x = -2.080507182, y = -5.122547821, z = -0.9408850733}
```

Examples:

a) $f(x) := \sin(x) + x^2 - \cos(x)^2$ finding productive function

> f4=sin(*x*)+*x*^2-cos(*x*)^2;

$f4 = \sin(x) + x^2 - \cos(x)^2$

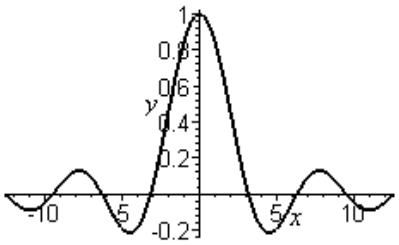
b) > C:=Matrix([[5,-1,3],[0,2,-1],[-2,-1,0]]);

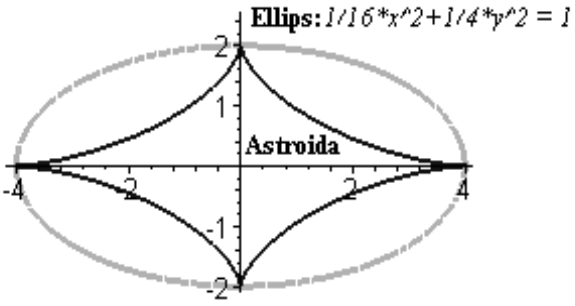
$$C := \begin{bmatrix} 5 & -1 & 3 \\ 0 & 2 & -1 \\ -2 & -1 & 0 \end{bmatrix}$$

c) $y = \frac{\sin x}{x}$ graphic of function [-4π; 4π] in Maple

```
> plot(sin(x)/x, x=-4*Pi..4*Pi, labels=[x,y],labelfont=[TIMES,ITALIC,12], thickness=2);
```

d) $x = 4\cos^3 t,\ x = 2\sin^3 t\ \ (0 \le t \le 2\pi)$ astroid functions and $\frac{x^2}{16} + \frac{y^2}{4} = 1$ formation of ellipse graphic in a single coordinating axe for creating Maplestate

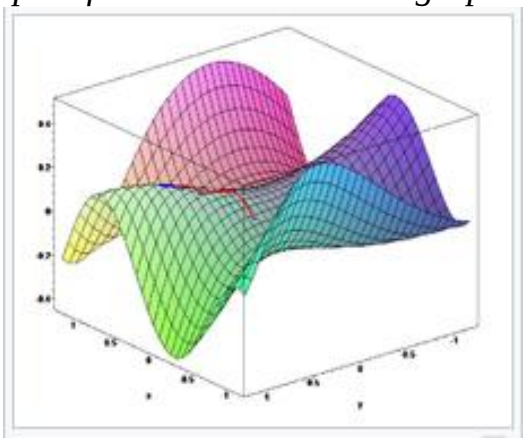




Example: The following code calculates the solution of a linear differential equation $\frac{d^2y}{dx^2} - 3y(x) = x$ with initial conditions $y(0) = 0,\ \left.\frac{dy}{dx}\right|_{x=0} = 2$:

