THE USING OF EDUCATIONAL TECHNOLOGIES IN TEACHING EXACT SCIENCES AND FORMING THE STUDENT'S CREATIVE ABILITY

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Abstract. *Education is the most important and reliable method of systematic education. Education is unique cognitive process controlled by a teacher. It is the leadership role of the teacher that ensures full mastery of knowledge, skills and abilities by students, development of their mental strength and creative abilities. The article also gives suggestions and recommendations regarding the methodical importance of forming the cognitive ability of the student in the teaching of specific sciences.*

Keywords: *education, recommendation, student, analysis, method, exact integral,surface, volume.*

The development of innovative pedagogical technologies and their introduction into the educational process, as well as the development of information technologies, require each pedagogue to improve their professional training and pedagogical skills.

Continuous education provides deep, all-round education, various forms, methods and quality of training of specialists, the interrelationship between various components, and the rational application of certain methods to the educational process.

In mastering specific subjects, students are based on the knowledge they have acquired from general education and other subjects. It is important to ensure continuity and continuity with modern technologies and specialized departments.

The active methods of education, which are especially common and unique in strengthening mathematical knowledge, include: conversation, discussion, educational games, "case study", design method, brainstorming, etc.

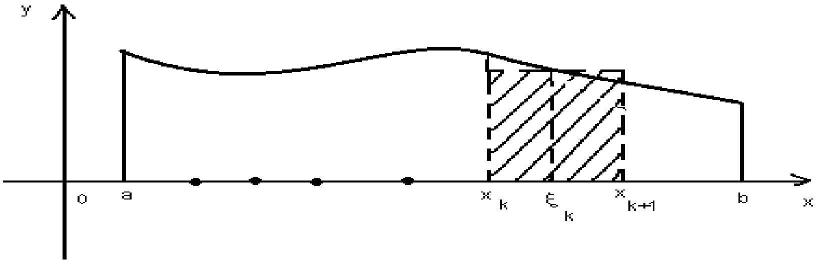
The science of mathematics occupies a key and special place in the development of the national economy and technology.

It is of great importance in various fields of economy and technology: including modeling of various projects and determining the level of large areas, calculating the project of constructions requiring a lot of work and alternative spending on them.

In this article, the subject of "Mathematical Analysis" subject "Definite integral and its applications" is studied using the "case-study" method to explain this subject more thoroughly to students.

A face of a flat shape. This, $f(x)$ function $[a,b]$ is continuous so, $\forall x \in [a,b]$ is $f(x) \geq 0$.

From above $f(x)$ graph of the function, from the sides $x=a$, $x=b$ vertical lines and from below Ox Let's look at the shape bounded by D the axis. (1 drawing)



1-drawing

$[a,b]$ any of the segment $P=\{x_0, x_1, x_2, ..., x_n\}$

$$(a=x_0<x_1<...<x_k<x_{k+1}<...<x_n=b)$$

we can divide. Each of the partitions

$$[x_k, x_{k+1}] \quad (k=0,1,2,...,n-1)$$

is optional in the section ξ_k in point $f(x)$ function value $f(\xi_k)$ multiply by the length of this piece:

$$f(\xi_k)(x_{k+1}-x_k)=f(\xi_k)\Delta x_k .$$

This is the basis of quantity Δx_k height $f(\xi_k)$ represents the face of a rectangle equal to (Figure 1). As above, the basics

$$\Delta x_0 = x_1 - x_0,\ \Delta x_1 = x_2 - x_1,\ ...,\ \Delta x_{n-1} = x_n - x_{n-1}$$

heights respectively $f(\xi_0),\ f(\xi_1),\ ...,\ f(\xi_{n-1})$ rectangular surfaces with

$$\sum_{k=0}^{n-1} f(\xi_k)\Delta x_k \qquad (1)$$

if you look at the amount *D*, it can be taken as the face of the figure.

At this moment (1) $f(x)$ is the integral sum of the function. It is known that $f(x)$ function $[a,b]$ is countinuosly, (1) there is a limit to the sum and

$$\lim_{\lambda\to 0}\sum_{k=0}^{n-1} f(\xi_k)\Delta x_k = \int_a^b f(x)dx$$

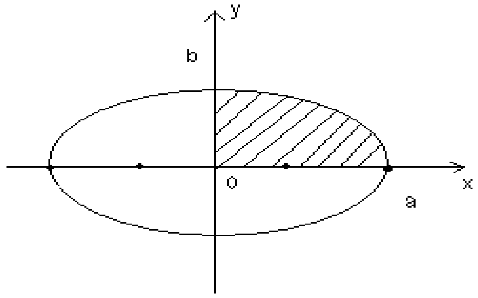
So, the considered shape has a surface *D* and its face is this *S*

$$S=\int_a^b f(x)dx \qquad (2)$$

Formula has been finded.

