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THE CONTENT OF THE PROJECT WORK OUTSIDE MATHEMATICAL ANALYSIS AND ITS TYPES

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ABSTRACT

In this article, a brief history of students' design and research activities, the content and types of project work in the discipline of mathematical analysis are presented.

Keywords: Learning, Students' Design and Research Activities, Project Service, Measurement Technology.

DISIPLINDEKI PROJE ÇALIŞMASININ IÇERIĞI MATEMATIKSEL ANALIZ VE TÜRLERI

ÖZET

Bu makalede, öğrencilerin tasarım ve araştırma faaliyetlerinin kısa bir tarihi, matematiksel analiz disiplinindeki proje çalışmasının içeriği ve türleri sunulmaktadır.

Anahtar Kelimeler: Öğrenme, Öğrencilerin Tasarım ve Araştırma Faaliyetleri, Proje Hizmeti, Ölçüm Teknolojisi.

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RESEARCH HISTORY

Today, higher education requires improving the system of students' design and research activities, their system of educational and cognitive motives, the ability to accept, preserve, implement learning goals and plan, monitor and evaluate their results.

This is the initial stage of Higher school education, which provides cognitive motivation and interests of students, readiness and ability to cooperate and work together with a teacher and fellow students, forms the foundations of moral behavior that determine a person's relationship with society and people around him.

Currently, the Russian methodological literature offers innovative developments of lessons on the study of the subject of mathematical analysis, multimedia presentations, textbooks in mathematics. However, in our opinion, these sources are not presented systematically, as a rule, the scope of their application is not extensive. In this regard, there is an indisputable need to generalize the best pedagogical experience associated with teaching the subject of mathematical analysis by the design method.

One of the ways to comprehensively solve the problems of modern higher school education is the ability to determine the purpose of project work and plan ways to achieve it, analyze and evaluate the results, which will allow students to form the ability to carry out project research activities.

This method contributes to the formation of the following skills in students (design and research activities): preparation of a work plan for the implementation of the project, distribution by groups, distribution of roles within the group, determination of project deadlines, determination of materials, data necessary for the implementation of the project, and determination of their origin, generalization of the information received, presentation of the result of the work performed.

DISCUSSION

Over the past ten years, the design method that forms the design and research activities of students has become the subject of numerous studies as a general pedagogical technology.

Pakhomova N.Yu. [1], Polat E. S.[2], Chechel I. D.[3], Zair Bek E. S. [4], Sergeev I. S.[5], Alekseev N. G. [6] revealed the pedagogical potential of students' project activities; G. V. Narykova[7], A.M. Vasileva[8], T. K. Smykovskaya[9], V. V. Serikov [10], Yu. V. Gromyko [11] described the stages of the educational project, the role of the teacher in each of them; I. D. Chechel, I. A. Kolesnikova [12] proposed various approaches to evaluating project activities. Finally, E. S. Polat, N.A.Masyukova[13], E. S. Bulycheva[14], Z. V. Toropova[15] examined the features of project activity in mathematics lessons.

The analysis of the state of practice of the higher school of the formation of students' design and research activities, including when studying the subject of mathematical analysis, allows us to conclude that modern Higher School as a technology of personality-oriented learning does not fully realize the pedagogical potential of the design method.

Currently, new pedagogical technologies are being introduced into the educational activities of higher schools, active teaching methods are being used, including project methods. O. V. Zadorozhnaya [16] believes that Higher School faces new challenges. The teacher should create an environment that encourages students to independently produce, process, exchange information, as well as move quickly and freely in the surrounding information space. Conditions should be created for students to promote their development in various subjects, but at the same time it is necessary to reduce the burden on students. To accomplish these tasks, it is necessary to make the learning process more interesting, to reveal the importance of the knowledge gained in Higher Education and their practical application in life.

I. A. Kolesnikova, M. P. Gorchakova-Sibirskaya [17] in accordance with the requirements of the new paradigm of education, the main task of the school is to prepare an educated, creative person capable of continuous development and self-education. This includes the search for new forms and methods of teaching, updating the content of education, including the use of developmental learning methods along with traditional methods and, above all, the design method.

The design method has a long history. Over time, the idea of the design method changed, N. G. Alekseev noted [18]. From the free educational component, it becomes an important part of a fully developed and structured educational system. In modern pedagogy, the design method is considered as one of the technologies of personality-oriented learning, combining a problem approach, group methods, reflexive, presentative, research, search and other methods.

The design method contributes to the development of the student's independence, all areas of his personality, ensures the subjectivity of the student in the educational process.Therefore, learning by the design method can be considered as a means of activating the cognitive activity of students, a means of improving the quality of the educational process.

