

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
KHERSON STATE MARITIME ACADEMY



APPROVED

Chairman of the Admissions Committee
Chairman of KSMA

Viktor HUSIEV
_____ 2026

MATHEMATICS INTERVIEW PROGRAM

for Admission to Bachelor's Degree Programme for International Citizens

Higher Education Degree	Bachelor's Degree
Field of Study	J Transport and Services
Speciality	J5 Maritime and Inland Water Transport
Specialization	J5.01 Navigation and Ship Handling
	J5.02 Operation of Ship Technical Systems and Complexes
	J5.03 Operation of Ship Electrical Equipment and Automation Systems

KHERSON – 2026

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1. EXPLANATORY NOTE

The Mathematics Interview Programme for applicants seeking admission to the Bachelor's Degree Programme has been developed in accordance with the Laws of Ukraine “On Education”, “On Higher Education”, the Procedure for Admission to Higher Education Programmes in 2026, and the Admission Rules of Kherson State Maritime Academy for 2026.

The Programme is based on the current Mathematics curricula for general secondary education institutions approved by the Ministry of Education and Science of Ukraine. The content of the Programme covers the principal sections of the secondary school Mathematics course and defines the requirements for the level of applicants’ theoretical preparation, practical skills and competencies, as well as logical reasoning abilities.

The purpose of the interview is to determine the level of applicants’ mathematical preparedness for participation in the competitive admission process for obtaining a Bachelor's Degree at Kherson State Maritime Academy.

The interview includes a set of comprehensive tasks of varying complexity aimed at assessing applicants’ mastery of fundamental mathematical concepts, laws, rules, and methods; their ability to apply theoretical knowledge when solving mathematical problems; and their capacity to present mathematical reasoning in a logical, consistent, and well-argued manner.

The interview programme is intended to assess an applicant’s readiness for study at a higher education institution.

During the Mathematics interview, an applicant must demonstrate:

Knowledge of mathematical concepts, definitions, theorem statements, rules, and criteria prescribed by the Programme;

The ability to present mathematical reasoning logically, accurately, and consistently in both oral and written forms using appropriate mathematical notation and symbolism;

Proficiency in practical mathematical skills and competencies required for solving problems of various levels of complexity.

For the purpose of conducting the Mathematics entrance assessment in the form of an interview, a Subject Examination Board shall be established by order of the Rector of Kherson State Maritime Academy. The Board shall consist of the Chairperson and appointed Examiners.

2. INTERVIEW STRUCTURE

The Mathematics entrance examination for applicants seeking admission to the Bachelor's Degree Programme at Kherson State Maritime Academy is conducted in the form of an interview consisting of a written test component and an oral component. The purpose of the interview is to assess applicants' theoretical and practical knowledge of Mathematics, as well as their ability to think logically, analyse mathematical concepts, and apply acquired knowledge in solving mathematical problems.

Structure of the Entrance Examination

1. Written Test Component

The written test component consists of 10 multiple-choice questions, each requiring the selection of one correct answer.

The questions cover the main areas of the secondary school Mathematics curriculum:

- Algebra and the Fundamentals of Mathematical Analysis;
- Plane Geometry;
- Solid Geometry;
- Elements of Combinatorics and Probability Theory.

Each correctly answered question is awarded **10 points**.

The maximum score for the written test component is **100 points**.

2. Oral Component

The oral component includes:

- one theoretical question in Algebra;
- one theoretical question in Geometry;
- one practical problem.

During the oral examination, applicants must demonstrate:

- knowledge of fundamental mathematical concepts, definitions, theorems, and formulas;
- the ability to present mathematical reasoning logically and coherently;
- skills in applying mathematical methods to problem-solving;
- proficiency in mathematical terminology and notation.

Where necessary, examiners may ask additional clarifying questions within the scope of the interview programme.

The maximum score for the oral component is **100 points**.

The maximum overall score for the entrance examination is **200 points**.

3. REQUIREMENTS FOR KNOWLEDGE, SKILLS, AND COMPETENCIES

The purpose of the Mathematics interview is to assess the knowledge, skills, and competencies of applicants. Applicants must demonstrate:

- a thorough knowledge of the definitions, mathematical concepts, terminology, statements of rules, criteria, and theorems prescribed by the Programme, as well as the ability to prove and justify them;
- the ability to express mathematical ideas accurately and clearly in both oral and written forms using appropriate mathematical notation and symbolism;
- confident command of the practical mathematical skills and competencies required by the Programme, together with the ability to apply them effectively in solving mathematical problems.