Problem solving 1. This $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ ellipses and Ox, Oy find the face of the figure bounded by the parts in the positive directions of its axes.

⊲ The form mentioned in the example is depicted in the drawing 2.



2-drawing

Obviously, the face of the shape in question is the face of the ellipse $\frac{1}{4}$ is part of it

$$y = \frac{b}{a}\sqrt{a^2 - x^2} \quad (0 \le x \le a)$$

function graph and $x = 0,\ x = a$ is a form bounded.

As formula (2) is

$$S = \int_a^b \frac{b}{a}\sqrt{a^2 - x^2}dx$$

Now we calculate the integral:

$$\int_a^b \frac{b}{a}\sqrt{a^2 - x^2}dx = \frac{b}{a}\int_a^b \sqrt{a^2 - x^2}dx = \begin{bmatrix} x = a\sin t & x = 0\,\text{da} & t = 0 \\ dx = a\cos t & x = a\,\text{da} & t = \frac{\pi}{2} \end{bmatrix} =$$

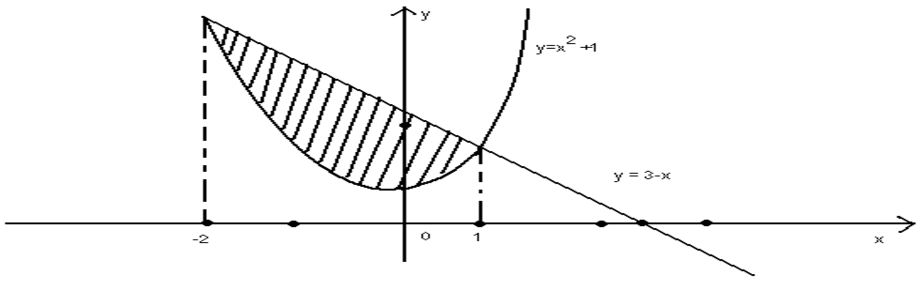
$$= \frac{b}{a}\int_0^{\frac{\pi}{2}} \sqrt{a^2 - a^2\sin^2 t} \cdot a\cos t dt = \frac{b}{a}a^2\int_0^{\frac{\pi}{2}} \cos^2 t dt = ab\int_0^{\frac{\pi}{2}} \left(\frac{1}{2} + \frac{1}{2}\cos 2t\right)dt =$$

$$= \frac{1}{2}ab \cdot \frac{\pi}{2} + \frac{1}{2}ab \cdot \frac{\sin 2t}{2}\Bigg|_0^{\frac{\pi}{2}} = \frac{\pi ab}{4}.$$

So, $S = \frac{\pi ab}{4}$. ▷

Problem solving 2. This $y = x^2 + 1,\quad x + y = 3$ find the face of the figure bounded by the lines.

◁ $y = x^2 + 1$ parabola and $x + y = 3$ the shape bounded by straight lines is depicted in drawing 3 below



3-drawing

By systematizing the equations of the parabola and the straight line,

$$\begin{cases} y = x^2 + 1, \\ x + y = 3 \end{cases}$$

then solve it off, $x_1 = -2,\ x_2 = 1$ we find that it will be. Now

$$a = -2,\ b = 1,\ f_1(x) = x^2 + 1,\ f_2(x) = 3 - x$$

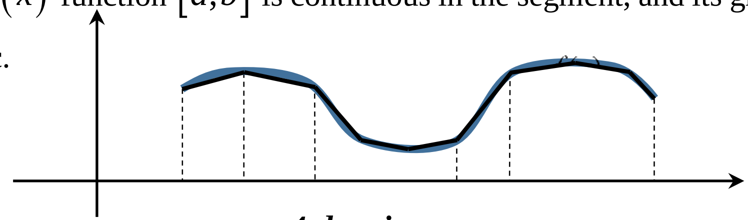
that, using formula (3), we find the face of S the desired shape:

$$S = \int_{-2}^{1} \left[(3 - x) - (x^2 + 1) \right] dx = \int_{-2}^{1} (2 - x - x^2) dx = \left(2x - \frac{x^2}{2} - \frac{x^3}{3} \right) \Bigg|_{-2}^{1} =$$

$$= 2 - \frac{1}{2} - \frac{1}{3} - \left(-4 - \frac{4}{2} + \frac{8}{3} \right) = 4\frac{1}{2}. \ \triangleright$$

2. Arc length.

Just imagine that, $f(x)$ function $[a,b]$ is continuous in the segment, and its graph is in the plane $\breve{AB}$ describe the arc.



