

Ministry of Education and Science of Ukraine
Kharkiv National Automobile and Highway University

APPROVED

Head of the admissions committee,

Acting Rector _____ Anzhelika BATRAKOVA

« _____ » _____ 2026

PROGRAM

of the entrance examination in Mathematics for admission to the "**Bachelor's**"
degree program for foreign citizens and stateless persons

Kharkiv – 2026

GENERAL PROVISIONS

The objectives of the entrance exam in mathematics are to assess the knowledge and skills of applicants:

- build mathematical models of real objects, processes and phenomena and investigate these models using mathematical tools;
- perform mathematical calculations (operations with numbers presented in different forms, operations with percentages, addition and solution of proportions, approximate calculations, etc.);
- perform expression transformations (understand the semantic meaning of each element of an expression, find permissible values of variables, find numerical values of expressions for given values of variables, express one variable in terms of others from the equality of two expressions, etc.);
- build and analyze graphs of functional dependencies, investigate their properties;
- solve equations, inequalities and their systems, text problems using equations, inequalities and their systems;
- depict and find geometric figures in figures, establish their properties and perform geometric constructions;
- find quantitative characteristics of geometric figures (lengths, angle sizes, areas);
- calculate probabilities of random events and solve the simplest combinatorial problems;
- analyze information presented in various forms (graphic, tabular, textual, etc.).

APPLICANTS MUST KNOW:

1. Real numbers and operations with them.
2. Rational, irrational, exponential, logarithmic, and trigonometric expressions.
3. Rational, irrational, power, exponential, logarithmic, trigonometric equations, inequalities and their systems. Application of equations, inequalities and their systems to solving text problems.
4. Linear, quadratic, power, exponential, logarithmic, trigonometric, inverse trigonometric functions, their properties and graphs.
5. Arithmetic and geometric progression and their properties.
6. Derivatives of elementary functions, differentiation rules.
7. Antiderivatives of elementary functions.
8. Definite integral (concept, Newton-Leibniz formula, application of the definite integral to calculating the areas of plane figures).
9. Elements of combinatorics (sum and product rules, combinations without repetitions).
10. Beginnings of probability theory (classical definition of the probability of a random event, combinatorial method of calculating classical probabilities).
11. Elements of mathematical statistics (selected characteristics of data series).
12. Planimetry:
 - the simplest geometric figures and their properties;
 - circle and circle;

- triangles (types of triangles and their properties; signs of equality; median, bisector, height and their properties; circle circumscribed around a triangle and inscribed in a triangle);
- quadrilaterals (parallelogram, rhombus, square, trapezoid and their properties; quadrilaterals inscribed in a circle and circumscribed around a circle);
- regular polygons and their properties;
- geometric quantities and their measurements;
- coordinates and vectors on the plane (distance between two points, coordinates of the midpoint of a segment, equations of a line and a circle, the concept of a vector and its length, conditions of collinearity and perpendicularity of vectors given by coordinates, scalar product of vectors and its properties);
- geometric transformations (signs of similarity of triangles, ratio of areas of similar figures).

13. Stereometry:

- line and plane in space;
- polyhedra and their elements, main types of polyhedra (prism, parallelepiped, pyramid, truncated pyramid);
- solids and surfaces of revolution and their elements; main types of solids and surfaces of revolution (cylinder, cone, truncated cone, ball, sphere);
- combinations of geometric solids;
- formulas for calculating surface areas and volumes of polyhedra and solids of revolution;
- coordinates and vectors in space.

APPLICANTS MUST BE ABLE TO:

1. Perform arithmetic operations.
2. Perform transformations of rational, irrational, power, exponential, logarithmic and trigonometric expressions according to known formulas and rules.
3. Solve rational, irrational, exponential, logarithmic and trigonometric equations, inequalities and their systems. Solve text problems using equations, inequalities and their systems.
4. Calculate derivatives and antiderivatives of elementary functions. Investigate functions for monotonicity in the simplest cases, find the extremum point, the largest and smallest value of a function on a segment.
5. Solve the simplest combinatorial and probability problems.
6. Solve planimetric and stereometric problems to find geometric quantities (lengths, angles, areas, volumes).
7. Perform operations on vectors and use the properties of these operations.

HAVE AN IDEA: about the application of mathematics to the construction and study of mathematical models of real objects, processes and phenomena.

