

Ministry of Education and Science of the Republic of Kazakhstan

Karaganda State Technical University

**Confirmed by
Chairman of the Academic
Council,
rector, RK NAS academician
Gazaliyev A.M.**

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Syllabus

Course Mat (I) 1204 «Mathematic I»

Module Mat (I) 15 «Mathematic I »

Major 5B073000 «Production of building materials, components and structures»

Institute of Architecture and Construction

Department of Higher Mathematics

Preface

Syllabus is worked out by cand. of Sc., senior tutor L.M. Mustafina, cand. of Sc., senior tutor G.A. Abdygalikova, cand. of Sc., senior tutor G.S. Shaihova.

Discussed at the meeting of the department «Higher Mathematics»
Minutes № _____ of _____ «____» 20____
Head of department _____ «____» 20____
(signature)

Approved by the Educational Council of the Transport and Road Institute
Minutes № _____ of _____ «____» 20____
Chairman _____ «____» 20____
(signature)

Agreed with department _____
(name of department)
Head of department _____ «____» 20____
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Tutor's personal data and contact information

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«Higher Mathematics» department is in the I building of KSTU, B. Mira, 56 room No.311, contact phone 56-59-32 add. 2008.

Course labour intensity

Term	Number of Credits	ESTC	Type of classes					number of AL	Total hours	Form of control
			number of contact hours			number of OH	total hours			
			Lectures	practical classes	laboratory classes					
1	3	5	15	30	-	45	90	45	135	Examination

Course description

Discipline "Mathematics I» part of a series of basic disciplines working curriculum specialty

Course purpose

Discipline "Mathematics I» is aimed at the acquisition of knowledge and understanding of basic concepts, laws, formulas, theories and methods of mathematical research.

Course objectives

As a result of studying of this Course student:
student knows: math course in the volume of this training program;
student is able: to apply advanced mathematical techniques to solve applied problems;
have skills: solving engineering problems using mathematical methods;
be competent: the choice of methods of mathematical modeling to solve specific engineering problems.

Student is able to use results of innovative researches for performance of individual tasks.

Prerequisites

To study the course "Mathematics I» Students need knowledge of the following subjects:

Discipline	Section (that)
1. Algebra (Secondary)	The full
2. Geometry (Secondary)	The full

Post requisites

The knowledge gained in the study of the subject "Mathematics I», used in the development of the following subjects: physics, theoretical mechanics and others.

Thematic plan of Course

Name of section (subject)	Labour intensity on types of classes				
	lectures	practical	laboratory	OH	AL
1 Elements of linear algebra	2	4	-	6	6
2 Vectors, operations on them	1	3	-	3	3
3 Limit of a function	2	3	-	6	6
4 The derivative of the function and its apps	3	6	-	9	9
5 The indefinite integral. The definite integral and its applications	3	6	-	9	9
6 Functions of several variables	1	2	-	3	3
7 Differential Equations	1	2	-	3	3
8 Theory of series	2	4	-	6	6
Total:	15	30	-	45	45

List of practical classes

1. Actions on matrices (addition of two matrices, matrix multiplication by a scalar, multiply two matrices, matrix transposition). Calculation determinants second, third and fourth orders in different ways.

2. Finding the inverse matrix for example, the dimension of the matrix and the Solving systems of linear equations of the matrix method.

3. Solving systems of linear equations by Cramer's rule. The study of systems of two and three linear equations in two and three unknowns, respectively. The solution of the homogeneous system of two linear equations with three unknowns.

4. Definition of rank of the matrix. Study of compatibility of a system of linear equations using the Kronecker - drops. Solving systems of linear equations by Gauss.

5. Survey lecture material number 3 (linear operations on vectors that are linearly independent system of vectors, basis, expansion of the vector in the basis, the scalar product). Analysis of common tasks.

6.7. Survey lecture material number 3 (definition of scalar, vector , mixed products of vectors and their properties). Analysis of common tasks.

8. Calculation limits sequences and functions. Finding limits by support limiting relations.

9. The survey on "Equivalent infinitesimal functions". Finding the limits of using equivalent infinitesimal functions.

10. Continuity of elementary functions. Determination of points of discontinuity and their classification.

11-12. Testing of technology differentiation, logarithmic derivative.