4-drawing.

$[a,b]$ segment's any $P = \{x_0, x_1, x_2, \ldots, x_n\}$

$$(a = x_0 < x_1 < \ldots < x_k < x_{k+1} < \ldots < x_n = b)$$

we can divide. Each partition of the partition

$$x_k \quad (k = 0,1,2,\ldots,n)$$

From points Oy passing straight lines parallel to the axis and them $\breve{AB}$ points of intersection with the arc $\quad A_k = A_k(x_k, f(x_k)) \qquad (k = 0,1,2,\ldots,n)$

we define with . As a result $\breve{AB}$ in arc

$$A_0(x_0, f(x_0)), A_1(x_1, f(x_1)), \ldots, A_k(x_k, f(x_k)), A_{k+1}(x_{k+1}, f(x_{k+1})), \ldots, A_n(x_n, f(x_n))$$

points $\left(A = A_0(a, f(a)),\ B = A_n(b, f(b)) \right)$.

$$\text{This } \lim_{\lambda \to 0} \sum_{k=0}^{n-1} \sqrt{(x_{k+1} - x_k)^2 + \left(f(x_{k+1}) - f(x_k) \right)^2}$$

if there is a limit, $\breve{AB}$ has an arc length, the value of the limit $\breve{AB}$ is called the length of the arc.

We can say, $f(x)$ function is continuously $f'(x)$ have a derivative. Using Lagrange's theorem, we find:

$$f(x_{k+1}) - f(x_k) = f'(\xi_k)(x_{k+1} - x_k) \quad (x_k \le \xi_k \le x_{k+1})$$

in result is

$$\sum_{k=0}^{n-1}\sqrt{\left(x_{k+1}-x_k\right)^2+\left(f\left(x_{k+1}\right)-f\left(x_k\right)\right)^2}=\sum_{k=0}^{n-1}\sqrt{\left(x_{k+1}-x_k\right)^2+f'^2\left(\xi_k\right)\left(x_{k+1}-x_k\right)^2}=$$

$$=\sum_{k=0}^{n-1}\sqrt{1+f'^2\left(\xi_k\right)}\cdot\left(x_{k+1}-x_k\right)=\sum_{k=0}^{n-1}\sqrt{1+f'^2\left(\xi_k\right)}\cdot\Delta x_k$$

So, $\breve{AB}$ arc has length and its length equal to

$$\ell=\int_a^b\sqrt{1+f'^2(x)}dx. \qquad (3)$$

Problem solving 3. This $\begin{matrix}\varphi(t)=a(t-\sin t),\\ \psi(t)=a(1-\cos t)\end{matrix} \qquad (0\le t\le\pi)$

find the length of the arc (cycloid) defined by the system of equations.

$\triangleleft$ Obviously, $\varphi'(t)=a(1-\cos t), \quad \psi'(t)=a\sin t$

$$\sqrt{\varphi'^2(t)+\psi'^2(t)}=\sqrt{a^2(1-\cos t)^2+a^2\sin^2 t}=a\sqrt{2(1-\cos t)}$$

So $\alpha=0, \ \beta=2\pi$ is,

we find the length of the curve using the formula (3):

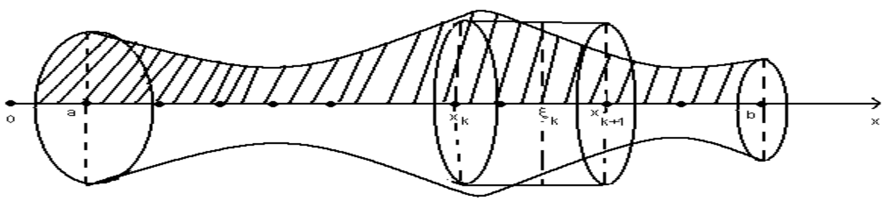
$$\ell=\int_\alpha^\beta\sqrt{\varphi'^2(t)+\psi'^2(t)}dt=\int_0^{2\pi}a\sqrt{2(1-\cos t)}dt=a\int_0^{2\pi}\sqrt{4\cdot\sin^2\frac{t}{2}}dt=$$

$$=2a\int_0^{2\pi}\sin\frac{t}{2}\cdot d\left(\frac{t}{2}\right)\cdot 2=-4a\cos\frac{t}{2}\Big|_0^{2\pi}=-4a(\cos\pi-\cos 0)=8a. \ \triangleright$$

