Name of discipline and code : B.2.1. Mathematics

Lecturer	**Supaeva Gulnaz Tunaevna**
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Amount of credits:	10
Date:	1-semester 2017-2018 academic year
Purpose and objectives of the course	The objectives of mastering the discipline "Higher Mathematics" are: -forming students of a high mathematical culture-mastering the basic knowledge of mathematics necessary in practical economic activity; -development of logical thinking and the ability to operate on abstract objects, inculcating the skills of the correct use of mathematical concepts and symbols to express various quantitative and qualitative relations; - a clear understanding of the mathematical component in the overall training of a specialist in economics and management. To achieve this goal, in the course of studying the course "Higher Mathematics", the problem of providing a broad, general and sufficiently fundamental mathematical education for students of economic direction is being solved. Fundamental preparation includes a sufficient generality of mathematical concepts and constructions, providing a wide range of their applicability, reasonable accuracy of formulations of mathematical properties of the objects under study, logical rigor of the presentation of the subject, based on an adequate modern mathematical language.
Course Description	The course includes chapters from the following sections of higher mathematics: elements of linear algebra and analytic geometry, vector algebra, introduction to mathematical analysis, differential calculus of functions of one variable, study of functions using a derivative, indefinite integral, definite integral and its applications, functions of several variables, differential equations.
Prerequisites disciplines	The school course of algebra and the beginning of analysis; the school course of geometry.
Post-requisition discipline	Basic and special. course subjects
Competencies	As a result of mastering the discipline, a bachelor must **know:** basic concepts of linear and vector algebra (matrices, determinants, vectors, scalar, vector and mixed products of vectors, etc.) * basic concepts and problems of analytic geometry (line on the plane, space, curves of the second order) * basic concepts and methods of differential and integral calculus (limit, derivative, differential of a function of one and several variables, extrema of functions, etc.); * basic types of ordinary differential equations and methods for their solutions. **To be able:** * apply mathematical methods in solving professional problems; * differentiate and integrate;

	* use mathematical software packages to solve algebraic equations, integrate and differentiate numerically; * establish the limits of applicability of methods; be able to check solutions. **Use:** *methods of solving problems of differential, integral calculus; * numerical methods of solution; methods of constructing a mathematical model of professional problems and a meaningful interpretation of the results obtained.
Course Policy	Do not be late for classes Do not skip classes, in case of illness, provide a certificate If the tasks are not fulfilled, the assessment is reduced Actively participate in the educational process Timely and diligently to do homework Be tolerant, open and friendly to fellow students and teachers Constructively support feedback in all classes Be punctual and compulsory
Teaching methods:	Active method, passive method, interactive method
Form of knowledge control	Assessment of knowledge will be conducted on the basis of the European ECTS system. The ECTS system initially divides students between the theses "credits", "not credits", and then assesses the work of these two groups separately. Students who score more than 50 points receive a "pass" rating. "Excellent" (from 85 to 100 points), "good" (from 70 to 84 points), "satisfactory" (from 50 to 69 points). The points of the final evaluation are distributed as follows: Current control work (max) -40 points Border control work (max) -40 points Final control (written examination max) -20 points At deducing of a total estimation activity of students in the decision of the problems offered on employment will be considered. • The current test (homework) is necessary to consolidate the material studied, as well as to check the level of understanding of the material. Homework will contain calculation tasks that use basic facts and statements. Doing homework will give students the opportunity to understand the material they have passed. • Border testing is given to check knowledge of current materials. We will propose computational tasks, as well as theoretical tasks that reveal an understanding of the basic definitions. Correct execution of tests will give students a chance to gain high credit marks. One of the basic conditions for recruitment of high scores is the student's possession of the material he has passed at a sufficiently high level. Test works will be held at the set time. Retake of control works is not provided. • Final control is a written examination. After receiving the exam ticket, the student must write down the answers to exam questions in writing. In order that students can properly prepare for the exam, a list of exam questions is given in advance. The answer is considered best if the theoretical facts are illustrated by concrete examples.
Literature:	**Basic** 1.General course of higher mathematics for economists edited by prof.