```
dsolve({diff(y(x), x, x) - 3*y(x) = x, y(0)=0, D(y)(0)=2}, y(x));
```

Example of a three-dimensional graph created in Maple

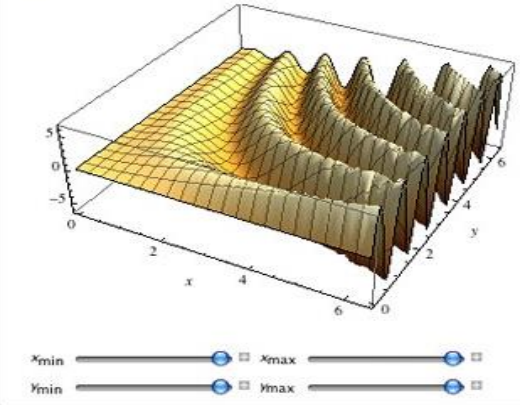


plot of x sin(xy)

Input interpretation:

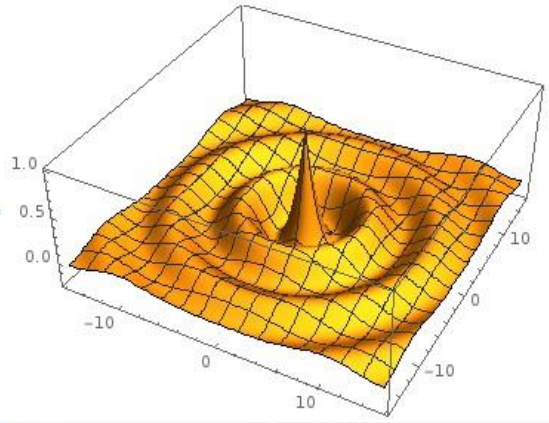
plot	$x \sin(x\, y)$

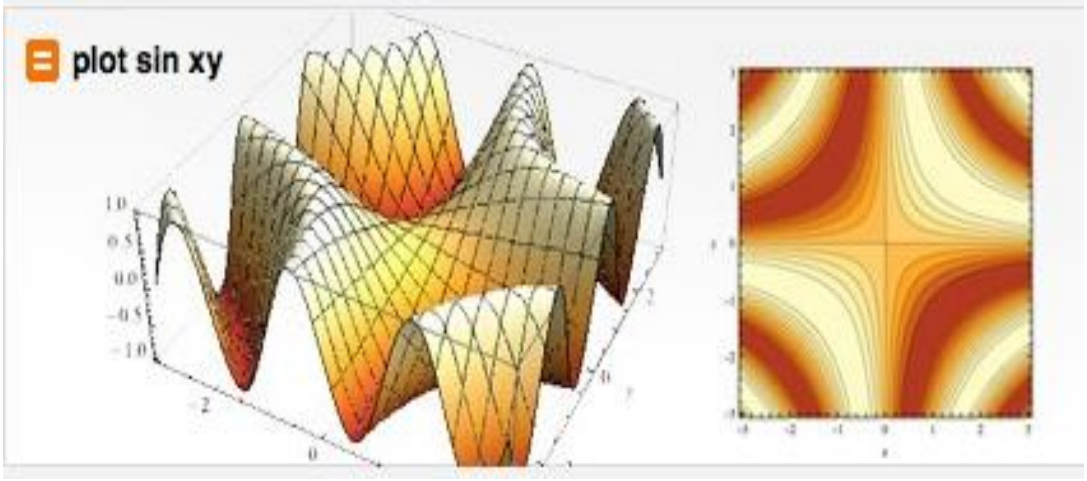
3D plot:



In[23]:=
```
Plot3D[Cos[Sqrt[x^2 + y^2]]/(1 + Sqrt[x^2 + y^2]), {x, -5 π, 5 π}, {y, -5 π, 5 π},
 PlotRange → All, PlotPoints → {100, 100}]
```

Out[23]=





Bivariate Polynomial Regression

Define Model Equation

The general form of a bivariate polynomial of total degree *n* is given by:

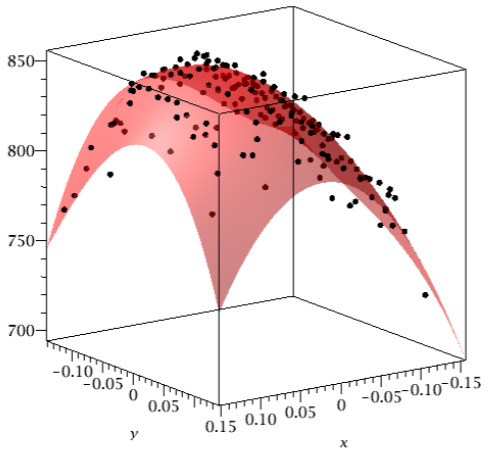
$$f := n \to \sum_{j=0}^{n} \left(\sum_{i=0}^{n} a_{i,j} x^i y^j \right)$$

$$n \to \sum_{j=0}^{n} \sum_{i=0}^{n} a_{i,j} x^i y^j \qquad (1.1)$$

Next, we choose the order of the bivariate polynomial which we will fit to the points. Increasing this value will refine the fit.