13. Finding the derivative of a function defined parametrically. Finding the derivative of implicit function. Finding the higher order derivatives of functions given explicitly, implicitly, parametrically. Finding the higher order derivatives product of two functions using the Leibniz formula.

14. Finding the tangent and normal to the graph of a function defined implicitly or parametrically. Finding the differential of the function. Finding the approximate values of the function by means of the differential. Finding the limit of a function by the rule of L'opital.

15. Finding a local extremum points. Finding the largest and smallest values of a function defined on an interval. Finding the points of inflection. Study the behavior of functions in a neighborhood with higher order derivatives.

16. To conduct a full investigation of the function and the construction timetable.

17. Finding the indefinite integral with the main table of integrals. Finding the indefinite integral by summing under the sign of the differential.

18. Finding the integral of a function containing quadratic polynomial. Integration by substitution variable. Integration by Parts.

19. Integration of rational functions. The integration of some irrational. The integration of trigonometric expressions.

20. The calculation of the definite integral using the Newton-Leibniz. Method of replacing a variable in the definite integral. The method of integration by parts integral.

21. Calculation of areas of plane figures by the definite integral. Finding the arc length of the curve.

22. Calculation of volumes of solids using the definite integral. The calculation of the surface areas of solids of revolution using the definite integral.

23. The domain of a function of two variables, the level curves of the two variables. Limit of a function of two variables. Repeated limit function of two variables. The continuity of the set of variables and the individual variables. Finding the partial derivatives of functions of two and three variables. Finding the differentials of the first and second order derivatives of functions of two variables, the application of a first-order differentials to approximate calculations.

24. Differentiation of a function. Tangent plane and normal to the surface. Extremum of a function of two variables. Finding the largest and smallest values of a function of two variables in a given set.

25.26. Differential equations with separated and the separation of variables. Homogeneous differential equation of the first order. Linear differential equations of the first order.

27. Finding the sum of the ranks. Analysis of the convergence of positive series by comparison theorems. Signs of D'alambert and Cauchy convergence of positive series.

28.29. Sign Leibniz convergence of alternating series. Estimate of the remainder in the ranks of Leibniz type. Using the necessary conditions for the convergence of numerical series to find the limits of sequences. The calculation of the radius of convergence of power series.

30. The definition of convergence of a power series. Finding the sum of a power series. The expansion of functions in power series. Approximate calculations based on the assessment of the accuracy of the expansion of functions in power series.

Thematic plan of office hours

OH theme	Objectives	Form of classes	Contents of classes	Recommended literature
Subject 1. Matrices and determinants	Study definitions and rules	Meeting the challenges	Individual homework nomer 1.1 and 1.2	1, 9, 11, 34, 35, 36
Subject 2. Solving systems of linear equations	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 1.3 and 1.4	1, 9, 11, 34, 35, 36
Subject 3. Vectors in the plane	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 2.1	1, 9, 11, 34, 35, 36
Subject 4. Vectors in space	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 2.2	1, 9, 11, 34, 35, 36
Subject 5. Technique for computing the limits	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 4.1	3, 5, 6, 7, 8, 10, 15, 16
Subject 6. Remarkable limits	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 4.2	3, 5, 6, 7, 8, 10, 15, 16
Subject 7. Technique for computing	Increasing	Meeting the	Individual	3, 5, 6, 7, 8,

derivatives	knowledge on this subject	challenges	homework nomer 5	10, 15, 16
Subject 8. Applications of derivatives	Increasing knowledge on this subject	Meeting the challenges	Settlement and graphics work number 1	3, 5, 6, 7, 8, 10, 15, 16
Subject 9. The calculation of the indefinite integral	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 6.1	3, 5, 6, 7, 8, 10, 15, 16
Subject 10. The integration of certain functions	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 6.2 and 6.3	3, 5, 6, 7, 8, 10, 15, 16
Subject 11. Definition and properties of the definite integral	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 7.1	3, 5, 6, 7, 8, 10, 15, 16
Subject 12. Applications of the definite integral	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 7.2	3, 5, 6, 7, 8, 10, 15, 16
Subject 3. Functions of several variables. Extremum of functions of several variables	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 1	1, 3, 6, 9, 14
Subject 14. Differential equations of the first order	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 2	1, 3, 6, 9, 14
Subject 15. Positive number series	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 3	1, 3, 6, 9, 14
Subject 16. Alternating number series	Increasing knowledge on this subject	Meeting the challenges	Individual homework nomer 4	1, 3, 6, 9, 14
Subject 17. Functional series. Power series	Increasing knowledge on this subject	Meeting the challenges	Settlement and graphics work number 2	1, 3, 6, 9, 14

