USE INTERNAL INTEGRATION TO SOLVE SOME EXTREME PROBLEM

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Abstract. We know that learning subject algebra and mathematical analyses at the academic lyceum's , at the vocational college's and subject's elements of functional analysis's at the higher educations. Since to right application means of method's of these subject's to gives-good result's. To this end, one innovative technology is recommended here for the study of some issues of the subject under consideration.

Key words. Segment, segment length , distance, space, metric, metric space, straight line, curved line.

СПОЛЬЗОВАНИЕ ВНУТРЕННЮЮ ИНТЕГРАЦИЮ ДЛЯ РЕШЕНИЯ НЕКОТОРЫХ ЭКСТРЕМАЛЬНЫХ ЗАДАЧ

Аннотация. В академических лицеях , профессиональных колледжах изучается предмет алгебра и основы матема-тического анализа. и в высших учебных заведениях изучается предмет элементы функционального анализа. Поэтому знание и умышленное применение методов этих предметов даёт хорошие результаты в практике. С этой целью здесь рекомендуется одна инновационная технология для изучения некоторых вопросов рассматриваемого предмета.

Ключевые слова: сегмент, длина сегмента, расстояние, пространство, метрика, метрическое пространство, прямая, кривая.

BA'ZI EKSTREMAL MASALALARNI YECHISHDA ICHRI INTEGRATSIYADAN FOYDALANISH.

Annotatsiya. Akademik litseylarda, kasb – hunar kollejlarida algebra va matematik analiz asoslari hamda oliy ta’limda esa funksional analiz elementlari fani o’rganiladi. Shu sababli matematik analiznig va funksional analiz elementlari fani bo’yicha misollarini yechishda boshqa fanlardagi tushunchalar va usullardan o’rinli foydalana olish talab etiladi.. Shu maqsadda ko'rib chiqilayotgan mavzuning ayrim masalalarini o'rganish uchun bu erda bitta innovatsion texnologiya tavsiya etiladi.

Kalit so'zlar. Kesma, kesmani usunligi, masofa, fazo, metrika, metric fazo, to'g'ri chiziq, egri chiziq.

The Decree of the President of the Republic of Uzbekistan dated 07.05.2020 No.PP-4708 “On MEASURES to improve the QUALITY of EDUCATION and the development of SCIENTIFIC research IN the FIELD of MATHEMATICS" emphasizes that one of the main tasks of our time is the integration of higher education, integration in teaching at universities of the republic and in scientific research [1]. Based on these tasks, the question of integration in training is a modern requirement..Fundamentals of algebra and mathematical analysis are studied in academic lyceums and vocational colleges, and the elements of functional analysis are studied in higher education. Therefore, it is necessary to use the concepts and methods of other disciplines in solving examples of mathematical analysis and elements of functional analysis. This article is aimed at this goal and demonstrates an innovative technology of study. If it is known that the technology of understanding and using the tools of another science in the study of one science is considered as external integration, a number of recommendations in this direction are given in the following articles [6,7,8] Now in the study of science can be considered as internal integration. The following recommendations are given in this context. In solving many practical and theoretical problems of geometry, algebra, and mathematical analysis, it is necessary to consider the proximity of points. It uses the concept of distance between them. So what is distance? As you know, in the school mathematics course, first of all, the concepts of section, the length of the section are introduced, and then the concept of distance between two points is introduced [1] .How is it determined? What are its properties? The distance between two P_1, P_2 points on the number axis is called the following $|P_1 - P_2|$ number, and it is called $d(P_1, P_2)$

To mean

$$d(P_1, P_2) = |P_1 - P_2| \quad (1)$$

This distance satisfies the following three conditions:

a) $d(P_1, P_2) \geq 0$, b) $d(P_1, P_2) = d(P_2, P_1)$, c) For points P_1, P_2, P_3 , $d(P_1, P_3) \leq d(P_1, P_2) + d(P_2, P_3)$.

The distance between points $P_1(x_1, y_1)$, $P_2(x_2, y_2)$ in the plane in the course of elementary geometry and analytical geometry []

$$d(P_1, P_2) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \quad (2)$$

formula, and the distance between two given points $P_1(x_1, y_1, z_1)$, $P_2(x_2, y_2, z_2)$ in space is

$$d(P_1, P_2) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2} \quad (3)$$

In addition, in the course of analytical geometry, the distance from point $M_0(x_0, y_0)$ in the plane to the straight line $ax + by + c = 0$

$$d(P,l)=\frac{|ax_0+by_0+c|}{\sqrt{a^2+b^2}} \quad (4)$$

formulas and distances from point $M_0(x_0, y_0, z_0)$ in space to plane

$$d(P,\alpha)=\frac{|ax_0+by_0+cz_0+d|}{\sqrt{a^2+b^2+c^2}} \quad (5)$$

is In the course of mathematical analysis, the distance from a given point to an arbitrary set A is $d(x,A)=\inf\{d(x,y), y\in A\}$ (6).

such as the distance from set to set

$$d(A,B)=\inf\{d(x.y), x\in A, y\in B\} \quad (7)$$

distances from the curve to the straight line, from the curve to the curve, and other distances are also considered.