The results obtained

Thus, today the design method is understood not only as one of the ways of organizing the interrelated activities of a teacher and a student ("teaching method"), but also as a single "pedagogical technology:

a) assumes the possibility of changing means and methods in order to set diagnostic goals, planning and designing the educational process, step-by-step diagnostics, correction of results;

V. V. Guzeev[19] noted that the learning technology based on the design method is one of the possible methods of problem-based learning. According to the author, the essence of this technology is as follows: the teacher sets a learning task for students, thereby providing initial data and describing the planned results. Students do everything else on their own: they set intermediate tasks, look for ways to solve them, act, compare the result with the desired one, adjust the action.

The same opinion is shared by Pakhomova N. Y. T. I. Dolgodvorova [20] considers the design method as a system-forming component in the description of various technologies. He suggests this method as follows:

a variant of the technology of problem-based learning; a comprehensive learning method that allows individualizing the learning process, allowing the student to exercise independence in planning, organizing and controlling their activities; a method of group learning; technology of alternative free labor; technology of developmental learning aimed at developing creative qualities of the individual; technology of self-development.

The methodological and pedagogical literature contains enough information about the design method, but the possibility of its implementation in the process of teaching the subject of mathematical analysis is given only by some authors.

E. S. Polat identifies the following requirements:

1. the presence of an important issue (task) in terms of search, requiring integrated knowledge, research work to solve it;

2. practical, theoretical, cognitive significance of predictive results;

3. independent (individual, pair, group) activity of students;

4. structuring the substantive part of the project (indicating the phased results);

5. application of research methods involving a certain sequence of actions: identification of the problem and the research tasks arising from it (using the method of "brainstorming", "round table" in the course of joint research); hypotheses and their solution; discussion of research methods (statistical methods, experimental, observations, etc.); discussion of ways to design the final results (presentations, defense, creative reports, views etc.); collection, systematization and analysis of the received data; summing up, registration of results, their presentation; conclusions, presentation of new research problems.

Some authors consider the classification of educational projects. V. G. Sotnik [21] considers three groups of educational projects.

"Game projects" are children's activities aimed at participating in group activities (various games, folk dances, dramatic performances, various entertainments, etc.).

"Excursion projects", for a reasonable study of issues related to the surrounding nature and social life.

"Narrative projects", developing them, children enjoyed stories in various forms - oral, written, vocal, artistic, musical.

Currently, there are many classifications of educational projects in the literature for various reasons.

There are various ways to describe the organization of work in projects. But many authors (R. Ibragimov, A.Karataev, B. T. Kalimbetov, T. Kerimbetov [22]) consider it important to describe the activities of the teacher and students at each stage of the organization of project activities. As a result, project work should be organized in accordance with their content.

So, the mathematical analysis of the design method in the study of the discipline is advisable to carry out the following stages in accordance with the content of the design work.

I. Planning

It is recommended to start working on the project by discussing the topic of the future project. In addition, as noted above, there is an exchange of views between the participants of the project activity, the first hypotheses are put forward, and only after that the project topics proposed by the students are put up for discussion. Initial objectives of the exchange of views:

1. stimulating the flow of ideas. The brainstorming method is important for stimulating the flow of ideas. The teacher should, if possible, refuse to comment, write down ideas on the blackboard, the direction of work on their pronunciation, as well as the objections of students. The teacher presents the students with an educational problem leading to a problem situation, the solution of which is important for a certain group of people, thereby stimulating project activity. Drawings, diagrams, posters and other types of visual aids will be appropriate here. At the next stage, students highlight the problem, the teacher helps them with leading questions and tries to find possible solutions to this problem. When such methods are sufficient to solve the problem, the teacher suggests analyzing each of the ideas.

2. determination of the general direction of research work. When determining all possible areas of research, the teacher invites students to express their point of view on each of them. Then the teacher invites students to work in the most successful areas; determines the deadlines necessary to achieve the final result; helps students formulate 5-6 interrelated subtopics.

The teacher should come up with an option for the audience to combine subtopics divided into a single project (parallels, several parallels, etc.). Each participant of the project chooses a subtitle for future research, only then the research work will be the most interesting for him. Thus, groups are created that work with a single subtitle. The task of the teacher at this stage is to ensure that students with different levels of knowledge, creative potential, different inclinations and interests work in each created group.

Further, students together with teachers determine the potential of each of them (communicative, artistic, journalistic, organizational, sports, etc.). The teacher should work so that everyone can express themselves and earn the recognition of others. You should also choose consultants, that is, leaders who help research groups solve certain problems at certain stages of work.

For the successful organization of this stage, the teacher is recommended: to prepare a problem task that encourages students to discuss; to consider possible ways and means of motivating students (practical tasks, visual aids, etc.), to think through questions that encourage students to a new idea necessary for the implementation of the project.