Subjects of control tasks for AL

1. Individual homework nomer 1.1. Assignments 1, 2a, 2б [6, T.1, P. 32].
2. Individual homework nomer 1.2. Assignments 2в, 2г, 2д [6, T.1, P. 34, 41].
3. Individual homework nomer 1.3. Assignments 1a, 3, 4 [6, T.1, P. 41].
4. Individual homework nomer 1.4. Assignments 1в, 2в [6, T.1, P. 41].
5. Individual homework nomer 1.5. Assignments 2a, 2г, 3 [6, T.1, P. 67].
6. И Individual homework nomer 1.6. Assignments 1, 2б, 2в, 3 [6, T.1, P. 6];
Individual homework nomer 2.2. Assignments 1, 2, 3 [6, T.1, P.75].
7. Individual homework nomer 1.7. Assignments 1б, 1в, 1г, 3 [6, T.1, P. 97] .
8. Individual homework nomer 2.1. Assignments 1д, 1е, 1ж, 3 [6, T.1, P. 97].
9. Individual homework nomer 2.2. Estimated job on "The Limit of a function" [10, P. 6].

10. Individual homework number 2.3. Estimated job on "The Limit of a function" [10, P. 6].
11. Assignments 3, 4 [6, T. 1, P. 169 - 174]
- 12, 13. Individual homework number 3.1. Estimated job on "The derivative" [10, P. 23].
14. Estimated job on "The derivative" [10, P. 35, 37, 38].
15. Estimated job on "The derivative" [10, P. 25, 36]. Assignments 1, 2 [14].
16. Estimated job on "The derivative". [10, P. 26]. Assignments 3, 4, 5, 6. Settlement and graphics work number 1 [14].
- 17,18. Individual homework number 4.1. Assignments 1-14 [6, T.2, P. 43-53].
- 19,20. Individual homework number 4.2. Assignments 7-10 [6, T.2, P. 73-85].
- Individual homework number 8.3, Assignments 1-2 [6, T.2, P. 88-94].
- 21,22. Individual homework number 4.3 [6, T.2, P. 27].
23. Individual homework number 5.1. Assignments 5 - 8 [6, T.2, P. 100-103].
24. Individual homework number 5.2. Assignments 1 - 4 [6, T.2, P. 105-116].
25. Individual homework number 6.1. Assignments [6, T.2, P. 38-39].
26. Individual homework number 6.2. Assignments [6, T.2, P. 41-42].
- 27,28. Individual homework number 7.1. Assignments 1-4 [6, P. 188-206].
29. Individual homework number 7.2. Assignments 1-3 [8, P. 188-206].
30. Individual homework number 7.3. Assignments 21 [10, P. 67].

Criteria of students' knowledge assessment

The examination mark is determined by course as the sum of the maximum indexes of progress on midterm controls (to 60%) and to final attestation (examination) (to 40%) and makes value to 100% according to the table.

Grade on alphabetic system	Numerical equivalents	Percentage	Traditional system
A	4,0	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3,0	80-84	
B-	2,67	75-79	
C+	2,33	70-74	Satisfactory
C	2,0	65-69	
C-	1,67	60-64	
D+	1,33	55-59	
D-	1,0	50-54	
F	0	0-49	Unsatisfactory

Grade «A» (excellent) is put in the case if student during a term showed perfect knowledge of all program questions of course, and also of subjects of independent work, regularly handed over midterm tasks, showed independence in

studying of theoretical and applied questions according to the main program of studied course, and also on extra program questions.

Grade «A-» (excellent) stipulates perfect knowledge of basic laws and processes, concepts, ability to generalization of theoretical questions of course, regular handing of midterm tasks of classroom and independent work.

Grade "B+" (good) is put in the case if student showed good and excellent knowledge of course questions, regularly handed over term tasks generally on "excellent" and some on "good".

Grade "B" (good) is put in the case if student showed good knowledge of the questions opening the main maintenance of a concrete subject of course, and also subject of independent work, regularly handed over term tasks on "good" and "excellent".