They also have the above three properties. The concept of distance between points in different sets is then introduced, which is determined according to the properties of the sets under consideration. Because limits, continuity, and other concepts in these collections cannot be defined in the usual way. That is, we need to expand the concept of distance when dealing with such issues. These distances are called metrics, and they define different metric spaces. From the above definitions, it is clear that in many cases, when determining distances, we are required to solve extreme problems. This article is dedicated to the study of some of these extreme issues. In this way, the application of innovative technology, which is one of the requirements of the modern course,

Issue -1. Find the distance from the point of the parabola $y = x^2$ to the straight line $x - y - 5 = 0$.

Solution: Given the points of the given $y = x^2$ parabola $P(x;x^2)$, the distance $l: x - y - 5 = 0$ from it to the straight line (4) is $d(P,l) = \frac{|x - x^2 - 5|}{\sqrt{2}}$. It is enough to find its minimum for the solution. For this we get

$\min |g(x)| = \min \left| \frac{19}{4} + (x - \frac{1}{2})^2 \right| = \frac{19}{4}$ or $\min\ d(P,Q) = \frac{19\sqrt{2}}{8}$ for

$$g(x) = x - x^2 - 5 = -5 - \left(x - \frac{1}{2}\right)^2 + \frac{1}{4} = -\frac{19}{4} - \left(x - \frac{1}{2}\right)^2.$$

Issue -2. Find the closest point from point $y = x^2$ to the straight line $y = 2x - 4$.

solution: To do this, we call the points of the given parabola $y = x^2$ $P(x;x^2)$ and the distance from it to the straight line $l: y = 2x - 4$. This distance is based on (4) $d(P,Q) = \frac{|2x - x^2 - 4|}{\sqrt{5}} = \frac{|x^2 - 2x + 4|}{\sqrt{5}}$

is equal to the minimum of To do this, we find the nearest $x = 1$ and $y = 1$ or $P(1;1)$ point for $g(x) = x^2 - 2x + 4 = (x-1)^2 + 3 \geq 3$. In this we obtain that the distance is $\min\ d(P,Q) = \frac{3\sqrt{5}}{5}$.

Issue -3. Find the distance from point $(1;0)$ to the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$.

Solution: To do this, we call the points of the given $\frac{x^2}{9}+\frac{y^2}{4}=1$ ellipse $(x;y)=\left(x;\pm 2\sqrt{1-\frac{x^2}{9}}\right)$.

(2) according to the formulaIt is sufficient to find the minimum $\min d(P,Q)$ of

$$d(P,Q)=\sqrt{(x-1)^2+(\frac{4}{9}\sqrt{9-x^2})-0)^2}=\sqrt{(x-1)^2+\frac{4}{9}(9-x^2)}$$ (7).

$$\min d(P,Q)=\frac{20\sqrt{5}}{5}$$ for this $g(x)=x^2-2x+1+4-\frac{4x^2}{9}=\frac{5}{9}x^2-2x+5=\frac{5}{9}(x-\frac{9}{5})^2+\frac{16}{5}\geq\frac{16}{5}$

Issue -4. Find the shortest distance from point $P(p;p)$ to parabola $y^2=2px$.

solution: Let's say $P(p;p)$ and $Q(x;\sqrt{2px})$ from the $d(P,Q)=\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$ formula

We find the minimum of $s(x)=(p-x)^2+(p-\sqrt{2px})^2$ for $d(P,Q)=\sqrt{(p-x)^2+(p-\sqrt{2px})^2}$.

$$s'(x)=-2(p-x)\ -2(p-\sqrt{2px})\frac{\sqrt{2p}}{2\sqrt{x}}=2(p-x)-2p\frac{\sqrt{2p}}{2\sqrt{x}}-2p=-2p+2x-2p\frac{\sqrt{2p}}{2\sqrt{x}}+2p=0$$ and

$x-\frac{p\sqrt{2p}}{2\sqrt{x}}=0$ or $x=\frac{p\sqrt{2p}}{2\sqrt{x}}$ has a minimum at critical points [5]. Since it is $x^{\frac{3}{2}}=\frac{p^{\frac{3}{2}}}{2^{\frac{1}{2}}}$, we get $x=\frac{p}{\sqrt[3]{2}}$. So this distance is we get that.

$$d(P,Q)=\sqrt{(p-x)^2+(p-\sqrt{2px})^2}=\sqrt{(p-p\frac{1}{\sqrt[3]{2}})^2+(p-\sqrt{2p}\frac{\sqrt{p}}{\sqrt{\sqrt[3]{2}}})^2}=p(\sqrt[3]{2}-1)\sqrt{\frac{\sqrt[3]{2}+2}{2}}$$