The teacher should also familiarize students with the conditions of work in the project (the number of people in the group, the timing of the project); if a large number of people are involved in the work on the project, then it is necessary to think over and organize several areas of work, defining the area of consideration for each of them. Some methodologists recommend starting a project log to record activities, deadlines for certain activities, emerging issues, difficulties, comments. At the same time, the teacher acts as a consultant and mentor for students.

II. Analytical Stage

This stage of independent research, extraction and analysis of information, during which each student, based on the overall goal of the project and the task of his group, clarifies and formulates his task, in particular, searches for and collects information:

- his own experience; -the result of information exchange with other students with teachers, parents, consultants, etc.;- data from specialized literature, the Internet, etc.;

Also analyzes and interprets the received data.

At this stage, the team members must agree on the distribution of work and forms of control over the project. Each student can keep a "personal journal" in which he records the progress of work. You can keep a general log for all project participants. This helps the teacher (and the student himself) to evaluate everyone's personal contribution to the work of the project, as well as to facilitate control. We believe that keeping a personal journal for a student is not mandatory due to certain circumstances.The following sequence of works is proposed:

1. Clarify and formulate the tasks (content of the project work). The correct formulation of the project task (i.e. the task being solved) determines the effectiveness of the group. The teacher's help is needed here. Firstly, the members of each group exchange their existing knowledge on their chosen field of work, as well as thoughts on what, in their opinion, they still need to know, study, understand. Then the teacher leads the students to the formulation of the task with the help of problematic questions. If students clearly know the solution of the task and easily answer the teacher's questions, the tasks for the group are set incorrectly, since they do not meet the main goal of the project – teaching independent work and research activities.

When working on a project, the teacher must ensure that each group and each of its members have a clear understanding of their responsibilities, so it is recommended to create a stand on which the general topics of the project, the tasks of each group, lists of team members, consultants, responsible persons, etc. will be posted.

2. Search and collection of information. Here students determine where and what data they need to find. Then the data collection and selection of the necessary information begins directly. This process can be carried out in various ways, the choice of which depends on the time allotted for a certain period, the material base and the availability of consultants. Students (with the help of training) choose a method of collecting information: observation, survey, sociological survey, interview, conducting experiments, working with the media, literature. The task of the teacher is, if necessary, to advise on the methodology of this type of work. Here, special attention should be paid to teaching students the skills of the abstract. At this stage, students acquire the skills of comparison, classification of information; establishing connections and creating similarities; analysis and synthesis; teamwork, coordination of different points of view:

- individual observations and experiments;

- communication with other people (meetings, interviews, surveys);

- work with literature and mass media.

The teacher monitors the progress of the study, compliance with the goals and objectives of the project; provides the necessary assistance to groups, preventing the passivity of individual participants; summarizes the intermediate results of the study to summarize the results at the last stage.

3. processing of the received information. A prerequisite for successful work with information is a clear understanding by each student of the purpose of the work and the criteria for choosing information. The task of the teacher is to help the group determine these criteria. Processing of the received information is its understanding, comparison, selection of the most important for the task. Students will need the ability to explain facts, draw conclusions, and form their own opinion. It is this stage that is the most difficult for students, especially if they are used to finding ready-made answers to all the teacher's questions in books.

4. The stage of generalization of information. At this stage, the information received is structured and the knowledge and skills acquired are combined. At the same time, students: systematize the data obtained; combine into a single whole the information received by each group; make up a common logical scheme of conclusions for summing up. (These are: conducting abstracts, reports, conferences, showing videos, performances; publishing wall newspapers, high school magazines, online presentation, etc.).

The teacher should ensure that students exchange knowledge and skills acquired in the course of various types of work, information (questionnaire and processing of knowledge, sociological survey, interview, experimental work, etc.). All necessary actions at this stage should be aimed at summarizing information, conclusions and ideas of each group. Students should know the order, forms and generally accepted norms for the presentation of the information received (correctly make a synopsis, summary, abstract, the order of presentation at the conference, etc.). At this stage, the teacher should provide students with maximum independence in choosing the forms of presentation of project results, support those who allow each student to unleash their creative potential. If students are experiencing difficulties in the process of solving any problem, the teacher should come to their aid, but only at the personal invitation of the students. Without their consent, one should not interfere in the process of their creative research. In addition, it is important to remember that you cannot let go of everything on your own, allow spontaneous independence. The process of summarizing information is important because each of the project participants "passes through" the knowledge and skills acquired by the whole group, since in any case he must participate in the presentation of the project results.

5. Presentation of the results of the work (presentation). This ends with student accountability by ordering the collected data determined at the last stage.For the successful organization of project activities, the teacher must fully study the essence of the design method, stages, principles of working with it: criteria for evaluating project work and know what knowledge and skills are formed by participants in such activities.