Grade "B-" (good) is put to a student in the case if he well is guided in theoretical and applied questions of course both on classroom, and on AL subjects, but irregularly handed over midterm tasks and had cases of a repeating an examination of term tasks on course.

Grade "C+" (satisfactory) is put to a student in the case he owns questions of conceptual character by all types of room classes and AL, can open the maintenance of separate modules of course, hands over on "good" and "satisfactory" term tasks.

Grade "C" (satisfactory) is put to a student in the case he owns questions of conceptual character by all types of room classes and AL, can open the maintenance of separate modules of course, hands over on "satisfactory" term tasks.

Grade "C-" (satisfactory) is put to a student in the case student during a term regularly handed over term tasks, but concerning room classes and AL owns only the general concepts and can explain only separate regularities and their understanding within a concrete subject.

Grade "D+" (satisfactory) is put to a student in the case he irregularly handed over term tasks concerning room classes and AL owns only the general concepts and can explain only separate regularities and their understanding within a concrete subject.

Grade "D-" (satisfactory) is put to a student in the case he irregularly handed over term tasks, concerning room classes and AL, owns the minimum volume of knowledge, and also allowed admissions of classes.

Grade "F" (unsatisfactorily) is put when student practically doesn't own the minimum theoretical and practical material of room classes and AL on course, irregularly visits classes and doesn't hand over in time term tasks.

Midterm control is carried out on the 7, 14 weeks of study and it develops proceeding from the following types of control:

Type of control	Percentage	Academic period of study, week															TOTAL %
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
first semester																	
Attendance	0.2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3
Lectures notes	0.2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3
Individual homework nomer 1	2	*	*	*													6
Control Work Number 1	4			*													4
Individual homework nomer 2	2				*	*											4
Testing	6					*											6
Individual homework nomer 3	2						*	*	*								6
Settlement and graphics work number 1	5								*								5
Individual homework nomer 4	2									*	*	*					6
Control Work Number 2	4											*					4
Individual homework nomer 5	2												*				2
Individual homework nomer 6	2													*			2
Control Work Number 3	5													*			5
Individual homework nomer 7	2														*	*	4
Total for the current rating									30							30	60
Examination																	40
Total																	100

Policy and procedures

In studying the course "Mathematics I» please observe the following rules:

1. Do not be late for class.

2. Do not miss classes without good reason, in case of illness to provide help, in other cases - an explanatory note.

3. Actively participate in the learning process.

Educational and methodical support of course

Author	Literature	Publishing house, year of the issue	Number of copies	
			in library	at department
Main literature				
1. Пискунов Н.С.	Дифференциальное и интегральное исчисления	М.: Интеграл-пресс, 2002, 2003, 2004	2002: т.1-86, т.2-3; 2003: т.2-19; 2004: т.2-7.	1
2. Берман Н.Г.	Сборник задач по курсу математического анализа: уч. пособие	М.: Наука, 1985 Сиб: профес. 2004, 2005.	1985: 336; 2004: 42; 2005: 1.	1
3. Запорожец Г.И.	Руководство к решению задач по математическому анализу	М.: Высшая школа, 1966.	111	1
4. Данко П.Е. и др.	Высшая математика в упражнениях и задачах, т. 1-2.	М.: Мир и образование, 2003.	200	1
5. Демидович Б.П.	Краткий курс высшей математики	М.: Астрель, 2004, 2005.	2004: 2; 2005: 5.	1
6. Рябушко А.П.	Индивидуальные задания по высшей математике: Т-1,2, 3.	Алматы: Образование и наука, 2002; Минск: Высшая школа, 2000.	т.1-248; т.2-257; т.3-100.	т.1-1; т.2-1 т.3-1
7. Клетеник Д.В.	Сборник задач по аналитической геометрии	М.: Наука, 1986, 1998; Спб.: Профессия, 2002, 2004, 2005.	77	1
8. Привалов И.И.	Аналитическая геометрия	М.: 1964, 1966.	186	1
9. Письменный Д.Т.	Конспект лекций по высшей математике: Полный курс, ч. 1-2	М.: Айрис-пресс, 2004-2005.	60	-

