NATIONAL AVIATIONAL UNIVERSITY
FACULTY OF TRANSPORT, MANAGEMENT AND LOGISTICS
DEPARTMENT OF HIGHER MATHEMATICS

Method guide to arrangement of students' self-study on the course " MATHEMATICS FOR ECONOMISTS"

Field of study: 29 "International relations"
Specialty: 292 "International Economic Relations"
Educational Professional Program: "International business"

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Minutes № ____ of "_____"_____2023
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METHODICAL SUPORT OF ARRANGEMENT OF STUDENTS' SELF-STUDY

1. Higher mathematics. Part 1: Manual/ Denisiuk V.P., Grishina L.I., Karupu O. W., Oleshko T.A., Pakhnenko V.V., Repeta V.K. – Kyiv: NAU, 2006.
2. Higher mathematics. Part 2: Manual/ Denisiuk V.P., Demydko V.G., Repeta V.K. – Kyiv: NAU, 2009.
3. Higher mathematics. Part 3: Manual/ Denisiuk V.P., Grishina L.I., Karupu O. W., Oleshko T.A., Pakhnenko V.V., Repeta V.K. – Kyiv: NAU, 2006.
4. Mathematical analysis: Manual / V. P. Denisiuk, V. G. Demydko., O. V. Karupu, T. A. Oleshko, V. V. Pakhnenko, V. K. Repeta. – Kyiv: NAU, 2013. – 396 p.
5. Higher mathematics. Part 4: V. P. Denisiuk, V.M. Bobkov, V. G. Demydko., O. V. Karupu, T. A. Oleshko, V. V. Pakhnenko, T.O.Pogrebetska, V. K. Repeta. – Kyiv: NAU, 2013. – 248p.

Module №1 "Elements of Linear and Vector Algebra. Analytical Geometry. Introduction to Mathematical Analysis"

Topic 1. 1. Elements of Linear and Vector Algebra

1. Concepts, definitions, formulations:

1. Determinants of the 2nd, the 3rd and the *n– th* orders.
2. Matrices. Linear operations with matrices. Multiplication of matrices.
3. Inverse matrix
4. Definite, indefinite, consistent, inconsistent SLAE.
5. Matrix form of SLAE.
6. Gauss' method of SLAE solution.
7. Kronecker-Capelli theorem usage in SLAE investigation.
8. Geometrical vector. Vector addition and subtraction operations, multiplication by scalar.
9. Linear dependence and independence of vectors.
10. Cartesian coordinate system (CCS).
11. Dot product of two vectors.
12. Cross product of two vectors.
13. Triple product

2. Proofs and conclusions

1. Properties of determinants (2nd and 3rd orders).
2. Matrix addition and multiplication properties.
3. Existence of an inverse matrix.
4. Inverse matrix method of SLAE solution.

5. Cramer's Theorem.
6. Kronecker-Capelli Theorem.
7. Projection of vector on axis.
8. Representation of a vector in terms of base vectors.
9. Properties of a dot product; calculation by coordinates.
10. Properties of a cross product; calculation by coordinates.
11. Properties of a triple product; calculation by coordinates

3. Assignments

1. Calculate the determinants of order 2, 3 and *n*, to be able to lay out a determinant by the elements of any row or column, to reduce determinant to the triangle form.
2, Find the matrix sum, difference and product.
3. Find the matrix rank.
4. Find an inverse matrix.
5. Solve the square systems by Cramer's method, through inverse matrix.
6. Solve the square systems by Cramer's method, through inverse matrix.
7. Solve the arbitrary SLAE by Gauss' method.
8. Analyse SLAE on the consistence (compatibility) according to Kronecker-Capelli Theorem.
9. Analyse SLAE on the consistence (compatibility) according to Kronecker-Capelli Theorem.
10. Find the eigenvalues and eigenvectors of matrix.
11. Find the vector coordinates, it's length, unit vector. Find the angle between vectors.
12. Find the vector sum, difference, dot and cross products.
13. Calculate the area of the triangle, volume of pyramid.
14. Be able to represent the vector in terms of base vectors.
15. Be able to use the condition of two vectors perpendicularity

Topic 1. 2. Introduction to Mathematical Analysis

1. Concepts, definitions, formulations:

1. Complex numbers.
2. Forms of the complex numbers.
3. Operations with them.
4. Sets. Classification of numerical sets. Operations on sets. The modules of a real number.
5. A sequence.
6. A function. Classification of functions. The elementary functions. An inverse function. A composite function.
7. The Limit of a numerical sequence. The Limit of a function. Infinitesimals.
8. Continuity. Continuity of a function at a point and on an interval. Properties of continuous functions. Points of discontinuity and its classification.