3. The volume of the rotating body.

We can say, $f(x)$ function $[a,b]$ is continuously, that is $f(x)\ge 0$. From above $f(x)$ the graph of the function, from the sides $x=a, \ x=b$ vertical lines and from below Ox flat shape bounded by the axis Ox rotating around its axis creates a rotating body.

For example, the shape depicted in the drawing below Ox rotation around its axis results in the following rotating object:



6-drawing

$[a,b]$ segment's any $P=\{x_0,x_1,x_2,...,x_n\}$

$$\left(a=x_0<x_1<x_2<...<x_k<x_{k+1}<...<x_n=b\right)$$

we can divide. Each of the partitions

$$[x_k,x_{k+1}] \quad (k=0,1,2,...,n-1)$$

is optional in the section ξ_k in point $f(x)$ function value $f(\xi_k)$ find the $\pi f^2(\xi_k)\cdot\Delta x_k$

we look at the amount. This quantity is the radius of the base $f(\xi_k)$ lenght Δx_k represents the volume of the cylinder equal to It appears that

$$\sum_{k=0}^{n-1} \pi f^2(\xi_k)\Delta x_k$$

the quantity can be thought of as the volume of the rotating body in question.

So $[a,b]$ Let's increase the number of dividing points of the segment in such a way that $\max\{\Delta x_k\}$ let it go to zero. In that case

$$\sum_{k=0}^{n-1} \pi f^2(\xi_k)\Delta x_k$$

the value of the sum also changes and it more and more accurately represents the size of the circular body.

This $V = \lim\limits_{\lambda\to 0}\sum_{k=0}^{n-1} \pi f^2(\xi_k)\Delta x_k$ the limit is called the volume of the rotating body.

At this moment $\lim\limits_{\lambda\to 0}\sum_{k=0}^{n-1} \pi f^2(\xi_k)\Delta x_k = \pi\int_a^b f^2(x)dx$ equality can be established. So, volume of a circular body is $V = \pi\int_a^b f^2(x)dx$ (4)

Problem solving 4. The radiuse is r find the volume of the sphere equal to

$\lhd$ This is the ball $f(x) = \sqrt{r^2 - x^2}, \quad -r \le x \le r$

of a semicircle Ox It can be considered as a body formed by rotation around its axis. () we find using the formula:

$$V = \pi\int_{-r}^{r}(r^2 - x^2)dx = \pi\left(r^2x - \frac{x^3}{3}\right)\Bigg|_{-r}^{r} = \pi\left[\left(r^3 - \frac{r^3}{3}\right) - \left(-r^3 + \frac{r^3}{3}\right)\right] = \frac{4}{3}\pi r^3. \rhd$$

4. To understand the economic meaning of the definite integral, $y = f(t)$ we consider that the function determines the change of labor productivity over time in any production. So $[0,T]$ the amount of product in the period of time u to calculate $[0,T]$ interval $0 = t_0 < t_1 < t_2 < \ldots < t_{n-1} <= T$ broken into small pieces with dots, $[t_i, t_{i+1}]$ labor productivity is approximately unchanged in a small interval $f(\xi_i)$ equal to $(\xi_i \in [t_i, t_{i+1}])$ $[t_i, t_{i+1}]$ the volume of output produced in the interval $\Delta u_i \approx f(\xi_i)\cdot\Delta t_i$ $(\Delta t_i = t_{i+1} - t_i)$ considering that the whole $[0,T]$ the amount of output produced in the interval u we create the following approximate equation for:

$$u = \sum_{i=0}^{n-1}\Delta u_i \approx \sum_{i=0}^{n-1} f(\xi_i)\Delta t_i$$

To increase accuracy in this equation $\max\Delta t_i \to 0$ we have to go to the limit. In that case,

$$u = \int_0^T f(t)dt$$
.