10. Кузнецов Л.А.	Сборник заданий по высшей математике (типовые расчеты)	М.: Высшая школа, 1983.	291	1-
11. Демидович Б.П. и др.	Задачи и упражнения по математическому анализу для вузов: Уч. пособие для студентов высш. Техн. Учеб. заведений.	М.: Астрель, 2002, 2003, 2004.	2002: 101; 2003: 35; 2004: 292	1
12. Швейдель А.П., Мустафина Л.М.	Установочные лекции по высшей математике для студентов технических специальностей. Семестр I	Караганда: Изд-во КарГТУ, 2007.	300	20
13. Швейдель А.П., Мустафина Л.М.	Установочные лекции по высшей математике для студентов технических специальностей. Семестр II	Караганда: Изд-во КарГТУ, 2007.	200	20
14. Мустафина Л.М.	Методические указания к расчетно-графической работе №1 «Производная и некоторые ее применения»	Караганда: Изд-во КарГТУ, 2008.	120	10
Additional literature				
1. Мышкис А.Д.	Математика для технических вузов: Специальные курсы: Учебник –2-е изд.	СПб: Лань, 2002.-632 с.	10	-
2. Бутузов В.Ф. и др.	Математический анализ в вопросах и задачах: уч. пособие для вузов.	М.: Высшая школа, 1984. 1988	1984: 39; 1988: 5.	1
3. Гусак А.А.	Высшая математика, т.1-2.	Минск: Тетра системс, 2000. 2003.	2000: т.1-67, т.2-76; 2003: т.1-20, т.2-20.	-
4. Лунгу К.Н. и др.	Сборник задач по высшей математике с контрольными работами, к.1-2.	М.: Айрис-пресс, 2003-2006.	курс 1-21; курс 2-11.	-

5.Герасимович А.И., Рысюк Н.А.	Математический анализ, ч.1-2.	Минск: Вышэйшая школа, 1989.	5	-
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Schedule of performing and handing in assignments on course

Type of control	Purpose and content of assignment	Recommended literature	Duration	Form of control	Handing term
Individual homework nomer 1	Linear Algebra	Main Reading [6, T.1]	2 weeks	Current	2 week
Control Work Number 1	Linear Algebra	Main Reading [6, T.1]	2 contact hours	Current	3 week
Individual homework nomer 1	Vectors	Main Reading [6, T.1]	3 weeks	Current	4 week
Testing	Elements of linear algebra and analytic geometry	Main Reading [6, T.1]	1 Contact hour	Current	6 week
Individual homework nomer 2	Limits	Main Reading [12]	1 week	Midterm	7 week
Individual homework nomer 3	Derivatives	Main Reading [6, T.1]	1 week	Current	8 week
Settlement and graphics work number 1	Application of derivatives	Main Reading [6, T.1]	1 week	Current	9 week
Individual homework nomer 4	Indefinite and definite integrals	Main Reading [12]	1 week	Current	10 week
Control Work Number 2	Evaluation of integrals	Main Reading [14]	1 Contact hour	Current	11 week
Individual homework nomer 5	Functions of several variables	Main Reading [6, T.2]	1 week	Current	12 week
Individual homework nomer 6	Differential Equations	Main Reading [13]	1 week	Current	13 week
Control Work Number 3	The solution of differential equations	Main Reading [6, T.1]	1 Contact hour	Midterm	14 week
Examinati	Check of	All list of the	2	Final	During the

on	assimilation of a Course material	main and additional literature	contact hours		session
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Questions for self-checking

1. What is called the matrix?
2. What is the element of the matrix?
3. What is called a square matrix?
4. What is called a diagonal matrix?
5. What is called the identity matrix, zero?
6. What a matrix is transposed?
7. What is called the sum (difference) of two matrices?
8. Which means that the matrix is multiplied by the number?
9. What is called the product of two matrices?
10. Rule for calculating the secondary identifier.
11. Triangle rule (rule Sarryusa).
12. What is a minor?
13. What is a cofactor?
14. List the basic properties of determinants.
15. What a matrix is nonsingular, degenerate?
16. Which matrix is the inverse of the matrix A?
17. Does every matrix has an inverse?
18. The formula for finding the inverse.
19. What is the rank of a matrix?
20. Cramer's rule.
21. Matrix notation of a system of linear equations.
22. The matrix form of the solution of linear equations.
23. What is called a solution of the system?
24. Homogeneous system of two linear equations with three unknowns.
25. Homogeneous system of three linear equations in three unknowns.
26. What system of equations is called the joint?
27. What system of equations is inconsistent?
28. What do you call a system of equations has a unique solution?
29. How is a system of equations that has more than one solution?
30. Explain why not every line can be defined by the equation with the slope and the equation in pieces.
31. Formulate the conditions of parallel and perpendicular lines, given the general equations.
32. How is direct to the coordinate system, if its equation is not the intercept, one of the coordinates, one of the coordinates and the constant term?
33. How to find the distance between two parallel lines?
34. Which line is called an ellipse?
35. What point is the center of an ellipse?