	VI Ermakova. Textbook. INFRA - M.2001g. 2. Higher mathematics for economists edited by prof. N.Sh. Kremer. Textbook Moscow, UNITI, 2013. 3. Collection of problems in higher mathematics for economists. Edited by prof. VI ErmakovaUchebnoe posobi.Moskva, INFRA-M, 2006. 4. Workshop on higher mathematics for economists edited by prof. N.Sh. Kremer. Tutorial. M. UNITY, 2002. **Additional** 1. Kremer NS, BA Pathko, IM Trishin, M, N. Fridman Higher mathematics for economists .- M: .UNITI, 2001. 2. Arefiev K.P., Ivlev E.T., Tarbokova T.V. Systems of linear equations. -Tomsk: Rotoprint TPU, 1996. 3. Barysheva VK, Galanov Yu.I., Ivlev E.T., Pakhomova Ye.G. Theory of Probability.-Tomsk: ed. TPU, textbooks of Tomsk Polytechnic University, 2004. 4. Arefiev K. P., Ivlev E.T., Tarbokova T.V. Systems of linear equations. - Tomsk: Rotaprint TPU, 1996. 5. Arefiev K. P., Ivlev E.T., Tarbokova T.V. Vector algebra and analytic geometry. - Tomsk: Rotaprint TPU, 1996. 6. Kang Yong-hee. Differential equations of the first order. - Tomsk: Rotaprint TPU, 1996.
Independent work of a student	**Homework №1** **(Deadline 02.10.17 -07.10.17)** 1. Calculate *5A-3B* , if а) $A=\begin{pmatrix}3 & -1 & 2 & 4\\ 1 & 2 & 5 & 6\end{pmatrix}$; $B=\begin{pmatrix}4 & 3 & -2 & 2\\ -3 & 3 & 1 & 8\end{pmatrix}$; б) $A=\begin{pmatrix}-1 & 0 & 4\\ 3 & 1 & -2\\ 0 & 2 & 1\end{pmatrix}$; $B=\begin{pmatrix}2 & 1 & -1\\ 3 & 2 & -2\\ -1 & 1 & 4\end{pmatrix}$ 2. Calculate $A\cdot B$ а) $A=\begin{pmatrix}1 & 5 & -2\\ 3 & -1 & 4\\ 3 & -2 & 6\end{pmatrix}$; $B=\begin{pmatrix}3 & 2 & -1\\ 4 & 2 & 5\\ 0 & -3 & 1\end{pmatrix}$ б) $A=\begin{pmatrix}-6 & 1 & 2\\ 4 & 1 & -3\\ 5 & 3 & 2\\ 1 & 7 & 4\end{pmatrix}$; $B=\begin{pmatrix}3 & 0\\ -3 & 2\\ 5 & 1\end{pmatrix}$ 3. а) Calculate $D=(AB)^T-C^2$, $A=\begin{pmatrix}3 & 4 & 2\\ 1 & 0 & 5\end{pmatrix}$; $B=\begin{pmatrix}2 & 0\\ 1 & 3\\ 0 & 5\end{pmatrix}$; $C=\begin{pmatrix}1 & 5\\ 3 & 2\end{pmatrix}$ б) Calculate D=ABC-3I $A=\begin{pmatrix}1 & 2 & -3\\ 1 & 0 & 2\\ 4 & 5 & 3\end{pmatrix}$ $B=\begin{pmatrix}1\\ 2\\ 1\end{pmatrix}$; $C=\begin{pmatrix}2 & 0 & 5\end{pmatrix}$; I 4. Calculate determinants

а) $\begin{vmatrix} 3 & -2 \\ 4 & 5 \end{vmatrix}$; б) $\begin{vmatrix} 6 & 2 \\ 7 & 3 \end{vmatrix}$; в) $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$; г) $\begin{vmatrix} 1 & 1 & 1 \\ 2 & -3 & 1 \\ 4 & -1 & -5 \end{vmatrix}$

5. а) $\begin{vmatrix} -1 & 3 & 1 & 2 \\ -5 & 8 & 2 & 7 \\ 4 & -5 & 3 & -2 \\ -7 & 8 & 4 & 5 \end{vmatrix}$; б) $\begin{vmatrix} 3 & 5 & 7 & 2 \\ 7 & 6 & 3 & 7 \\ 5 & 4 & 3 & 5 \\ -5 & -6 & -5 & -4 \end{vmatrix}$

6. Calculate A^{-1}

а) $A = \begin{pmatrix} 3 & 1 & -1 \\ 2 & -2 & 3 \\ 1 & 4 & 2 \end{pmatrix}$; б) $A = \begin{pmatrix} 1 & 2 & -1 \\ 2 & 1 & -1 \\ 1 & -7 & 3 \end{pmatrix}$;

