

**MINISTRY OF SCIENCE AND EDUCATION OF UKRAINE
STATE HIGHER EDUCATIONAL INSTITUTION
«BANKING UNIVERSITY»**

APPROVED by
The Head of the Admission Board of
SHEI «Banking University»

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PROGRAMME

**of competitive selection of applicants
for SHEI “University of banking” on Mathematics
to be awarded Bachelor’s Degree
on the basis of complete general secondary education
in specialties 071”Accounting and taxing”,
072 “Finances, banking and assurance”,
073 “Management”, 051 “Economics”, 081 “Law”,
126 “Information systems and technologies”, 125
“Cybersecurity”, 232 "Social welfare"
for full-time and distance learning**

Kyiv 2017

Composer:

L.D. Filatova, Associate Professor of Informational Technologies and High Mathematics Department, PhD in Physics and Mathematics

Reviewer:

I.K. Kirichenko, Doctor of Physical and Mathematical Sciences, Professor, Head of Informatics and Computer Technologies, Ukrainian Engineering and Pedagogical Academy

Considered and agreed at the meeting of Informational Technologies and High Mathematics Department Kharkiv educational and scientific institute of SHEI "University of banking" December 29, 2016 (Minutes № 7).

Considered and agreed at the meeting of the Educational and Methodical Council of SHEI "Banking University " January 24, 2017 (Minutes №5).

Considered and approved at the meeting of the Admission Committee of SHEI "Banking University " January 17, 2017 (Minutes №11).

INTRODUCTION

The syllabus for competitive selection of those who enter “the University of banking” (testing) is drawn up, taking into account the objectives, requirements and content of learning Maths at school, incorporated in the State standard of education and current syllabus in Mathematics for the 11-year-old schooling.

The purpose of the application of competitive selection for the entrants to the University in Mathematics is to identify the level of obtained knowledge and skills defined by the standards of the comprehensive educational institutions.

The task of the syllabus is the formation of the entrants’ knowledge and skills:

- building mathematical models of real objects, processes, phenomena and exploring these patterns by means of Mathematics;
- performing mathematical calculations (performing actions with numbers, listed in various forms, with interest, composing and solving the aspect ratio, approximate calculations, etc.);
- performing the conversion expressions (understanding the content value of each element of the expression, finding the valid values variables, finding the numerical values of expressions in the given values of the variables, etc.);
- building and analyzing graphs of simple functional dependencies, exploring their properties;
- solving equations, inequalities and their systems, solving the text problems using equations, inequalities and their systems;
- finding on the pictures geometric shapes and identifying their properties;
- defining the quantitative characteristics of geometric figures (length, magnitude of angles, area, volume);
- solving the easiest complex tasks and calculating probability of random events;
- analyzing the information that is filed in graphic, tabular, textual and other forms.

The program covers theoretical and applied issues, knowledge of which is essential in the study of Mathematics and consists of the following sections:

Algebra and basics of analysis:

1. The numbers and expressions
2. The equations, inequalities and their systems
3. The functions
4. Elements of combinatorics, probability theory, principles and elements of statistics.

Geometry:

1. The Planimetry
2. Stereometria

Tests on mathematics of competitive selection of applicants for SHEI “University of banking” in 2016 to to be awarded Bachelor’s Degree on the basis of complete general secondary education in specialties: 071 ”Accounting and taxing”, 072 “Finances, banking and assurance”, 073 “Management”, 051 “Economics”, 081 “Law”, 126(122) “Information systems and technologies”, 125 “Cybersecurity” for full-time and distance learning consist of twenty-five test

items. Each correct answer is estimated at 8 points. Each wrong answer is estimated at 0 points. Maximum score is 200.

The minimum score for successful passing the exam should be at least 100.

ALGEBRA AND BASICS OF ANALYSIS

Section 1. NUMBERS AND EXPRESSIONS

Theme 1. Real numbers (natural, goals, rational and irrational), comparing them and dealing with them. Numeric sets and correlations between them.

Properties of real numbers; the rules for comparison of real numbers; the peculiarities to divide natural numbers by 2, 3, 5, 9, 10; the rules of rounding the whole numbers and decimal fractions; the definition of the n -th root number and n -th arithmetic root number; properties of roots; definition of degree with a natural, whole and rational indicators, their properties; numeric intervals; module of real numbers and its properties.

References: 2, 3, 6, 7, 8, 9.

Theme 2. Ratios and proportions. Interests. The basic problems on the interest. Text problems.

Ratios, proportions; the basic property of proportion; definition of percent; rules of interest payments.

References: 2, 3, 6, 7, 8, 9.