36. What is called the eccentricity of the ellipse and what inequality always satisfies its value?
37. Which line is the hyperbole?
38. What point is the center of the hyperbola?
39. What is called the eccentricity of the hyperbola, and to which the inequality always satisfies its value?
40. Which line is called a parabola?
41. What is the geometric meaning is the inverse of the coefficients in the equation of the plane $Ax + By + Cz = 1$?
42. What is the location of the plane relative to the coordinate axes in the equation plane no free member? One of the coordinates? Two coordinates? One of the coordinates and the constant term? Two coordinates and the constant term?
43. How to find the distance between two parallel planes?
44. How to make sure that the point $M(x_1, y_1, z_1)$ lies in this plane?
45. State the definition of the limit variable, limit of a function as the argument tends to a certain value and the limit of the function and the argument tends to infinity.
46. How are the concepts of limit of a function with the concepts of left and right limits?
47. What is infinitesimal, and what are its main features?
48. What value is called the infinite? Its relationship with the infinitely small?
49. State the definition of continuity of a function at a point on the segment. What is the difference between the statement "the function $y = f(x)$ is continuous at $x = a$ " and "the finite"?
50. State the theorem of continuity of elementary functions.
51. Show $0 \rightarrow$ that the infinitesimal $\sin x$, $\arcsin x$, $\operatorname{tg} x$, $\operatorname{arctg} x$ (as x equivalent.
52. What is called the rate of change of the function?
53. A definition of the derivative of the function.
54. What is called the tangent line to the line at this point?
55. What is the geometric meaning of the derivative of the function $y = f(x)$ in Cartesian coordinates?
56. Formulate rules for differentiating the results of arithmetic operations. Give examples.
57. What is the rule for differentiating a composite function? Inverse function?
58. Derive formulas for the derivatives of the basic elementary functions.
59. What is the technique of logarithmic differentiation?
60. How to differentiate implicitly defined functions? Examples.
61. Specify the method of differentiation of parametrically defined functions.
62. What is called the direction of the line to the given point? The angle between two intersecting lines? Normal to the line in the given point?
63. What is called the differential of a function? As expressed by the differential of the derivative?
64. What is the geometric meaning of the differential of the function $y = f(x)$?
65. List the main properties of the differential function. What is the invariance of

the form of the differential?

66. Which function is called differentiable? What is the necessary condition for differentiability?
67. Specify the formula for calculating the approximate values using differential. Examples.
68. How are higher-order derivatives of functions defined explicitly? Implicitly? Parametrically?
69. What is called the differential of n -th order? As expressed by the relevant differential derivative function?
70. Formulate Theorem Rolle. What is the geometric meaning?
71. Stating the theorem of Lagrange. What is the geometric meaning?
72. Stating the theorem of Cauchy.
73. State a theorem about the relationship between the growth of the function and the sign of its derivative.
74. Determine the points of extremum, the extreme values of the function, the highest and lowest values.
75. Formulate the necessary condition for the extreme, to give examples showing that it is not sufficient.
76. What is the first sign of extreme enough?
77. The methods of investigation of the function of optimization.
78. How to find the maximum and minimum values of the function on the given interval?
79. What is the sufficient condition for the second extreme?
80. A definition of convexity, concavity of $y = f(x)$, inflection points.
81. State a theorem about the relationship between the nature of a curved line $y = f(x)$ and the sign of the second derivative of the function $y = f(x)$.
82. What is a sufficient condition for points of inflection?
83. L'Hospital, of the theory. Give examples of l'Hopital rule.
84. What is called an asymptote of the line?
85. Give analytical features vertical and inclined asymptotes line $y = f(x)$.
86. Describe the general scheme of function studies.
87. Define the primitive. Prove that any two primitives for the same functions differ by a constant term.
88. Give the definition of indefinite integral, and specify its geometric meaning.
89. Give a formula for integration by parts for the indefinite integral. Specify the types of integrals, the calculation of which should be made with a method of integration by parts.
90. Give the definition of the definite integral and specify the geometric and mechanical meaning.
91. Let them. How to interpret it geometrically?
92. Bring a change of variable formula for the calculation of the definite integral.
93. That is the function of two independent variables? The domain of this function?
94. That is the graph of the function of two variables?