2. Proofs and conclusions

1. Complex number.
2. Module and argument of a complex number
3. Theorems about limits.
4. The first and the second honorable limits.
5. Theorems about equivalent infinitesimals.

3. Assignments

1. Operate with complex numbers
2. Evaluate the limits.
3. Evaluate the limits using the equivalent infinitesimals.
4. Investigate functions for continuity.

Module №2 "Differential Calculus of the Function of One Variables. Integral Calculus of the Function of One Variable"

Topic 2. 1. Differential Calculus of the Function of One Variable

1. Concepts, definitions, formulations:

1. Definition of a derivative. Geometrical and physical interpretation.
2. A table of derivatives. Rules of differentiation.
3. A connection between continuity and differentiability.
4. A differential. Geometrical interpretation of a differential.
5. The usage of the differentials.
6. Evaluation of the first and higher order derivatives.
7. Leibniz's formula.
8. Lagrange's formula.
9. L'Hospital's rule for expansion of indeterminate forms $\left[\frac{0}{0}\right]$ or $\left[\frac{\infty}{\infty}\right]$.
10. Taylor's formula.
11. Maclaurin's formula.
12. Investigation for function increase and decrease on the given interval.
13. Investigation of a function for extremum.
14. Minimum and maximum values on the interval.
15. Concavity intervals. Inflection points.
16. Asymptotes.
17. Plan of graph construction.

2. Proofs and conclusions

1. The derivatives of elementary functions.
2. The first order and higher order derivatives of the parametric functions.
3. Theorem about continuity of differentiable functions.
4. Geometrical interpretation of the first order differential.
5. Equation of a tangent line and a normal to the curve.
6. Lagrange's and Fermat's theorems.

7. L'Hospital's rule for expanding of indeterminate form $\left[\frac{0}{0}\right]$.
8. The necessary monotony conditions.
9. The necessary and sufficient extremum conditions.
10. Curve asymptotes seeking rule.

3. Assignments

1. Find the derivatives of functions.
2. Find the derivatives of composite functions, implicit functions and parametric functions.
3. Find the differentials of functions.
4. Find the derivatives and the differentials of higher order.
5. Solve tasks for geometrical and physical interpretation of a derivative.
6. Investigate elementary functions.
7. Sketch the graphs of elementary functions.
8. Find different limits with the help of L'Hospital's rule.
9. Find intervals of function increase and decrease, local extremum.
10. Find concavity intervals.
11. Find graph asymptotes.
12. Construct the graph.

Topic 2.2Integral Calculus of the Function of One Variable

1. Concepts, definitions, formulations:

1. Antiderivative. Indefinite integrals. Table of integrals. Evaluating techniques.
2. Polynomial functions. Rational functions.
3. Integrating of rational functions by partial fractions.
4. Integrals involving powers of trigonometric functions.
5. Integrating of irrational functions.
6. Definite integrals. Newton-Leibniz fundamental theorem.
7. Properties of definite integrals. Evaluating techniques.
8. Improper integrals. Convergence of improper integrals.
9. Application of the definite integrals

2. Proofs and conclusions

1. Concepts of antiderivative and the indefinite integral. The table of the integrals.
2. The substitution technique.
3. Integration by parts.
4. Integrating of partial fractions. Integrating of rational functions.
5. Integrals involving powers of trigonometric functions.
6. Integrating of irrational functions.
7. Definite integrals. Newton-Leibniz fundamental theorem.

8. Properties of definite integrals.
9. Improper integrals. Convergence and evaluating.
10. Application of the definite integrals in geometry and mechanics.

3. Assignments

1. Find indefinite integrals applying table of integrals.
2. Find indefinite integrals applying substitution technique.
3. Find indefinite integrals applying integration by parts.
4. Find integrals of rational functions by partial fractions.
5. Find integrals involving powers of trigonometric functions.
6. Find integrals of irrational functions.
7. Find definite integrals applying Newton-Leibniz formula..
8. Find definite integrals applying evaluating techniques.
9. Investigate improper integrals for convergence. Find improper integrals.
10. Apply definite integrals for solving geometric and mechanical problems.