Section / Topic	Applicants Should Know	Subject-Specific Skills
ALGEBRA AND THE FUNDAMENTALS OF MATHEMATICAL ANALYSIS		
Section: NUMBERS AND EXPRESSIONS		
Real Numbers (Natural Numbers, Integers, Rational and Irrational Numbers), Their Comparison and Operations. Number Sets and Relationships Between Them.	• properties of operations with real numbers; • rules for comparing real numbers; • divisibility rules for natural numbers by 2, 3, 5, 9, and 10; • rules for rounding integers and decimal fractions; • the definition of the nth root and the arithmetic nth root; • properties of roots; • the definition of powers with natural, integer, and rational exponents, and their properties; • numerical intervals; • the absolute value of a real number and its properties.	• distinguish between different types of numbers and numerical intervals; • compare real numbers; • perform operations with real numbers; • apply divisibility rules; • determine the quotient and remainder when dividing one natural number by another; • convert a common fraction into a decimal fraction and a repeating decimal into a common fraction; • round integers and decimal fractions; • apply the properties of absolute value in solving mathematical problems.
Ratios and Proportions. Percentages. Basic Percentage Problems.	• ratios and proportions; • the fundamental property of a proportion; • the definition of a percentage; • rules for performing percentage calculations.	• determine the ratio of two numbers expressed as a percentage, calculate a percentage of a number, and find a number from the value of its percentage; • solve problems involving percentage calculations and proportions.
Rational, Irrational, Power, Exponential, Logarithmic, and Trigonometric Expressions and Their Transformations	• - the definition of the domain of permissible values of the variables in an expression; • the definitions of identically equal expressions, identity transformations of expressions, and identities; • the definitions of a monomial and a polynomial; • rules for the addition, subtraction, and multiplication of monomials and polynomials; • algebraic identities; • factorization of polynomials; • the definition of an algebraic fraction;	perform identity transformations of rational, irrational, power, exponential, logarithmic, and trigonometric expressions, and determine their numerical values for given values of the variables.

	• rules for performing operations with algebraic fractions; • the definition and properties of logarithms; common and natural logarithms; • the fundamental logarithmic identity; • the definitions of the sine, cosine, tangent, and cotangent of a numerical argument; • the fundamental logarithmic identity and its consequences; • reduction formulas; • addition formulas and their consequences.	
Section: EQUATIONS, INEQUALITIES, AND THEIR SYSTEMS		
Linear, Quadratic, Rational, Irrational, Exponential, Logarithmic, and Trigonometric Equations, Inequalities, and Their Systems. Application of Equations, Inequalities, and Their Systems to Solving Word Problems.	• equations in one variable; the definition of a root (solution) of an equation in one variable; • inequalities in one variable; the definition of a solution of an inequality in one variable; • the definition of a solution of a system of equations in two variables and methods for solving such systems; • equivalent equations, inequalities, and their systems; • methods for solving rational, irrational, exponential, logarithmic, and trigonometric equations.	• solve first- and second-degree equations and inequalities, as well as equations and inequalities reducible to them; • solve systems of first- and second-degree equations and inequalities, as well as systems reducible to them; • solve equations containing trigonometric expressions; • solve irrational equations and inequalities; • apply general methods and techniques (factorization, substitution, and the use of function properties) in solving equations, inequalities, and their systems; • use graphical methods for solving and analysing equations, inequalities, and their systems; • apply equations, inequalities, and their systems to solving word problems; • solve equations and inequalities containing a variable under the absolute value sign;