We noticed the importance of the following project works, organizing the project activities of students, conducted in sections corresponding to the discipline of mathematical analysis.

1-project work. Numerical sets

1. Write down the Peano axiom for natural numbers, give examples to it.

2. specify the axiomatic structure of integers.

3. write the axiomatics of rational numbers.

4. Write down the Axomatics of real numbers.

Problematic tasks:

1.1/4 for an ordinary fraction of 0.25 (or 0.2500 ...) the limit decimal fraction corresponds to. This number is 0.2499...It is worth noting that the infinite decimal fraction, 0, 24 (9), corresponds to.

2 .2,142857142857 per digit 15/7 ..., i.e. 2, corresponds to an infinite decimal fraction (142857).

3.the number 5/6 corresponds to 0.833, i.e. 0.8 (3) infinite decimal fraction.

When converting any periodic decimal fraction to a simple fraction, the following two rules apply.

A) if the period of the decimal fraction begins immediately after the integer part of the fraction (i.e., the pure periodic fraction), then the fraction part is replaced by a fraction whose numerator is the period whose numerator is the period whose denominator is the decimal fraction containing as many digits as in the period of the decimal fraction.

B) if after the integer part of the decimal fraction there are other digits before the period of the fraction (i.e. a mixed periodic fraction), then the fraction part consists of the difference between the number up to the second period after the decimal point and the number up to the first period after the decimal point, the numerator of which consists of the number of digits before the period, the same number before the first period after the decimal point is replaced a fraction containing as many zeros as digits.

Examples

1. 2,142 857...=2,(142857)=$2\frac{142857}{999999} - 2\frac{1}{7} = \frac{15}{7}$

2. 2,12141414.....=2,12(14) =$2\frac{1214-12}{9900} = 2\frac{1202}{9900} = 2\frac{601}{4950}$

Therefore, each rational number corresponds to a pure or mixed periodic fraction (sometimes this fraction can only end in zeros or nines) and vice versa, and each periodic decimal number corresponds to a rational number.

Thus, a rational number is a periodic Decimal Fraction.

From the above, we can see that all Infinite tens without periods are a number other than rational numbers. Such numbers are called irrational numbers.

2. what two rules apply when converting any periodic decimal to a prime fraction? Write down these rules and give an example.

3. is the phrase"rational number - periodic Decimal Fraction" correct?

Is the phrase" decimals without dots - irrational numbers " correct?

2-Design work

Design work topic: proportion and proportional dependence

Design work purpose: to teach students the concepts of proportion and proportional dependence.

Theoretical questions:

Ratio and proportion.

The main property of proportion.

Proportional dependence of quantities.

Proportional distribution.

Definition: the division that comes out when dividing one number by another is called the ratio of these numbers. For example: 14: 7 is called the ratio of fourteen to seven.

Definition: proportion refers to two equal relations that are continued by the sign of equality. For example: 14:7=30:15

The main property of the proportion is thatthe majority of the extreme terms of the proportion are equal to the product of its Middle terms, that is, if a/b=c / d, then

will Vs=ad.

For example, if $\frac{3}{4} = \frac{15}{20}$, then 3x20=4 x15.

Example 1 let the number 90 be classified into three connectors in proportion to the numbers 1,2,3.

Solve. 1+2+3=6 90:6=15 15x1=15, 15x2=30, 15x3=45 in glass

15:30:45=1:2:3 and 15+30+45 = 90.

Example 2 the number 30 must be inversely proportional to the numbers 1 and 1/2 and divided into two connectors.

Solution: we divide the number 30 in direct proportion to the number 1 and 2 $\frac{30}{1+2} = 10$

10x1=10 10x2=20 10: 20=1:2

3-Design work

Some ways to calculate the function limit

Design work is carried out by dividing the group into 3-4 subgroups.Each group is assigned a head who manages the design work. Each manager is given problematic tasks, reports, and questions of different content. The final result is a generalization of all the formulas for the limits of the function considered in high school. Presentations on the limits of functions are prepared. The group leaders will be replaced, and the defense of these presentations will be organized with new leaders.

Design topic: some ways to calculate the function limit. Comparison of finite small and finite large

Design goal: to master various ways to calculate the function limit. The ability to compare finite small and finite large.

Problem tasks:

Study of theoretical material.

1.What is the function limit?

2. show applied examples of the concepts of finite small and finite large;

3. simple characteristics of digital circuits:

a) shelled and non-shelled chains ;

B) What types of digital circuits do you know?

C) do the concepts of being periodic or non-periodic for a chain make sense?

d) give an example to find the limit of a function;

4. What do you need to know to determine the function limit?

A) explain the meaning of the definition of the function limit in the language.

B) what is the limit of a digital circuit?