$poly := unapply(f(3), x, y)$

$$(x, y) \to x^3 y^3 a_{3,3} + x^3 y^2 a_{3,2} + x^2 y^3 a_{2,3} + x^3 y a_{3,1} + x^2 y^2 a_{2,2} + x y^3 a_{1,3} + x^3 a_{3,0} + x^2 y a_{2,1} + x y^2 a_{1,2} + y^3 a_{0,3} + x^2 a_{2,0} + x y a_{1,1} + y^2 a_{0,2} + x a_{1,0} + y a_{0,1} + a_{0,0} \qquad (1.2)$$

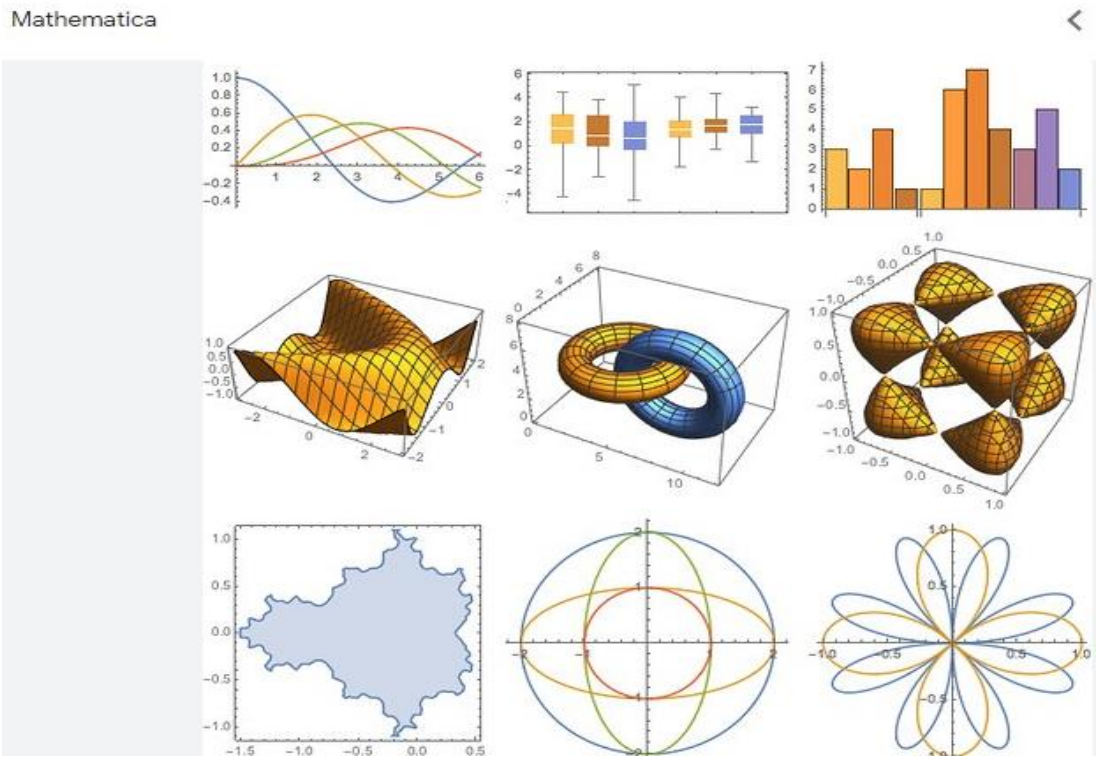


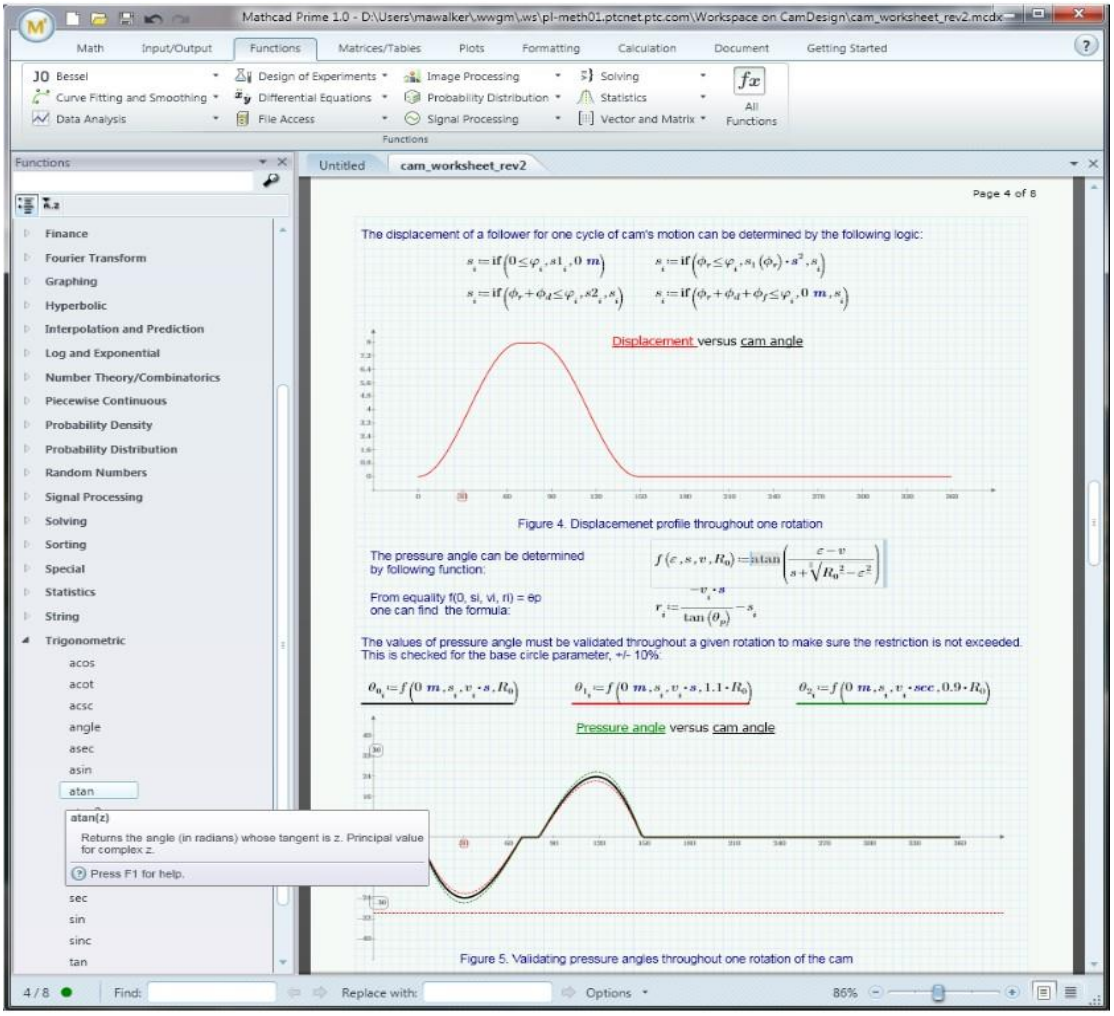
Specify the Data Set

Below we include some sample point data in a DataTable component and associate it with the variable *data*.

	X	Y	Z
1	-6059.36	-5227.76	774.0
2	-5165.25	4856.31	728.0
3	-5098.9	1553.98	758.0
4	-5092.68	-3018.86	772.0
5	-5066.15	-4868.94	792.0

Alternatively, this data could be imported from an external source using the Import command.

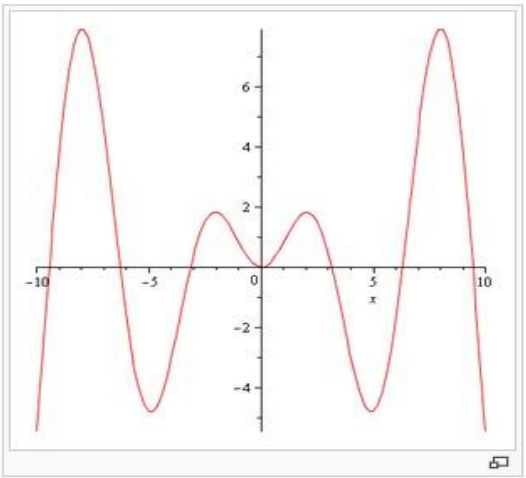




Plotting of function of single variable [edit]

Plot $x\sin(x)$ with x ranging from -10 to 10:

```
plot(x*sin(x), x = -10..10);
```

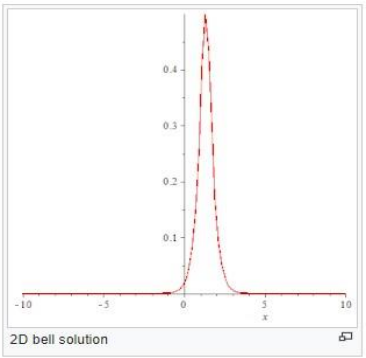


Animation of functions [edit]

- Animation of function of two variables

$$f := \frac{2k^2}{\cosh^2(xk - 4k^3t)}$$

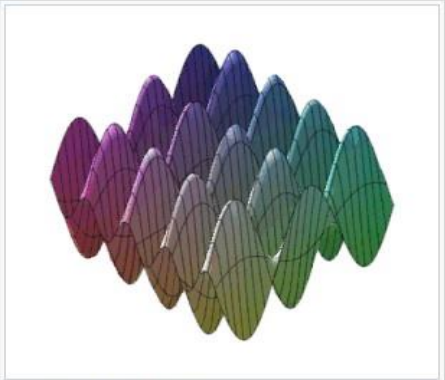
```