		• solve equations, inequalities, and systems involving parameters.
Section: FUNCTIONS		
Linear, Quadratic, Power, Exponential, Logarithmic, and Trigonometric Functions and Their Fundamental Properties. Numerical Sequences.	• the definition of a function, the domain and range of a function, and the graph of a function; • methods of defining a function; the fundamental properties and graphs of the functions specified in the topic title; • the definition of the inverse function of a given function; • the definitions of arithmetic and geometric progressions; • formulas for the nth term of an arithmetic progression and a geometric progression; • formulas for the sum of the first n terms of an arithmetic progression and a geometric progression; • the formula for the sum of an infinite geometric progression with common ratio ($q < 1$).	• determine the domain and range of a function; • investigate a function for evenness (oddness) and periodicity; • construct graphs of the elementary functions specified in the topic title; • identify the properties of numerical functions given by a formula or a graph; • apply transformations of function graphs; • solve problems involving arithmetic and geometric progressions.
Derivative of a Function, Its Geometric and Physical Interpretation. Derivatives of Elementary Functions. Rules of Differentiation.	• the equation of the tangent line to the graph of a function at a given point; • the definition of the derivative of a function at a point; • the geometric and physical interpretation of the derivative; • the table of derivatives of elementary functions; • rules for finding the derivative of the sum, product, and quotient of two functions; • the chain rule for finding the derivative of a composite function.	• determine the slope and the angle of inclination of the tangent line to the graph of a function at a given point; • find derivatives of elementary functions; • determine the numerical value of the derivative of a function at a point for a given value of the argument; • find the derivative of the sum, product, and quotient of two functions; • find the derivative of a composite function; • solve problems using the geometric and physical interpretation of the derivative.
Investigation of Functions Using	• the sufficient condition for a function to be increasing (decreasing) on an interval; • extremes of a function;	• determine intervals of monotonicity of a function;

Derivatives. Graphing Functions.	the definition of the maximum and minimum values of a function.	- find the extremes of a function using derivatives, as well as its maximum and minimum values; - investigate functions using derivatives and construct their graphs; - solve applied problems involving the determination of maximum and minimum values.
Antiderivative and Definite Integral. Application of the Definite Integral to Calculating the Areas of Curvilinear Trapezoids.	- the definitions of an antiderivative, a definite integral, and a curvilinear trapezoid; - the table of antiderivatives; - rules for finding antiderivatives; - the Newton–Leibniz formula.	- find antiderivatives and apply their fundamental properties; - apply the Newton–Leibniz formula to evaluate definite integrals; - calculate the area of a curvilinear trapezoid using a definite integral; - solve simple applied problems involving the evaluation of integrals.
Section: ELEMENTS OF COMBINATORICS, FUNDAMENTALS OF PROBABILITY THEORY, AND ELEMENTS OF STATISTICS.		
Permutations. The Addition and Multiplication Principles of Combinatory. Probability of a Random Event. Sample Characteristics.	- the definition of a permutation; - the addition and multiplication principles of combinatory; - the classical definition of the probability of an event; the simplest cases of calculating probabilities of events; - the definitions of sample characteristics of data sets (range, mode, median, and mean); - graphical, tabular, textual, and other forms of presenting statistical information.	- solve basic combinatorial problems; - calculate the probabilities of random events in simple cases; - calculate and analyse sample characteristics of data sets (range, mode, median, and mean).
GEOMETRY		
Section: PLANE GEOMETRY.		
The Simplest Geometric Figures in the Plane and Their Properties.	- the concepts of a point and a line, a ray, a line segment, a polyline, and an angle; - the axioms of plane geometry;	apply the definitions, criteria, and properties of the simplest geometric figures in solving plane geometry problems and practical problems.

	• adjacent and vertical angles; the angle bisector; • properties of adjacent and vertical angles; • the property of an angle bisector; • parallel and perpendicular lines; • a perpendicular and an oblique line, the perpendicular bisector of a segment, the distance from a point to a line; • criteria for parallel lines; • Thales' theorem and the generalized Thales' theorem.	
Circle and Disk.	• a circle, a disk, and their elements; • central and inscribed angles and their properties; • properties of two intersecting chords; • tangents to a circle and their properties.	• apply the acquired knowledge to solving plane geometry problems and practical problems.
Triangles.	• types of triangles and their fundamental properties; • criteria for triangle congruence; • the median, angle bisector, and altitude of a triangle and their properties; • the theorem on the sum of the angles of a triangle; • the triangle inequality; • the midline of a triangle and its properties; • the circumscribed circle and the inscribed circle of a triangle; • the Pythagorean theorem; proportional segments in a right triangle; • relationships between the sides and angles of a right triangle; • the Law of Sines; • the Law of Cosines.	• classify triangles according to their sides and angles; • solve triangles; • apply the definitions and properties of different types of triangles in solving plane geometry problems and practical problems; • determine the radii of the circumscribed circle and the inscribed circle of a triangle.
Quadrilaterals.	• a quadrilateral and its elements; • a parallelogram and its properties; • criteria for a parallelogram;	• apply the definitions, criteria, and properties of various types of quadrilaterals in solving plane geometry problems and practical problems.