95. That is called a line-level functions ?
96. That is the limit of a function at ?
97. Give the definition of continuity of a function of two independent variables at a point and in the field.
98. Give a definition of the partial derivative of the function . Extended to functions of several independent variables.
99. What is the geometrical meaning of partial derivatives of the function ?
100. What is called the private increments and private differential of the function ?
101. That is called complete the increment and total differential of the function ?
102. What is called the tangent plane to the surface in this part of it?
103. How to use the full differential for the approximate calculation of values of functions?
104. What is called the partial derivative of the second order of the function of two independent variables?
105. Formulate the theorem on the equality of the second mixed derivatives.
106. Give a definition of the total differential of the second order of the function .
107. Formulate a necessary and sufficient condition in order that the expression was full of differential.
108. Formulate a rule of differentiation of complex functions.
109. What is called full derivative of?
110. What is the property of invariance of the type of the total differential?
111. What is the rule of differentiation of the implicit function?
112. Write the equation of the tangent plane and the normal to the surface .
113. What is the necessary sign of an extremum of a function of two variables?
114. Formulate sufficient conditions for an extremum.
115. Describe the way of finding the maximum and the minimum values of a function in a closed region.
116. That is called a differential equation of the second order?
117. What is the geometrical meaning of the initial conditions of a differential equation of the second order?
118. Formulate the theorem of existence and uniqueness of solutions for second order equations.
119. Outline ways of bringing equation of the second order equation of the first order in cases when the right part should contain: 1) and ' ; 2) ; 3) .
120. To give a definition of a differential equation of the second order and its General solution. Indicate how to set the initial conditions for the equation of the second order.
121. That is called a linear differential equation of the second order?
122. What kind of has the General solution of the linear equation without the right part?
123. Specify the basic property of a General solution of the linear equation of the second order.
124. Formulate and prove a theorem on the structure of the General solution of the linear equation with the right-hand side.

125. Describe the method of solution of the homogeneous linear equations of the second order with constant coefficients. Which equation is called the characteristic? As it is?
126. What kind of has the General solution of the homogeneous linear equations of the second order with constant coefficients at the valid and various roots of the characteristic equation? At the valid equal roots?
127. Specify the type of decision in the case of complex roots of the characteristic equation.
128. Explain to the rule of finding the private solutions for equations with special right-hand side.
129. How can you find the solution of the equation with the right-hand side, if the right part is presented in the form of a sum of several functions?
130. What is the method of variation of arbitrary constants?
131. What the function is called linearly independent? Linearly dependent?
132. Formulation of the condition of the linear independence of the system of partial solutions of a linear differential equation of the second order.
133. Formulate a theorem on the structure of the General solution of the linear equation of the second order without the right pane and in the right part.
134. How can there be a General solution of the linear equation without the right part with constant coefficients of the order depending on the roots of the characteristic equation?
135. What a number is called convergent and what is the sum of a series?
136. What is the necessary attribute of a convergence of a series?
137. Specify the maximum principle of comparison of convergence sign-positive series.
138. Specify the sign of d'alembert.
139. As formulated integral sign of convergence знакоположительного rows?
140. What series is the знакоперевающимся and what is the sign of Leibniz?
141. What series are absolutely convergent, and what conditionally convergent.
142. What are the properties of absolutely convergent series You know?
143. What is known as a region of convergence of functional series?
144. A functional series is called uniformly convergent?
145. What is the sign of Weierstrass?
146. Formulate the theorem on the continuity of sums of the function series.
147. Formulate the theorem on integrating and differentiating series.
148. What series is the power?
149. What is the Abel theorem on convergence of the power series?
150. As is determined by the radius of convergence of the power series?
151. Formulate the theorem on the properties of power series.

State pub. lic. No. 50 of 31.03.2004 Passed for printing

Format 60x90/16

Printers sheets 1.2 sh. Number of copies 20 cop. Order Contract price

Publishing house of Karaganda State Technical University
100027, Karaganda, Mira Boulevard, 56