Theme 3. Rational, irrational, degree, indicator, logarithm, trigonometric expressions and their conversion

The definition of the region of possible values of the variables of the expression with the interchangeable; the definition of identically equal expressions, identical conversion of the expression, identities; the definition of monomial and polynomial; the rules of adding, subtracting and multiplying monomials and polynomials; formulae of shortened multiplying, decomposing a polynomial into multipliers; the definition of algebraic fractions; the rules to perform actions with algebraic fractions; the definition and properties of logarithm, the decimal and natural logarithms; a basic logarithmic identity; definition of sine, cosine, tangent, cotangent of numerical argument; basic trigonometric identities and consequences of them; formulae of summaries; Add formulas and the consequences of them.

References: 2, 3, 6, 7, 8, 9.

Section 2. EQUATIONS, INEQUALITIES AND THEIR SYSTEMS

Theme 1. Linear, square, rational, irrational, indicator, logarithm, trigonometric equations, inequalities and their systems.

Using equations, inequalities and their systems to solve text problems.

Equation with one changeable, definition of the root of the equation with one changeable, inequality with one changeable, definition of solving equalities with one changeable, definition of solving the system of equations with two changeables and methods of their solution; equal equations, inequalities and their systems; methods to solve rational, irrational, indicator, logarithm, trigonometric equations and inequalities.

References: 2, 3, 6, 7, 8, 9.

Section3. FUNCTIONS

Theme 1. Linear, square, degree, indicator, logarithm and trigonometric functions, their basic properties. Numeric sequences.

The definition of the function, the field of the definition, the field of the values of the function, the graph of the function; the ways to specify the basic properties of functions and graphs of functions, specified in the title of the theme; the definition of functions, inversed to the set; the definition of the arithmetic and geometric progressions; formulae of the n-th member of the arithmetic and geometric progressions; the formula of the sum of the first n members of the arithmetic and geometric progressions; the formula for the sum of an infinite geometric progression with denominator $|q| < 1$.

References: 2, 3, 6, 7, 8, 9.

Theme 2. The derivative of the function, its geometric and physical content. Derivatives of elementary functions. The rules of derivation.

Equation of the tangent to the graph of the function at the point; the definition of the derivative of a function at a point; physical and geometric content of derivative; table of derivatives of elementary functions; rules for finding derivatives of the sum, product, the share of the two functions; rule of finding the derivative of a composite function.

References: 2, 3, 6, 7, 8, 9.

Theme 3. Study of functions using derivatives. The construction of the graphs of the functions.

A sufficient condition for growth (decreasing) function on the interval; the position of the function; the definition of the largest and least values of the function.

References: 2, 3, 6, 7, 8, 9.

Theme 4. Primitive and definite integral. Application of the definite integral to calculate the area of the curved trapezoid.

The definition of the primitive function, the definite integral, the curvilinear trapezoid area; the table of primitive functions; the rules to find the primitives; Newton's- Leibniz formula.

References: 2, 3, 6, 7, 8, 9.

Section 4. ELEMENTS OF COMBINATORICS, BASICS OF PROBABILITY THEORY AND ELEMENTS OF STATISTICS.

Theme 1. Permutations, combinations, placement (without repetition).

Combinatorial rules and the amount of product, classic definition of probability of random events, the easiest cases to calculate the probability of events; the definition of selected properties for a number of data (swing of sampling, mode,

median, medium meaning); graphic, tabular, text and other forms of submission of statistical information.

References: 9.

GEOMETRY

Section1. PLANIMETRY

Theme 1. Simple geometric shapes on a plane and their properties

The concept of point and line, ray, segment, broken line, angle; planimetry axioms; adjacent and vertical angles, bisect of the angle; properties of adjacent and vertical angles; property of the angle bisect; parallel and perpendicular lines; perpendicular and inclined, median perpendicular, distance from point to line; definition of parallel lines; Thales theorem, generalized theorem of Thales.

References: 1, 4, 5.

Theme 2. Circumference and circle

Circumference, circle and its elements; central and inscribed angles and their properties; properties of two chords that intersect; tangent to the circle and its properties.

References: 1, 4, 5.

Theme 3. Triangles

Types of triangles and their main properties; definition of triangles' equality; median, bisector, height of triangle and their properties; theorem on the sum of angles of a triangle; triangle inequality; the middle line of the triangle and its properties; circle described round the triangle and circle inscribed in the triangle; Pythagorean theorem, proportional segments of a right triangle; the ratio between the sides and angles of a right triangle; law of sines; law of cosines.

References: 1, 4, 5.

Theme 4. Quadrangle

Quadrangle and its elements; parallelogram and its properties; parallelogram features; rectangle, diamond, square, trapezoid and their properties; the middle line of the trapezoid and its property; inscribed in a circle and described circles around quadrangles.

References: 1, 4, 5.

Theme 5. Polygons

Polygon and its elements, convex polygon; perimeter of a polygon; sum of the angles of a convex polygon; regular polygon and its properties; inscribed in a circle and described polygons around the circle.

References: 1, 4, 5.

Theme 6. Geometric quantities and their measurement

The length of the segment of a circle and its arc; the measure of an angle, measurement of angles; the perimeter of the polygon; the formula for calculating area of a triangle, parallelogram, rhombus, square, trapezoid, regular polygon, circle, circular sector.