	• a rectangle, a rhombus, a square, and a trapezoid and their properties; • the midline of a trapezoid and its properties; • polygons inscribed in a circle and circumscribed about a circle.	
Polygons.	• a polygon and its elements; a convex polygon; • the perimeter of a polygon; • the sum of the interior angles of a convex polygon; • a regular polygon and its properties; • polygons inscribed in a circle and circumscribed about a circle.	• apply the definitions and properties of polygons in solving plane geometry problems and practical problems.
Geometric Quantities and Their Measurement.	• the length of a line segment, a circle, and its arc; • the measure of an angle and angle measurement; • the perimeter of a polygon; • formulas for calculating the areas of a triangle, parallelogram, rhombus, square, trapezoid, regular polygon, circle, and sector.	• determine the lengths of line segments, angle measures in degrees and radians, and the areas of geometric figures; • calculate the circumference of a circle and the lengths of its arcs, as well as the area of a circle and a sector; • apply formulas for the areas of geometric figures in solving plane geometry problems and practical problems.
Coordinates and Vectors in the Plane.	• the Cartesian coordinate system in the plane and the coordinates of a point; • the formula for calculating the distance between two points and the formula for determining the coordinates of the midpoint of a line segment; • equations of a line and a circle; • the concept of a vector, the magnitude of a vector, collinear vectors, equal vectors, and vector coordinates; • vector addition, vector subtraction, and multiplication of a vector by a scalar; • the scalar (dot) product of vectors and its properties;	• apply coordinates and vectors in solving plane geometry problems and practical problems.

	- formulas for finding the angle between vectors given by their coordinates; - conditions for collinearity and perpendicularity of vectors given by their coordinates.	
Geometric Transformations.	- the main types and concepts of geometric transformations in the plane (motion, symmetry with respect to a point and a line, rotation, translation, similarity transformation, and homothety); - criteria for the similarity of triangles; - the ratio of the areas of similar figures.	apply the properties of the main types of geometric transformations and the criteria for triangle similarity in solving plane geometry problems and practical problems.
Section: STEREOMETRY.		
Lines and Planes in Space.	- the axioms and theorems of stereometry; - the relative positions of lines in space, a line and a plane in space, and planes in space; - criteria for the parallelism of lines, a line and a plane, and planes; - parallel projection; - criteria for the perpendicularity of a line and a plane, and of two planes; - the projection of an oblique line onto a plane; orthogonal projection; - the direct and converse Three Perpendiculars Theorems; - the distance from a point to a plane, from a point to a line, from a line to a plane parallel to it, between parallel lines, between parallel planes, and between skew lines; - the criterion for skew lines; - the angle between lines, between a line and a plane, and between planes.	- apply the definitions, criteria, and properties of parallel and perpendicular lines and planes in solving stereometric problems and practical problems; - determine the specified distances and angle measures in space.
Polyhedra, Solids of Revolution, and Surfaces of Revolution.	- the dihedral angle and the linear angle of a dihedral angle; - polyhedra and their elements; the main types of polyhedra: prism, parallelepiped, pyramid, and frustum of a pyramid; - solids and surfaces of revolution and their elements; the	- solve problems involving the calculation of surface areas and volumes of geometric solids; - identify the type of geometric solid from its net; - apply the definitions and properties of the main

	main types of solids and surfaces of revolution: cylinder, cone, frustum of a cone, and sphere; • cross-sections of polyhedra and solids of revolution by a plane; • combinations of geometric solids; • formulas for calculating the surface areas and volumes of polyhedra and solids of revolution.	types of polyhedra, solids of revolution, and surfaces of revolution in solving stereometric problems and practical problems.
Coordinates and Vectors in Space.	• the Cartesian coordinate system in space and the coordinates of a point; • the formula for calculating the distance between two points and the formula for determining the coordinates of the midpoint of a line segment; • the concept of a vector, the magnitude of a vector, collinear vectors, equal vectors, and vector coordinates; • vector addition, vector subtraction, and multiplication of a vector by a scalar; • the scalar (dot) product of vectors and its properties; • the formula for finding the angle between vectors given by their coordinates; • conditions for the collinearity and perpendicularity of vectors given by their coordinates.	• determine the coordinates of the midpoint of a line segment and the distance between two points; • perform operations with vectors; • calculate the scalar (dot) product of vectors; • apply coordinates and vectors in solving stereometric problems and practical problems.