5. What are finite small and finite large chains?

6.learn the structure of definitions of finite small and finite large chains.

7.theorems on the limits of a numerical sequence.

8. What is the transition to the limit in inequalities?

9.state the ways in which the digital circuit is transmitted.

Problem tasks that meet the level of practical significance and calculation.

1. prove the following equality:

1) $\lim\limits_{x\to\infty}(1+\frac{1}{x})^{x}=e$

2) $\lim\limits_{x\to 0}(1+x)^{\frac{1}{x}}=e$

3) $\lim\limits_{x\to 0}\frac{log_a(x+1)}{x}=lg_a e$, $\lim\limits_{x\to 0}\frac{ln1+x}{x}=1$

4) $\lim\limits_{x\to 0}\frac{a^x-1}{x}=lna$

5) $\lim\limits_{x\to 0}\frac{sinx}{x}=1$

2. 6) $\lim\limits_{x\to 0}\frac{(1+x)^m-1}{x}=m$

2.Mutual comparison of finite small and finite large.

$\alpha=\alpha(x)$, $\beta=\beta(x)$ functions $x\to 0$ - let there be finite little ones in the:

$x\to\infty$ for $\frac{1}{x}\to 0$,$a>0$ and $a\neq 1$

Where a -the number, $-\infty$, $+\infty$, will be.

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4-Design work.

Design work is carried out by dividing the group into 5-6 subgroups.Each group is assigned a head who manages the design work. Each manager is given problematic tasks, reports, and questions of different content. The end result is an analysis of all the relationships of limits according to the themes of progressions considered in high school. It is planned to prepare reports on the topics:" finding the sum of progressions and relationships between the limits of functions "and" the use of limits in finding the sum of arithmetic progressions".Protection of reports(Group leaders are replaced and new leaders are organized).

Design topic: calculation of the sum of the members of the arithmetic progression in the margin allowance.

Design goal: applying limits to find the sum of arithmetic progressions

1. study of theoretical materials.

1. What is Arithmetic Progression?

2. Write down the formula for finding the general term of the arithmetic progression;

3. Write down the formula for finding the sum of the members of the arithmetic progression;

4. give the characteristics of progressions:

a) finding the sum of the terms of arithmetic and geometric progressions;

B) finding the sum of the terms of an infinitely small geometric progression.

5.write down the appropriate formulas for Geometric progressions.

a) write down numerical sequences that are examples of geometric progressions.

b) find a multiple of geometric progression, give examples of finding the difference of arithmetic progression; write down the formula for finding their general term?

1. extract from the implementation of the design work:

$a_n = a_1 + d(n-1),\quad S_n = \frac{1}{2}(a_1 + a_n)\cdot n,$ here a_n – General member, $S_n - n$- independent sum, - first member,- difference, - number of the resulting member.

1. Write the formula for the general term of the geometric progression:

a) $a_n = a_1 q^{n-1},\quad S_n = \frac{a_1 + a_n q}{1-q}$ a_n– General member a_1- first member $S_n - n$ - independent sum, q multiple of progression, $n \to \infty,\quad q < 1,\quad S = \frac{a_1}{1-q}.$

5. the following chains should be given by describing them in words:

а) $2, 3, 5, 7, 11, ...$
б) $2; 2,2; 2,23; 2,236; 2,2361;$

6. $\left\{\frac{n-1}{n+1}\right\}$ the sequence converges and its limit is 1. Check if the limit definition is met.

Attention is paid to the implementation of the following tasks by students:

Example 1. Determine the sum of the terms of an infinite exponential geometric progression: $\frac{1}{3} + \frac{1}{6} + \frac{1}{12} + ... + \frac{1}{3\cdot 2^{n-1}} = \sum_{n=1}^{\infty} \frac{1}{3\cdot 2^{\to n-1}}$

Solution: Here $a_1 = \frac{1}{3}, a_n = \frac{1}{3\cdot 2^{n-1}}, q = \frac{1}{2},$ therefore $q < 1,$ $S_n = \frac{\frac{1}{3}}{1-\frac{1}{2}} = \frac{1}{3}\cdot$

Determine the sum of the following series:

$$1.\frac{1}{1\cdot 3}+\frac{1}{2\cdot 4}+\frac{1}{3\cdot 5}+\cdots+\frac{1}{n(n+2)}+\cdots\ \sum_{n=1}^{\infty}\frac{1}{n(n+2)}$$