GENERAL CHARACTERISTICS OF THE TEST COMPONENTS

ALGEBRA AND THE BEGINNINGS OF ANALYSIS

I. NUMBERS AND EXPRESSIONS

1. Natural numbers. Simple and composite numbers. Divisibility properties. Divisor, multiple. Greatest common divisor. Least common multiple.
2. Integers, rational and real numbers and operations with them. Root of the n th degree and arithmetic root of the n th degree, properties of roots. Power with natural, integer and rational exponents, properties of powers. Numerical intervals. Modulus of a real number and its properties. Ratios, proportions. Percentages. Problems on percentages.
3. Rational, irrational, power, exponential, logarithmic, trigonometric expressions and their transformations. Domain of permissible values of variables. Identities, identical transformations. Monomials and polynomials. Factorization of a polynomial. Rules for performing operations with algebraic fractions. Logarithms (definition and properties, basic logarithmic identity). Sine, cosine, tangent, cotangent of a numerical argument. Trigonometric identities. Reduction formulas. Addition formulas and consequences from them.

II. EQUATIONS, INEQUALITIES AND THEIR SYSTEMS

1. Equations with one variable, root (solution) of the equation. Inequality with one variable, solution of inequality. System of equations with two variables, solution of the system. Equivalent equations, inequalities and their systems.
2. Methods of solving rational, irrational, exponential, logarithmic, trigonometric equations, inequalities and their systems.
3. Application of equations, inequalities and their systems to solving text problems.

III. FUNCTIONS

1. Linear, quadratic, power, exponential, logarithmic, trigonometric, inverse trigonometric functions, their properties and graphs. Graph transformations.
2. The concept of a numerical sequence. Arithmetic and geometric progression. Formulas for the n th term and the sum of the first n terms of arithmetic and geometric progressions. Formula for the sum of an infinite geometric progression with the denominator $|q| < 1$.
3. The derivative of a function, its geometric and physical meaning. Derivatives of elementary functions. Rules for finding the derivative of the sum, difference, product, quotient of two functions. Derivative of a composite function.
4. Studying a function using the derivative. Construction of function graphs (sufficient conditions for the increase and decrease of a function on an interval, extrema of a function, the largest and smallest value of a function on an interval).

5. Antiderivative and definite integral. Definition of the antiderivative function. Antiderivatives of elementary functions. The concept of a definite integral. Newton-Leibniz formula. Application of a definite integral to calculating the areas of plane figures.

IV. ELEMENTS OF COMBINATORICS. BEGINS OF PROBABILITY THEORY AND ELEMENTS OF STATISTICS

1. Elements of combinatorics. Rules of sum and product. Combinations without repetitions (arrangements, permutations, combinations).
2. Beginnings of probability theory. Classical definition of the probability of a random event. Combinatorial method of calculating classical probabilities.
3. Elements of mathematical statistics. Definition of sample characteristics of data series (sample range, mode, median, mean). Graphical, tabular, textual forms of presentation of statistical information.

GEOMETRY

V. PLANIMETER

1. The simplest geometric figures and their properties. Point, line, segment, polyline, angle. Angle bisector and its properties. Parallel and perpendicular lines. Signs of parallelism of lines. Median perpendicular. Thales' theorem.
2. Circle and circle and their elements. Central, inscribed angles and their properties. Properties of two intersecting chords. Tangent to a circle and its properties.
3. Triangles, their types and basic properties. Signs of equality of triangles. Median, bisector, altitude of a triangle and their properties. Midline of a triangle and its properties. Circle circumscribed around a triangle and circle inscribed in a triangle. Pythagoras' theorem. Proportional segments of a right triangle. Relationship between sides and angles of a right triangle. Theorems of sines and cosines.
4. Quadrilateral and its properties. Parallelogram, properties and signs of a parallelogram. Rectangle, rhombus, square, trapezoid and their properties. The midline of a trapezoid and its property. Quadrilaterals inscribed in a circle and circumscribed around a circle.
5. Polygons and their elements. Regular polygon and its properties. Polygons inscribed in a circle and circumscribed around a circle.
6. Geometric quantities and their measurements. Length of a segment, circle and its arc. Measurement of angles. Perimeter of a polygon. Formulas for calculating the area of a triangle, parallelogram, rhombus, square, trapezoid, regular polygon, circle, circular sector.
7. Coordinates and vectors on the plane. Rectangular coordinate system, coordinates of a point. Distance between two points. Coordinates of the midpoint of a segment. Equations of a line and a circle. Concept of a vector, vector length. Vectors are equal, collinear. Operations with vectors. Conditions for collinearity and perpendicularity of vectors given by coordinates. The scalar product of vectors and its properties.

8. Geometric transformations. Types and content of geometric transformations on the plane. Signs of similarity of triangles. Ratio of areas of similar figures.

VI. STEREOMETRY

1. Lines and planes in space. Signs of parallelism of lines, a line and a plane, planes. Signs of perpendicularity of a line and a plane, two planes. Projection of an inclined plane onto a plane. Theorems about three perpendiculars (a line and its inverse). Distance from a point to a line, from a line to a parallel plane, between parallel lines (planes). Angle between lines, a line and a plane. Dihedral angle, linear angle of a dihedral angle.