This equality $[0,T]$ the amount of output produced over time $u,\ f(t)$ - labor productivity function $f(t)$ is expressed by the definite integral of This integral is numerically $f(t)$ function is $[0,T]$ is equal to the surface of the curved trapezoid formed by the intervals.

$y = f(x)$ function $\int_a^b f(x)dx$

Let's look at the conditions under which the integral will exist.

CASE STUDY TECHNOLOGY

Study subject: Mathematical analysis

Theme: Applications of the definite integral

The main purpose of the case:

learning to calculate the volume of a rotating body;

- learning to calculate surfaces;
- learning to calculate the length of an arc.

Expected results of educational activities:

• Learning to calculate surfaces;
• Learning to calculate the length of an arc;
• Learning to calculate volumes;
• To teach students to use the exact integral in the calculation of some physical, geometric and other quantities.

In order to successfully implement this case, students must first have the following knowledge and skills:

The student should know:

- basic concepts of mathematics, mathematical formulas and properties;

The student must:

- learns the subject independently; clarifies the essence of the problem; promotes ideas; learns to make independent decisions, considering information from a critical point of view; has his own point of view and makes a logical conclusion; works independently with educational information; compares, analyzes and summarizes data;

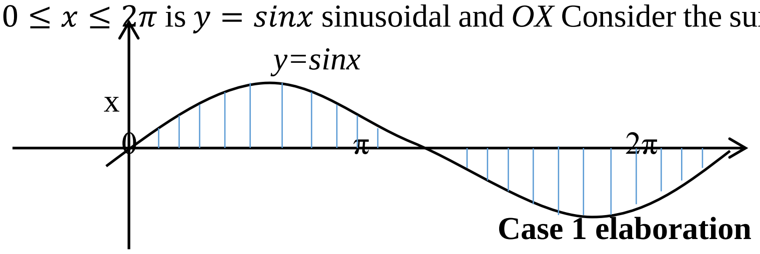
A student should have:

communicative skills; presentation skills; skills of collaborative work; to be able to use the skills of analyzing problem situations, the application of definite integrals in practice and production.

Case studies of the subject of definite integral applications

Case 1

$0 \le x \le 2\pi$ is $y = sinx$ sinusoidal and OX Consider the surface bounded by the axis Q. y



Case 1 elaboration

$0 \leq x \leq \pi$ is $sinx \geq 0, \pi \leq x \leq 2\pi$ and when $sinx \leq 0$ because $Q = \int_0^{\pi} sinxdx + \left|\int_{\pi}^{2\pi} sinxdx\right| = \int_0^{2\pi} |sinx|dx,$

$$\int_0^{\pi} sinxdx = -cosx\Big|_0^{\pi} = -(cos\pi - cos0) = -(-1-1) = 2,$$

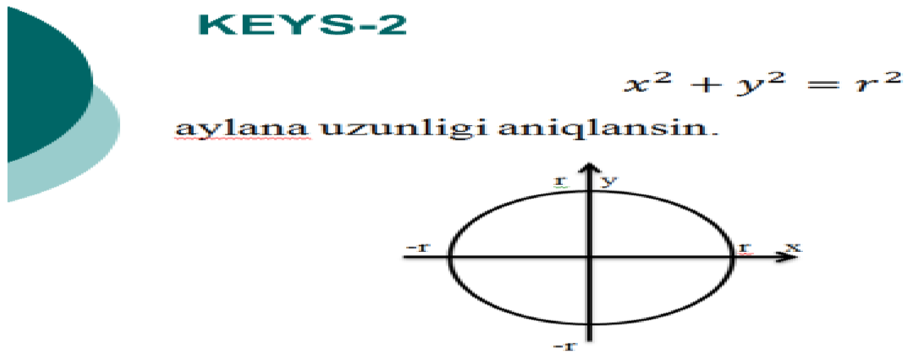
$$\int_{\pi}^{2\pi} sinxdx = -cosx\Big|_{\pi}^{2\pi} = -(cos2\pi - cos\pi) = -2.$$

So, $Q = 2 + |-2| = 4.$

Case 2

$x^2 + y^2 = r^2$ determine the length of the circle.