References: 1, 4, 5.

Theme 7. Coordinates and vectors in the plane

Rectangular coordinate system in the plane, coordinates of a point; the formula to calculate the distance between two points and the formula to calculate the coordinates of the midpoint; the equation of the straight line and circle; the concept of vector, length of a vector, collinear vectors, equal vectors, coordinates of a vector; addition, subtraction of vectors, multiplication of a vector by a number; decomposition of a vector by means of two incollinear vectors; scalar product of vectors and its properties; the formula to find the angle between vectors that are defined by coordinates; the conditions collinearity and perpendicularity of vectors given by coordinates.

Reference: 1, 4, 5.

Theme 8. Geometric transformations

Principal types and the maintenance of geometric transformations in the plane (movement, symmetry about a point and about straight, rotation, translation, similarity transformation, homothety); signs of similarity of triangles; the ratio of areas of similar figures.

Reference: 1, 4, 5.

Section 2. STEREOMETRY

Theme 1. Lines and plane in space

Axioms and theorems of solid geometry; the mutual arrangement of straight lines in space, straight line and plane in space, planes in space; signs of parallel lines, line and plane, planes; parallel design; the signs of perpendicularity of line and plane, two planes; a projection on an inclined plane, orthographic projection; direct and inverse theorem on three perpendiculars; the distance from point to plane, from point to straight line, straight to the parallel planes, between parallel lines, between parallel planes, between crossing straight lines; a sign of by going lines; the angle between the straight lines, a straight line and plane, planes.

Reference: 1, 4, 5.

Theme 2. Polyhedrons, solids and surfaces of rotation

The dihedral angle, linear angle of dihedral angle; polyhedrons and their elements, the main types of polyhedrons: prism, parallelepiped, pyramid, truncated pyramid;

solids and surfaces of revolution and their elements, the main types of solids and surfaces of revolution: cylinder, cone, truncated cone, sphere, field, section of polyhedrons and solids of revolution plane; combination of geometric solids; formulas for calculating surface areas, volumes of polyhedrons and solids of revolution.

Reference: 1, 4, 5.

Theme 3. Coordinates and vectors in space

Rectangular coordinate system in space, the coordinates of a point; the formula to calculate the distance between two points and the formula to calculate the coordinates of the midpoint; the concept of vector, length of vector, collinear vectors, equal vectors, coordinates of a vector; addition, subtraction of vectors, multiplication of a vector by a number, scalar product of vectors and its properties; the formula to find the angle between vectors that are defined by coordinates; the conditions of collinearity and perpendicularity of vectors given by coordinates.

Reference: 1, 4, 5.

RECOMMENDED LITERATURE

1. G.P.Bevz i inshi . Geometriia: pidruchnyk dlia 10 - 11 klasiv zahalnoosvitnikh zakladiv – K.:, 2004. – 224 p.
2. Ye. P. Nelin. Нелін Є.П. Algebra i pochatky analizu: Dvorivnevyy pidruchnyk dlia 10 klasu zahalnoosvitnikh zakladiv. – Kh.: Svit dytynstva,2004. – 432 p.
3. Ye. P. Nelin. Нелін Є.П. Algebra i pochatky analizu: Dvorivnevyy pidruchnyk dlia 11 klasu zahalnoosvitnikh zakladiv. – Kh.: Svit dytynstva,,2005. – 392 p.
4. V.O. Tadeyev. Geometriia 10 klas: pidruchnyk. – Ternopyl: Navchalna knyha – Bogdan. 2003.–384 p.
5. V.O. Tadeyev. Geometriia 10 klas: pidruchnyk. – Ternopyl: Navchalna knyha – Bogdan. 2004.–480 p.
6. M.I. Shkil, T.V. Kolesnyk, T. M. Khmara. Algebra i pochatky analizu: Pidruchnyk dlia 10 klasu z poglyblenym vyvchenniam matematyky v serednikh zakladakh osvity. – K.:Osvita, 2004. – 318 p.
7. M.I. Shkil, T.V. Kolesnyk, T. M. Khmara. Algebra i pochatky analizu: Pidruchnyk dlia 11 klasu z poglyblenym vyvchenniam matematyky v serednikh zakladakh osvity. – K.:Osvita, 2001. – 311 p.
8. M.I. Shkil, Z.I. Sliepkan, O.S. Dubnychuk. Algebra i pochatky analizu: Pidruchnyk dlia 10 klasu zahalnoosvitnikh zakladiv. – K.:Zodiak – EKO, 2002. – 272 p.
9. M.I. Shkil, Z.I. Sliepkan, O.S. Dubnychuk. Algebra i pochatky analizu: Pidruchnyk dlia 11 klasu zahalnoosvitnikh zakladiv. – K.:Zodiak – EKO 2006. – 384 p.