Solution: we use the method of mathematical induction:

$$S_n=\frac{1}{2}\left\{\frac{1}{1}-\frac{1}{3}+\frac{1}{2}-\frac{1}{4}+\frac{1}{3}-\frac{1}{5}+\frac{1}{4}-\frac{1}{6}+\frac{1}{5}-\frac{1}{7}+...+\frac{1}{n-1}-\frac{1}{n+1}+\frac{1}{n}-\frac{1}{n+2}\right\}=$$

$$=\frac{1}{2}\left\{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+...+\frac{1}{n}\right\}-\frac{1}{2}\left\{\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+...+\frac{1}{n}+\frac{1}{n+1}+\frac{1}{n+2}\right\}=$$

$$=\frac{1}{2}\left\{1+\frac{1}{2}+\frac{1}{n+1}+\frac{1}{n+2}\right\};\quad S=\lim_{x\to\infty}\frac{1}{2}\left\{1+\frac{1}{2}+\frac{1}{n+1}+\frac{1}{n+2}\right\}=\frac{3}{4}$$

2. Find the sums below:

$$1.\frac{1}{1\cdot 3}+\frac{1}{3\cdot 5}+\frac{1}{5\cdot 7}+\cdots+\frac{1}{(2n-1)(2n+1)}+\cdots=\sum_{n=1}^{\infty}\frac{1}{(2n-1)(2n+1)}$$

2. $\frac{3}{1^2\cdot 2^2}+\frac{5}{2^2\cdot 3^2}+...+\frac{2n+1}{n^2\cdot(n+1)^2}+...=\sum_{n=1}^{\infty}\frac{2n+1}{n^2\cdot(n+1)^2}$

3. $1+\frac{1}{2}-\frac{1}{4}-\frac{1}{8}-...-+\frac{1}{2^n}-...=\sum_{n=1}^{\infty}\frac{1}{2^n}$

A necessary condition for accumulation If the number series is convergent, then $n\to\infty,\ a_n\to 0$

$\lim_{n\to\infty}a_n=0.$

If $\lim_{x\to+\infty}a_n\neq 0$ if, then the number series converges.

In the following series, check that the necessary condition for accumulation is met:

1. $\sum_{n=1}^{\infty}\cos\frac{1}{n}$; 5. $\sum_{n=1}^{\infty}\frac{n}{(n+1)^3}$; 6. $\sum_{n=1}^{\infty}n\cdot arctg\frac{1}{n}$; 7. $\sum_{n=1}^{\infty}\frac{n^2+1}{n^2}$.

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5-Design work

It was compiled for all members of the student group in order to familiarize them with the practical application of the theory of limits. In the course of this work, students recall the initial concepts of the theory of limits learned in high school and independently analyze the data on the increment of the function and the increment of the argument. The final result is supposed to be completed by writing a mathematical essay.

Preparatory design work on the topic of the work.

Design topic: finding the speed of rectilinear uniform movement of a body.

Design goal: solving applied problems for the calculation of limits.

Design content: tasks of the following practical content are submitted to the entire group of students for independent solution:

The rectilinear uniform motion of a point is given by the equation, where it is given in the calculation of seconds and in the calculation of meters. Find the speed of the point movement in moments of seconds.

Expected result: finding the speed of the point.

Example 1. the analysis of students can be as follows:

1) we find the average speed of Point Movement.
2) I. $S+\Delta S=3(t+\Delta t)^2-2(t+\Delta t)+5=3t^2+6t\cdot\Delta t+3(\Delta t)^2-2t-2\Delta t+5$
3) II. $(S+\Delta S)$-тен (S)- we reduce from:
4) $\Delta S=6t\cdot\Delta t+3(\Delta t)^2-2(\Delta t)$
5) III. $\frac{\Delta S}{\Delta t}$ we find the relationship:
6) $\frac{\Delta S}{\Delta t}=\frac{6t\cdot\Delta t+3(\Delta t)^2-2(\Delta t)}{(\Delta t)}=6t+3(\Delta t)-2$

2) we find the actual speed of the point movement at the moment of time:

IV. $\upsilon=\lim\limits_{\Delta t\to 0}\frac{\Delta S}{\Delta t}=\lim\limits_{\Delta t\to 0}\left(6t+3(\Delta t)-2\right)=6t-2$

3) 5 sec of Point torque. we find the speed at the end:

$$\upsilon_{t=5} = 6 \cdot 5 - 2 = 28$$

Example 2.a straight-line uniform movement of a point is given by the equation (in the calculation of seconds, in the calculation of meters). Find the speed of the point movement in 10 seconds.

Example 3.the rectilinear motion of a point is $S = 5t^2$ given by the equation. find (in t seconds,S meters) the speed of the movement of a point in 8 seconds.

Example 4.a point $S = 2t^3 + t^2 - 4$ is moving in a straight line with a pattern. $t = 4$ find the speed and acceleration in seconds of torque.