2. Polyhedra and their elements. Main types of polyhedra (prism, parallelepiped, pyramid, truncated pyramid).

3. Solids and surfaces of revolution and their elements. Main types of solids and surfaces of revolution (cylinder, cone, truncated cone, ball, sphere).

4. Sections of polyhedra and solids of revolution by a plane.

5. Combinations of geometric bodies.

6. Formulas for calculating surface areas, volumes of polyhedra and solids of revolution.

7. Coordinates and vectors in space.

GENERAL ASSESSMENT OF THE ENTRANCE EXAMINATION

The total duration of the entrance examination is 60 minutes (1 hour). Each task of the entrance exam in mathematics contains 20 closed-ended test tasks with the choice of one correct answer from three proposed options. The results of the test tasks are assessed by awarding 5 points for each correctly selected answer.

After checking the tasks by members of the subject examination committees, the sum of the points awarded is determined on a scale from 100 to 200. The maximum sum of points that an applicant can receive based on the results of the entrance exam in mathematics is 200 points. The minimum number of points for admission to study is at least 115 points (on a scale from 100 to 200). Work that is rated below 115 points receives a grade of "unsatisfactory".

REFERENCES

1. Бевз В.Г. Зовнішнє незалежне оцінювання 2022. Математика. Комплексне видання. / В. Г. Бевз, О. І. Буковська. – Київ: Освіта, 2021. – 176 с.

2. Гап'юк О. НМТ 2025. Математика. Довідник-практикум (повний курс). / О. Гап'юк. – Тернопіль: Підручники і посібники, 2025. – 89 с.

3. Захарійченко Ю. О. Енциклопедія тестових завдань. Повний курс математики в тестах. / Ю. О. Захарійченко, О. В. Школьний, Л. І. Захарійченко, О. В. Школьна. – Харків : Ранок, 2019. – 496 с.

4.Захарійченко Ю. Математика. Тестовий зошит. Усе для підготовки до НМТ в режимі онлайн і офлайн / Ю. Захарійченко, О. Школьний, О. Роганін, В. Дергачов. – Харків : Ранок, 2024. – 128 с.

5.Захарійченко Ю. НМТ 2026. Математика. Повний комплекс тренувальний вправ. / Ю. Захарійченко, Л. Захарійченко, В. Репета. – Харків : Ранок, 2025. – 116 с.

6.Істер О. С. Математика. Комплексне видання для підготовки до НМТ 2025 / О. С. Істер. – Київ: Генеза, 2025. – 416 с.

7.Капіносов А. М. Зовнішнє незалежнє оцінювання. Довідник. Математика. Алгебра і геометрія / А. М. Капіносов. – Тернопіль: Підручники і посібники, 2021. – 400 с.

8.Капіносов А. М. Комплексне видання для підготовки до ЗНО і НМТ 2026. / А. М. Капіносов та ін. – Тернопіль: Підручники і посібники, 2025. – 448 с.

9.Капеняк І. Математика. Комплексна підготовка до ЗНО/НМТ / І. Капеняк, Я. Гринчишин, О. Мартинюк. – Тернопіль : Мозаїка, 2025. – 576 с.

10.Клочко І. Я. Математика. Тестові завдання. Частина І. Алгебра. ЗНО 2021 / І. Я. Клочко – Тернопіль: Навчальна книга. – Богдан, 2020. – 304 с.

11.Клочко І. Я. Математика. Тестові завдання. Частина ІІ. Алгебра і початки аналізу. ЗНО 2019 / І. Я. Клочко – Тернопіль: Навчальна книга. – Богдан, 2020. – 464 с.

12.Клочко І. Я. Математика. Тестові завдання. Частина ІІІ. Геометрія / І. Я. Клочко – Тернопіль: Навчальна книга. – Богдан, 2020. – 368 с.

13.Клочко І. Я. Математика. Тестові завдання. Частина ІV. Стереометрія. / І. Я. Клочко – Тернопіль: Навчальна книга. – Богдан, 2020. – 224 с.

14.Мартинюк О. М. Національний мультипредметний тест. Тестові завдання у форматі НМТ 2025 / О. М. Мартинюк. - Тернопіль: Підручники і посібники, 2024. – 96 с.

15.Математика. Довідник-практикум. / М. Я. Забелишинська, Ю. О. Захарійченко, В.В. Карпик. – 3-тє вид. – Х. : Вид-во «Ранок», 2024. – 224 с. – (Серія «Національний мультипредметний тест»).

The program was reviewed and approved at the meeting of the Department of Department of High Mathematics, Classical and Applied Mathematical Disciplines, minutes No. 8 of March 4, 2026.

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