Issue -5. Find the distance from the point of the parabola $y=x^2$ to the straight line $x-y-2=0$.

solution: It is sufficient to find the minimum of $d(P,Q)=\frac{\left|x-x^2-2\right|}{\sqrt{2}}$ for the distance from the given $y=x^2$ parabola points $P(x;x^2)$ to the points of the straight line $x-y-2=0$. For this we get $\min\left|g(x)\right|=\min\left|x-x^2-2\right|=\min\left|x^2-x+2\right|=\min\left|(x-\frac{1}{2})^2+\frac{7}{4}\right|=\frac{7}{4}.$ $\min d(P,Q)=\frac{7\sqrt{2}}{8}$ for

$$g(x)=x-x^2-2=-2-\left(x-\frac{1}{2}\right)^2+\frac{1}{4}=-\frac{7}{4}-\left(x-\frac{1}{2}\right)^2\leq 0.$$

Practical and theoretical problems of mathematical analysis or functional analysis are considered in relation to different functional spaces. In these cases, distance $\rho(f,g)$ is determined accordingly. These distances (metrics) satisfy the above three conditions.

Issue -6. Find the distance between the following $f(x)=x^4+3$ and $g(x)=8x^2$ functions given in section $[-2;2]$.

Solution: Our functions are based on [4] for $f(x),g(x)\in C_{[-2;2]}$

$$\rho(f,g)=\max_{-2\le x\le 2}|f(x)-g(x)|=\max_{-2\le x\le 2}|x^4+3-8x^2|$$

it suffices to find the maximum of the $h(x)=|x^4+3-8x^2|$ function from $[-2;2]$ in cross section. For $s(x)=x^4+3-8x^2$, we get $x_1=0,x_2=-2,x_3=2$ as $s'(x)=4x^3-16x=0$. We obtain that $s(0)=3,s(-2)=-13,s(2)=-13$ is mainly $\max h(x)=|-13|=13$ [5]. So $\rho(f,g)=\max_{-2\le x\le 2}|f(x)-g(x)|=13$.

Issue -7. Find the distance between the $f(x)=e^{2x}$ and $g(x)=e^{-2x}$ functions given in section $[-2;1]$.

Solution: For $f(x), g(x) \in C_{[-2;1]}$, it is sufficient to find the maximum of the $h(x) = \left|e^{2x} - e^{-2x}\right|$ function from $\rho(f,g) = \max\limits_{-2 \le x \le 1} |f(x) - g(x)| = \max\limits_{-2 \le x \le 1} \left|e^{2x} - e^{-2x}\right|$ in the $[-2;1]$ cross section. There are no critical points within the section $[-2;1]$ given as $s'(x) = 2e^{2x} + 2e^{-2x} \ne 0$ for the $s(x) = e^{2x} - e^{-2x}$ function. Therefore, we obtain $\max h(x) = \left|e^{-4} - e^{4}\right| = e^{4} - e^{-4}$ because of the presence of $\min s(-2) = e^{-4} - e^{4}, \max s(1) = e^{2} - e^{-2}$ at point $a = -2, b = 1$ [5]. So, $\rho(f,g) = \max\limits_{-2 \le x \le 1} |f(x) - g(x)| = \left|e^{-4} - e^{4}\right| = e^{4} - e^{-4}$.

Issue -8. Find the distance between $y = 2\sqrt{x}$ and $y = -x$ the functions given in section $[0;4]$.

Solution: Here we find the maximum of the $h(x) = \left|2\sqrt{x} + x\right|$ function from $\rho(f,g) = \max\limits_{0 \le x \le 4} |f(x) - g(x)| = \max\limits_{0 \le x \le 4} \left|2\sqrt{x} + x\right|$ to $f(x), g(x) \in C_{[0;4]}$ in cross section $[0;4]$ for $f(x), g(x) \in C_{[0;4]}$. So we get that the distance sought is $\max d(P,Q) = 8$.

Issue -9. At what value of parameter a does the minimum value of the function $y = x^2 - 4ax - a^4$ reach the maximum?

Solution: Here from $y = x^2 - 4ax - a^4 = (x-2a)^2 - (4a^2 + a^4)$ to $y_{\min} = -(4a^2 + a^4) \le 0$

for $\max_a(\min_x y(x)) = -(4a^2 + a^4) = 0$, we get that the value $a^2(a^2+4) = 0$ is looking for is $a = 0$.

Issue -10. Find the distance between $f(x) = x^3 + 6x$ and $g(x) = 3x^2 + 2$ the functions given in section $[-1;1]$.

Issue -11. Find the distance between $f(x) = x^5 + 1$ and $g(x) = 5x^4 - 5x^3$ the functions given in section $[-1;2]$.

Issue -12. Find the distance between $y = \sin 2x$ and $y = x$ functions in the $[-\frac{\pi}{2};\frac{\pi}{2}]$ section.

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