Resolution:

we find the t speed of movement of a point at any given time:

$$\upsilon = \frac{dS}{dt} = 6t^2 + 2t$$

1. we find $t = 4$ the speed of movement of a point in seconds:
2. $\upsilon_{t=4} = 6 \cdot 4^2 + 2 \cdot 4 = 104$ (m/sec)
3. 3. we find the acceleration of the point action at any given t time:

$$a = \frac{d\upsilon}{dt} = 12t + 2$$

4. we find $t = 4$ the acceleration of movement of a point in moments of seconds:

$$a_{t=4} = 12 \cdot 4 + 2 = 50 \text{ (m/sec)}$$

Example 5. $3S + 5t^3 - 2 = 0$ the movement of a point is given by the equation. $t = 4$ find the speed and acceleration in seconds.

Resolution:

$$3S = 2 - 5t^3 \quad S = \frac{2}{3} - \frac{5}{3}t^3$$

1) $S + \Delta S = \frac{2}{3} - \frac{5}{3}\left(t + \Delta t\right)^3 = \frac{2}{3} - \frac{5}{3}\left[t^3 + 3t^2 \cdot \Delta t + 3t\left(\Delta t\right)^2 + \left(\Delta t\right)^2\right]$

2) $\left(S + \Delta S\right)$-тен S-ті азайтсақ

$$\Delta S = -5t^2 \cdot \Delta t - 5t\left(\Delta t\right)^2 - 5\left(\Delta t\right)^3$$

3) $\frac{\Delta S}{\Delta t}$ қатынасты тапсақ: $\frac{\Delta S}{\Delta t} = -5t^2 - 5t \cdot \Delta t - 5\left(\Delta t\right)^2$

4) $\lim\limits_{\Delta t \to 0} \frac{\Delta S}{\Delta t} = \lim\limits_{\Delta t \to 0}\left[-5t^2 - 5t \cdot \Delta t - 5\left(\Delta t\right)^2\right] = -5t^2$

If so, $y' = -5t^2$ it turns out.

5) $t = 4$ speed in seconds:

$y'/_{t=4} = -5 \cdot (4)^2 = -80$ m/sec

6)we calculate the acceleration $y'' = -10t$

7) $t = 4$ we find the acceleration in seconds.

$y''_{t=4} = -10 \cdot 4 = -40$ m/sec

Questions:

1) $3y + 5x^2 - 2 = 0$, $25 = 41t^2 - 5$ what can be done to find the derivative of linear functions?

2) give (summarize) formulas for finding the derivative of trigonometric functions.

3) the speed of rectilinear movement of the body $\upsilon = 3t^2 - 2t$ given by the equation.S find the equation of the line.

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6-design work

Theme of the project work: functional circuits and series.

The purpose of the project work: to teach the study of the convergence of functional series. Present in the form of tasks that students should learn independently.

Content of project work:

Students independently search for answers to the following questions and compose design works to issue them definitions, rules, etc.

Problematic questions:

1. What is the functional series?
2.give a definition of the compactness of a functional series.
3.the area of convergence of the functional series.
4.convergence interval of a functional series.
5.determination of the functional chain.
6.name the terms of convergence of the functional chain.
7.Weierstrass sign.

Extract from the execution of project work.

A functional series is a series whose members are compiled from functions:

$$u_1(x) + u_2(x) + \ldots + u_n(x) + \ldots = \sum_{n=1}^{\infty} u_n(x).$$

The convergence of functional series is formulated as follows:

any numerical x_0 value is converted $u_n\left(x_0\right)$ to a number, so the functional series becomes a numerical series, and the convergence at the point is studied by the signs of the convergence of the numerical series.

Definition 1.the area X of convergence of a functional series is called the sum of all the elements of a series.

If the members of the functional series are defined at one known interval, then the definition below is accepted.

Definition 2.if a (a,b) function series is summed as a numerical series at each point in the interval, it is said to be an Convergence series of an intermediate function series.

Independent (a,b) sums of the interval of a functional series give a functional sequence.

$$S_1(x)=u_1(x),\ S_2(x)=u_1(x)+u_2(x)...,\ S_n(x)=\sum_{n=1}^{\infty}u_n(x).$$

Definition 3. (a,b) we say that a sequence $\sum_{n=1}^{\infty}u_n(x)$ of functions converges in the interval if a number converges x – as a sequence in each value of the interval.

If all $\lim_{n\to\infty}S_n(x)=S(x)$,

$S(x)$- $\sum_{n=1}^{\infty}u_n(x)$ a function is called a limit function of a sequence, and it is equal to the sum of the functions: $\sum_{n=1}^{\infty}u_n(x)=S(x)$

Example. $[0,1]$ given a functional series on the segment: $\sum_{n=1}^{\infty}\frac{1}{x+n}$

Define a function sequence and a limit function.