plots:-animate(subs(k = 0.5, f), x=-30..30, t=-10..10, numpoints=200, frames=50, color=red, thickness=3);
```



2D bell solution

- Animation of functions of three variables

```
plots:-animate3d(cos(t*x)*sin(3*t*y), x=-Pi..Pi, y=-Pi..Pi, t=1..2);
```

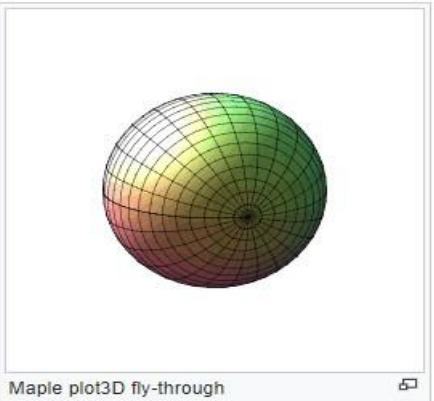


3D animation of function

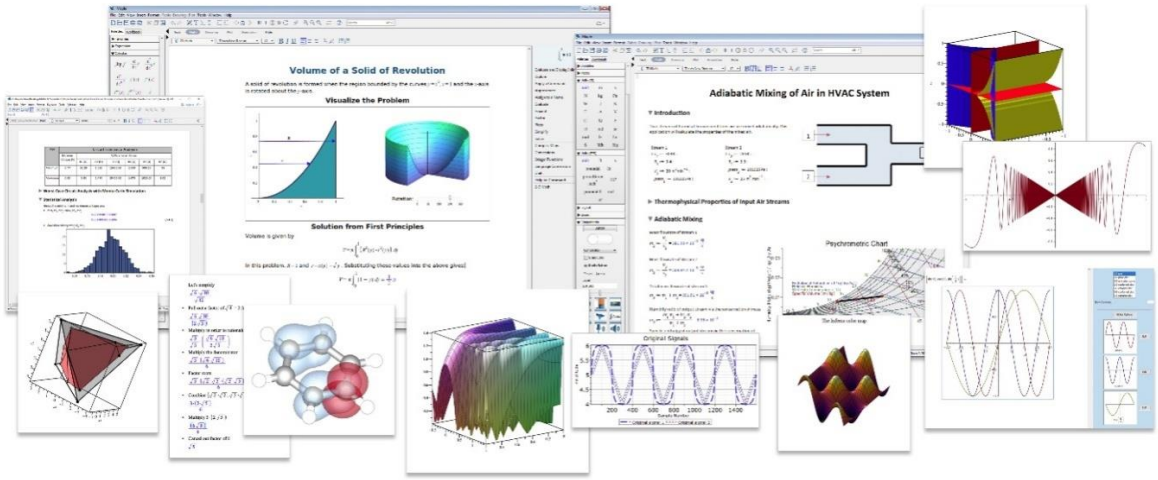
The purpose of learning how to use these packages is to deepen and expand the speaking skills of those interested, to work with students during the lesson, to use the time resources correctly, to use pre-prepared handouts on the topic, to use the achievements of information technology in the coverage of the selected topic, and to form knowledge, skills and competencies [3-7].

- Fly-through animation of 3-D plots.[28]

```
M := Matrix([[400,400,200], [100,100,-400], [1,1,1]], datatype=float[8]):
plot3d(1, x=0..2*Pi, y=0..Pi, axes=none, coords=spherical, viewpoint=[path=M]);
```



Maple plot3D fly-through



References:

1. Aripov M. «Applied mathematics in natural science & technology». Part II, Methodic pointer. – Tashkent: NUUz, 2013. – 264 p.

2. Bogdanov A. V. «Mathematica package for engineering computing». Part 1. Textbook. – Tomsk: Polytechnic University. – 97 p.

3. Resolution of the President of the Republic of Uzbekistanof. 2019. – P. 4433. «About measures for enhancement of system of involvement of youth to science and support of its initiatives», (as amended of the Presidential decree of the Republic of Uzbekistan of 01.04.2021 No. UP-6198).

4. Samarsky A. A., Mikhailov M. «Mathematical modeling: idea, methods primers». – Moscow: Fiz.Matt.lit., 2005. – 320 p.

5. Saxobidinova O. I. «MathCad 2000 working with package». Autor G. Gulom Gulistan State Universitet XXXII, Gulistan, 2007. – P. 43-45.

6. Tashpulatov F. A., Abdullayeva N. F., Varlamova L. P. Sakhobidinova O.I. «Intelligence of Mathcad systems in the electronic study of mathematics». Transactions of the international scientific conference «Modern problems of applied mathematics and information technologies-al-Khorezmiy». Vol. № 2. – Samarkand, 2014. – P. 144-146.

7. Aladev V. Z., Boyko V. K., Rovba E. A. «Programming and application development in Maple». – Tallinn, 2014. – 458 p.