7. а) $\begin{cases} 2x_1 - x_2 + 5x_3 = -1, \\ x_1 + 4x_2 - x_3 = 14, \\ 3x_1 + x_2 + x_3 = 2 \end{cases}$ б) $\begin{cases} x_1 - x_2 + 2x_3 = 2, \\ 2x_1 + x_2 - 3x_3 = -7, \\ 4x_1 + 2x_2 + x_3 = 0 \end{cases}$

Homework №2
(Deadline 06.11.17 -11.11.17)

1. Given vectors $\alpha = (2,-1,0,3); \hat{a} = (-1,1,2,-1); C = (2,1,-2,0)$

Find a) the vectors $d = 3(a+c) + 2(a-b) - (\hat{a}+b) + 2\grave{a} + c$ and

$f = 2c + 2(a-b) - 3(a+b)$

b) the scalar product of the vector d by the vector f;

c) the length of the vectors d and f

2. Compose the simplest equation of the hyperbola if the distance between its vertices is 30, and the distance between the foci is 40.

3. Write the equation of the circle with the center at the point C (5, -4) and the radius equal to 7.

4. . Find the lengths of the axes, the coordinates of the foci, and the eccentricity of the ellipse $9x^2 + 16y^2 = 196$.

5. The straight line ℓ_1 has the equation 6y-4x-3 = 0, the straight line is the equation 2y-40x + 7 = 0, the straight line is the equation 18y-17x + 51 = 0. Which of these lines goes up faster than everyone. Draw the graphs of these lines in one coordinate system.

6. Find the equation of a straight line passing through the point (1,2) and parallel to the line 4x + 12y + 3 = 0. Draw the graphs.

7. Find the equation of the straight line passing through the point (6, -3) and perpendicular to the line x-3y + 12 = 0. Draw the graphs.

8. Given a triangle with sides 4; 8; 9. Find the length of the bisectrix drawn to the larger side.

Homework №3
(Deadline 11.12.17 -16.12.17)

1. For the production of two types of products A and B, the enterprise uses three types of raw materials. The norms of consumption of raw materials of each type for the production of a unit of production

of this type in the table. It also indicates revenues from the sale of one type and the total amount of raw materials of this type that can be used by the enterprise.

Type of raw material	Norms of raw material consumption (kg) per product		Total amount of raw materials (kg)
	A	B	
I II III	12 4 3	4 4 12	300 120 252
Profit from the sale of one product (som)	30	40	

Given that products A and B can be produced in any ratio (sales are secured), it is required to draw up a plan for their release, in which the company's profit from the sale of all products is maximum.

Solve linear programming problems with two variable graphical methods:

2. $F(X) = 2x_1 + x_2 \to \min$

$$\begin{cases} x_1 + x_2 \le 12 \\ 2x_1 - x_2 \le 12 \\ 2x_1 - x_2 \ge 0 \\ 2x_1 + x_2 \ge 4 \\ x_2 \ge 0 \end{cases}$$

3. $F(X) = 4x_1 - 3x_2 \to \max$

$$\begin{cases} -x_1 + x_2 \le 5 \\ 5x_1 - 2x_2 \le 20 \\ 8x_1 - 3x_2 \ge 0 \\ 5x_1 - 6x_2 \le 0 \end{cases}$$

4. $F(X) = x_1 - 3x_2 \to \min$

$$\begin{cases} -x_1 + x_2 \le 6 \\ -2x_1 + x_2 \le 6 \\ x_1 + 3x_2 \ge -3 \\ x_1 - 2x_2 \le 2 \end{cases}$$

1. $F(X) = -x_1 + 4x_2 \to \min$

$$\begin{cases} 2x_1 + 3x_2 \le 24 \\ -8x_1 + 3x_2 \le 24 \\ 2x_1 - 3x_2 \le 12 \\ 4x_1 + 3x_2 \ge -12 \end{cases}$$

Note

Homework should be presented in the exact time set by the teacher. In the case of delivery of work after a fixed period, 50% of the points received by the student for work are removed.