Solution:1) $n=1,2,...$ when the function chain is written as:

$$\frac{1}{x+1},\frac{1}{x+2},...,\frac{1}{x+n},\ S_n(x)=\sum_{n=1}^{\infty}\frac{1}{x+n}.$$

2) The Limit function is found from the above expression.

$$S(x)=\lim_{n\to\infty}S_n(x)=\sum_{n=1}^{\infty}\frac{1}{x+\infty}=0,\ S(x)=0.$$

Definition 4. (a,b) the sequence $S_n(x)$ of functions in $S(x)$ the interval is summed up in the limit function uniformly, if the $\varepsilon > 0$ following condition is met for $n \geq N(x)$ $x \in (a,\mathrm{b})$ any number of intervals $\left|S_n(x) - S(x)\right| < \varepsilon.$

this is called the condition of one normal accumulation.

Let's copy this condition as: $S(x) - \varepsilon < S_n(x) < S(x) + \varepsilon, \quad (n = 1,2,...)$

If the function sequence converges uniformly to the limit function between, then the sequence is located between and.

Definition 5. $S_n(x)$ if the function (a,b) sequence converges $S(x)$ uniformly to the limit function, then $S_n(x)$ the function series converges uniformly $\left[S(x) - \varepsilon\right]$ and $\left[S(x) + \varepsilon\right]$ at this interval.

Theorem 1. (Weierstrass sign). Let be given $\sum_{n=1}^{\infty} u_n(x)$ (a,b) between the functional series. If a positive-digit cumulative series is found $\sum_{n=1}^{\infty} b_n(x)$, the condition is $\left|u_n(x) \leq \right| b_n, \quad n = 1,2,3,...$

if it is done, $\sum_{n=1}^{\infty} u_n(x)$ then the series converges in a uniform and absolute form, and is $\sum_{n=1}^{\infty} b_n$ called majoranta.

Example. Prove a uniform convergence of a series $\sum_{n=1}^{\infty} \frac{\sin nx}{n^2}$.

Solution: in Tin, $\left|\sin nx\right| \leq 1,$ therefore, $\sum_{n=1}^{\infty} \frac{1}{n^2}$ as a major (it is a set) and $\sum_{n=1}^{\infty} \left|\frac{\sin nx}{n^2}\right| < \sum_{n=1}^{\infty} \frac{1}{n^1}$, according to theorem 1, $(-\infty, \infty)$ a series is a uniform set.

Determine the area of convergence of the series in the problem below:

1. $\sum_{n=1}^{\infty} e^{-nx}$. solution: we use Cauchy notation

$$\lim_{n\to\infty}\sqrt[n]{e^{-nx}} = e^{-x} = \begin{cases} <1, & \textit{егер} \quad x>0, \quad \textit{жинакталады}; \\ >1, & \textit{егер} \quad x<0, \quad \textit{жинакталмайды}; \end{cases}$$

$x=0$ at a point, $1+1+\ldots+1+\ldots$ a row becomes a numerical series that does not converge, so the convergence zone $\left(0<x<+\infty\right)$.

2. $\sum_{n=1}^{\infty}\frac{1}{n}\left(\frac{|x|}{x}\right)^n$. Solution: the members of the function series are not defined at the $x=0$ point, and are defined at the remaining points and are.

If, $x<0$ then $\frac{|x|}{x}=\frac{-x}{x}=-1,$ so in x –reverse characters:

$$\sum_{n=1}^{\infty}\frac{1}{n}\left(\frac{|x|}{x}\right)^n = \sum_{n=1}^{\infty}(-1)^n\frac{1}{n}.$$

Converges under the sign of Leibniz.

If $x>0,$ there $\frac{|x|}{x}=\frac{x}{x}=1,$ are also positive characters:

$$\sum_{n=1}^{\infty}\frac{1}{n}\left(\frac{|x|}{x}\right)^n = \sum_{n=1}^{\infty}\frac{1}{n}.$$

The harmonic series does not converge, so the conditional convergence zone $\left(-\infty,0\right)$.

2. solution: by the Cauchy sign

3. $\lim_{n\to\infty}\sqrt[n]{\left(3-x^2\right)^n} = \lim_{n\to\infty}\left(3-x^2\right) = 3-x^2<1, \quad 3-x^2<1, \quad 2<x^2, \quad \pm\sqrt{2}<x,$

$\left(-2,-\sqrt{2}\right) \quad \left(2,\sqrt{2}\right).$

4. $\sum_{n=1}^{\infty}\frac{1}{x^n};$ 5. $\sum_{n=1}^{\infty}\ln^2 x;$ 6. $\sum_{n=1}^{\infty}\left(2-x^2\right)^n;$

7. $\sum_{n=1}^{\infty}\left[\frac{x\left(x+n\right)}{n}\right]^n;$ 8. $\sum_{n=1}^{\infty}\frac{1}{x^n+1}.$

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