Case 2 elaboration



First, we calculate the length of the fourth part of the circle lying in the first square. Then the equation of the arc *AB* is:

$$y = \sqrt{r^2 - x^2},$$

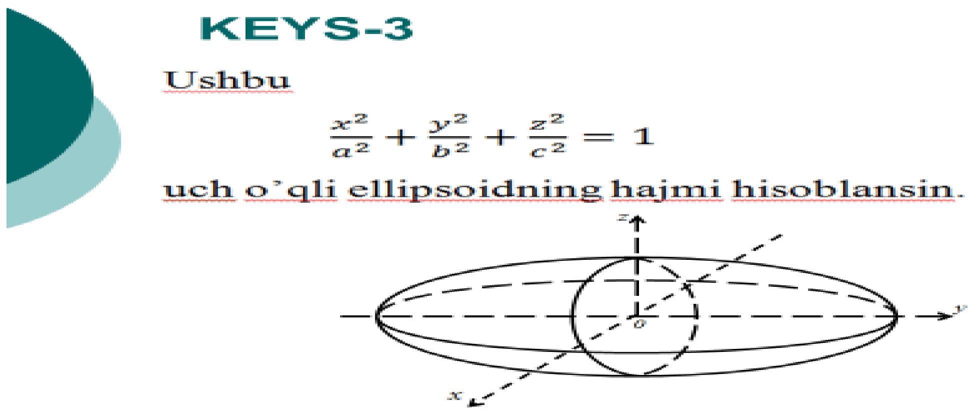
so

$$\frac{dy}{dx} = -\frac{x}{\sqrt{r^2-x^2}}.$$

So, $\frac{1}{4}s = \int_0^r \sqrt{1 + \frac{x^2}{r^2-x^2}}dx = \int_0^r \frac{r}{\sqrt{r^2-x^2}}dx = rarcsin\frac{x}{r}\Big|_0^r = r\frac{\pi}{2}.$

The length of the whole circle $s = 2\pi r.$

Case 3



This $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ calculate the volume of the three-axis ellipsoid.

Case 3 elaboration

When the ellipsoid *Oyz* is cut by a plane parallel to the Moon plane at a distance x from it $\frac{y^2}{b^2}+\frac{z^2}{c^2}=1-\frac{x^2}{a^2}$ or semi-axes

$$b_1=b\sqrt{1-\frac{x^2}{a^2}},\qquad c_1=c\sqrt{1-\frac{x^2}{a^2}}$$

is an ellipse

$$\frac{y^2}{\left[b\sqrt{1-\frac{x^2}{a^2}}\right]^2}+\frac{z^2}{\left[c\sqrt{1-\frac{x^2}{a^2}}\right]^2}=1$$

But the face of such an ellipse $\pi b_1 c_1$ is equal to That is why:

$$Q(x)=\pi bc\left(1-\frac{x^2}{a^2}\right).$$

The size of the ellipsoid: $v=\pi bc\int_{-a}^{a}\left(1-\frac{x^2}{a^2}\right)dx=\pi bc\left(x-\frac{x^3}{3a^2}\right)\Big|_{-a}^{a}=\frac{4}{3}\pi abc.$

If $a=b=c$, the ellipsoid becomes a sphere, so we generate $v=\frac{4}{3}\pi a^3$

Conclusion. State educational standards, educational standards, which determine the necessary requirements for the quality of high professional training, qualification, cultural and moral level of learners and aim to raise the quality of education to the level of world requirements. a new generation of plan and science programs has been developed. As a result, an educational system organized on the basis of new innovative technologies is being formed in the educational process.

REFERENCES

1. Худойберганов Г.,Ворисов А.,Мансуров Х.,Шоимкулов Б., Математик анализдан маърузалар. I,II қисм, Тошкент 2010 йил.
2. Egamberdiyev B., Isanov R. Sh. Oliy matematikadan hisob-grafik ishlarning misol va masalalarini yechish. I-qism. Toshkent, 2009
3. Шоимқулов Б.А.,Туйчиев Т.Т., Джумабоев Д.Х. «Математик анализдан мустақил ишлари», 2008й.
4. Yo’ldoshev J .G’., Usmonov S.A. Pedagogik texnologiya asoslari. T., O’qituvchi, 2004.-102 b
5. Курбанов Ш., Сейтхалилов Э. Национальная программа по подготовке кадров. Т., Университет, 2000. -103 с.
6. Begimqulov U.SH. Pedagogik ta’limda zamonaviy axborot texnologiyalarini joriy etishning ilmiy-nazariy asoslari. T., Fan, 2007. -143 b.