Calendar-thematic plan of distribution of hours with the indication of the week, topics

№	**Date**	**Subject**	**Number of hours**	**Literature**	**Preliminary questions on modules**
1	1	Linear Equations	2	**Literature:** **Basic** 1.General course of higher mathematics for economists edited by prof. VI Ermakova. Textbook. INFRA - M.2001g. 2. Higher mathematics for economists edited by prof. N.Sh. Kremer. Textbook Moscow, UNITI, 2013. 3. Collection of problems in higher mathematics for economists. Edited by prof. VI ErmakovaUchebnoe posobi.Moskva, INFRA-M, 2006. 4. Workshop on higher mathematics for economists edited by prof. N.Sh. Kremer. Tutorial. M. UNITY, 2002. **Additional** 1. Kremer NS, BA Pathko, IM Trishin, M, N. Fridman Higher mathematics for economists .- M: .UNITI, 2001. 2. Arefiev K.P., Ivlev E.T., Tarbokova T.V. Systems of linear equations. -Tomsk: Rotoprint TPU, 1996. 3. Barysheva VK, Galanov Yu.I., Ivlev E.T., Pakhomova Ye.G. Theory of Probability.-	1. Types of straight lines 2. Point of intersection of lines
2	1	Systems of second order. Cramer’s Rule	2		1.What is a system of equations. 2. Conditions for the application of the Cramer rule
3	1	Systems of linear equations. Determinants. Cramer’s Method	2		1. Rules for calculating determinants 2. The application of Cramer's method for solving the system of equations
4	2	Matrix. Operations on matrices.	2		1. Definition of the concept of a matrix. 2. Types of matrices 3. Actions over matrices.
5	2	Inverse matrix	2		1.Conditions for the existence of an inverse matrix 2. Inverse matrix formula 3. Algebraic complement of matrices
6	3	Exercises	2		Problem solving on the topics covered
7	3	Determinants of 4order	2		1.Method of calculating determinants of the 4-order 2.Computation rule by element or row
8	3	Gauss method - the method of elimination	2		1.Conditions for solving systems of equations by the Gauss method 2. The Gauss method as a universal method for solving systems of equations

9	4	Matrix equations	2	Tomsk: ed. TPU, textbooks of Tomsk Polytechnic University, 2004. 4. Arefiev K. P., Ivlev E.T., Tarbokova T.V. Systems of linear equations. - Tomsk: Rotaprint TPU, 1996. 5. Arefiev K. P., Ivlev E.T., Tarbokova T.V. Vector algebra and analytic geometry. - Tomsk: Rotaprint TPU, 1996. 6. Kang Yong-hee. Differential equations of the first order. - Tomsk: Rotaprint TPU, 1996.	1. Types of matrix equations 2. Matrix operations in solving systems of equations
10	4	Method inverse matrix	2		1. Application of an inverse matrix in solving systems of equations 2.Matrix equations in economics
11	5	Examination №1	2		
12	5	Vectors. Linear operations on vectors	2		1. Definition of a vector 2. Linear operations on vectors
13	5	The scalar product of two vectors	2		1.Formula for the scalar multiplication of two vectors 2. Application of the scalar product of vectors in solving economic problems
14	6	Exercises	2		
15	6	Equations of lines. Direct on the plane	2		1.Types of equations of lines in the plane and in space 2. Singularities of lines in space
16	7	Plane. Equations of plane	2		1. Definition of a plane as a geometric concept 2. Equation of a plane and application.
17	7	Direct in space	2		1. The equation of a line in space. 2. The problem of direct
18	8	Lines and plane in space	2		1.Features of lines in space 2.Features of the plane in space 3.Plane equation

19	8	Curves 2 order. Circle.	2		1.The concept of 2-order curves 2.Types of equations of a circle
20	9	Ellipse	2		1.Ellipse equation 2. Basic characteristics of the ellipse
21	9	Hyperbola	2		1. Hyperbola equation 2. Basic characteristics of the hyperbola
22	10	Parabola	2		1. Parabola equation 2. Basic characteristics of the parabola
23	10	Exercises	2		
24	11	The use of analytic geometry in the economy	2		
25	11	Examination №2	2		
26	11	Model Leontief	2		
27	12	Supply and demand.	2		
28	12	Market Equilibrium	2		
29	13	CVP Models	2		
30	13	Introduction in linear programming	2		
31	13	The geometrical approach to the solution of problems of linear programming	2		

32	14	A problem on a minimum	2		
33	14	Exercises	2		
34	15	A transport problem.	2		
35	15	Closed transport problem	2		
36	15	Exercises	2		
37	16	Examination №3	2		
38	16	Examples of calculation	1		
		TOTAL	**75** hours		

Schedule of independent work of students

№	Weeks Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Amount of points
		October				November						December						
1	Current control	10				15						15						40 points
2	Deadline IWS*.	**19-24.02.18**				**26-31.03.18**						**7-12.05.18**						