4. ASSESSMENT CRITERIA

The structure of the interview programme covers the entire content of the mathematics course.

The assessment of applicants' mathematical proficiency is carried out in two areas: the level of mastery of theoretical knowledge and the quality of practical skills and abilities, including the ability to apply the acquired knowledge when solving mathematical problems.

Structure of the Examination Ticket and Assessment Criteria

The entrance examination in Mathematics at the Kherson State Maritime Academy is conducted in the form of an interview consisting of a written test component and an oral component.

The maximum score for the entrance examination is 200 points.

1. Written Test Component

The written test component consists of 10 multiple-choice questions, each with one correct answer. Each correctly completed test item is worth 10 points.

The maximum score for the written test component is 100 points.

2. Interview Component

The interview component includes:

- one theoretical question in Algebra;
- one theoretical question in Geometry;
- one practical problem.

Answers to the theoretical questions are provided without prior preparation.

Distribution of Points for the Oral Component:

Type of Task	Maximum Number of Points
Theoretical Question in Algebra	30 Points
Theoretical Question in Geometry	30 Points
Practical Problem	40 Points

The maximum score for the Oral Examination Component is 100 points.

Assessment Criteria for Theoretical Questions

When assessing theoretical responses, the following criteria are taken into account:

- correctness and completeness of the answer;
- understanding of mathematical concepts and relationships;

- logical consistency and coherence of presentation;
- command of mathematical terminology;
- ability to apply theoretical knowledge in practice.

An applicant may receive a partial score if he or she:

- correctly identifies the appropriate approach to the answer;
- demonstrates an understanding of the fundamental material;
- makes minor errors or inaccuracies;
- provides an answer with limited guidance from the examiner.

Assessment Criteria for the Practical Problem

When assessing the practical problem, the following criteria are taken into account:

- correctness of the selected solution method;
- justification of the mathematical procedures used;
- consistency and logical structure of the solution;
- correctness of the final answer.

The overall score is determined on the basis of a discussion by the members of the Subject Examination Board of their individual assessments of the applicant's responses. The final grade is awarded by a collective decision of the Board.

5. RECOMMENDED LITERATURE

Mathematics textbooks and study guides recommended by the Ministry of Education and Science of Ukraine.

1. Apostolova, H.V. *Geometry* (Academic and Advanced Level), Grade 11. Kyiv: Heneza, 2011.
2. Apostolova, H.V. *Geometry*, Grade 7. Kyiv: Heneza, 2008.
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19. Burda, M.I., Kolesnyk, T.V., Malovanyi, Yu.I., Tarasenkova, N.A. *Mathematics (Standard Level)*, Grade 10. Zodiac-ECO, 2010.
20. Burda, M.I., Tarasenkova, N.A. *Geometry*, Grade 7. Zodiac-ECO; Osvita Publishing House, 2007, 2011.

Additional Literature

1. *Mathematics. Curriculum for General Secondary Education Institutions: Grades 5–11*. Ministry of Education and Science of Ukraine. Kyiv, 2023.
2. *National Multi-Subject Test (NMT) Mathematics Programme*. Ukrainian Center for Educational Quality Assessment. Kyiv, 2025.
3. Merzliak, A.H., Nomirovskyi, D.A., Polonskyi, V.B., Yakir, M.S. *Mathematics: Algebra and Elements of Mathematical Analysis (Standard Level)*. Kharkiv: Himnaziia, 2019.
4. Ister, O.S. *Algebra and Elements of Mathematical Analysis*. Kyiv: Heneza, 2020.
5. Burda, M.I., Tarasenkova, N.A. *Geometry*. Kyiv: Orion, 2021.
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Approved at the meeting of the Department
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**Chairperson of the
Subject Examination Board**



Tetiana Spychak.