	Federal State-Funded Educational Institution of Higher Professional Education **Volga State University of Technology**
	Entry Examination Scheme
	Higher Education – Bachelor Degree Program **Higher Education – Specialist Degree Program**

APRROVED BY
Rector of VOLGATECH
_____ I.V. Petukhov
"25" 10 2024

MATHEMATICS ENTRY EXAMINATION SCHEME

Reviewed at the meeting of the Subject Examination Panel for Mathematics and Applied Mathematics,
Minutes No.1 of October 28, 2024

2024

	Position	***Full Name / Signature***	***Date***
Developed by	*Chairman of the Subject Examination Panel for Mathematics and Applied Mathematics*	*I.V. Zhuravleva/*	25.10.24
Approved by	*First Vice-Rector*	*A.A. Rozhentsov/*	25.10.24
Valid until re-approval			

Re-approved			
		Full Name / Signature	***Date***
Approved by	*Meeting of the Subject Examination Panel for Mathematics and Applied Mathematics, Minutes No.1 of _____ __, 20__ Chairman of the Subject Examination Panel*		
Agreed with			
Re-approved			
		Full Name / Signature	***Date***
Approved by	*Meeting of the Subject Examination Panel for Mathematics and Applied Mathematics, Minutes No.1 of _____ __, 20__ Chairman of the Subject Examination Panel*		
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Agreed with			
Valid until re-approval			

INTRODUCTION

The scheme is designed for Bachelor or Specialist Degree Program applicants who achieved secondary general education grade and who are eligible to undertake general education entry examinations conducted by the university independently, in accordance with the current Rules for Admission to the Federal State-Funded Educational Institution of Higher Education Volga State University of Technology.

The scheme contains a list of the main topics recommended for preparing for entry examinations in Mathematics.

The scheme includes a demo version of an examination paper (test), a marking scale for evaluating examination papers (tests).

The examination paper contains 10 tasks is to be completed within 60 minutes. The level of complexity of the first 8 tasks of the test paper requires the basic knowledge, they are similar to the tasks of Part 1 of the Unified State Examination. The level of complexity of the 2 final tasks of the test paper corresponds to that of Part 2 tasks of the Unified State Examination. All 10 tasks are of an open type, which require the detailed solution.

I. MAIN TOPICS IN MATHEMATICS TO PREPARE FOR ENTRY EXAMINATION

This scheme contains a list of concepts, facts and methods to be known by applicant to perform the test paper in Mathematics.

SECTION 1. ARITHMETIC, ALGEBRA

1. Natural and integer numbers. Prime and Composite Numbers.
2. Divisor, multiple. The greatest common divisor (GCD) and the lowest common multiple (LCM). Signs of divisibility by 2, 3, 4, 5, 9 and 10. Division with a remainder.
3. Rational and irrational numbers. Actions with fractions.
4. Representation of numbers on a straight line. Absolute magnitude (module) of a number, its geometric meaning.
5. Reduced multiplication formulas.
6. Power with integer and rational exponents, raising to a power.
7. Logarithms and their properties, decimal and natural logarithms.
8. Function, its scope and set of values.
9. Basic elementary functions (linear, quadratic, power, exponential, logarithmic, trigonometric), their properties and graphs.
10. Equations and systems of equations. Equivalence of equations and systems.
11. Quadratic equations and their reductions. Vieta theorem.
12. Irrational equations. Equations with modules.

13. Logarithmic and exponential equations and systems, equation-solving techniques.
14. Analysis and solution of equations and systems of equations with a parameter.
15. Solving text problems for compiling equations and systems of equations.
16. Arithmetic and geometric progressions. Formulas for the n^{th} term and sums of the first n terms.
17. Inequalities and systems of inequalities. Equivalence of inequalities and systems of inequalities. Interval method for solving inequalities.
18. Square, irrational, logarithmic, illustrative inequalities and systems.

SECTION 2. INTRODUCTION TO MATHEMATICAL ANALYSIS

1. Functions and their graphs. Even parity, odd parity.
2. Derivative of a function, its geometric meaning.
3. Derivative of the sum, product and quotient of two functions. Derivative of a complex function.
4. Derivatives of basic elementary functions (power, exponential, logarithmic, trigonometric).
5. The geometric meaning of the derivative. The equation of the tangent to the graph of the function.
6. Analysis of a function using a derivative.
7. Finding the largest and smallest values of the function on a segment.

SECTION 3. TRIGONOMETRY

1. Degree and radian angle measures.
2. Functions $y = \sin x$, $y = \cos x$, $y = tgx$, $y = ctgx$. Their properties and graphs.
3. Basic trigonometric formulas: basic identities; functions of the sum of arguments; double and half angle formulas; converting a sum to a product and vice versa; reduction formulas.
4. Solving simple equations like: $\sin x = a$, $\cos x = a$, $tgx = a$ and equations reducible to them.
5. Finding solutions (or the number of solutions) to an equation in a given interval.

SECTION 4. GEOMETRY (PLANIMETRY)

1. Properties of an isosceles triangle.
2. Properties of points equidistant from the ends of a segment.
3. Properties of points equidistant from the sides of an angle.
4. Centers of the inscribed and circumscribed circles of a triangle.
5. Medians of a triangle, their division at the point of intersection.
6. Bisectors of a triangle, dividing the sides by bisectors.
7. Tangent to a circle, properties of a tangent.
8. Measurement of an angle inscribed in a circle.

9. Secant of the circle, properties of a secant.
10. Properties of inscribed and circumscribed quadrilaterals.
11. Properties of parallel lines. Parallelogram features.
12. Properties of a rhombus. Trapezoid properties.

References:

1. Mathematics: Handbook for MarSTU rapid form of accelerated learning applicants. Compiled by L.N. Sharafutdinova, Yu.A. Fomina, L.V. Nikolayeva. – 4th ed. - Yoshkar-Ola: MarGTU, 2008. - 44 p.
2. Algebra. 8th Grade. Textbook. Mordkovich A.G. (2010, 215 p.)
3. Algebra. 8th Grade. Task book. Mordkovich A.G. et al. (2010, 271 p.)
4. Algebra. 9th Grade. Textbook. Mordkovich A.G., Semenov P.V. (2010, 224 p.)
5. Algebra. 9th Grade. Task book. Mordkovich A.G. et al. (2010, 223 p.)
6. Algebra and Introductory Calculus. Grades 10-11. Textbook. Mordkovich A.G. (2001, 335 p.)
7. Algebra and Introductory Calculus. Grades 10-11. Task book. Mordkovich A.G. (2001, 315 p.)
8. Algebra and Introductory Calculus. Grades 10-11. Textbook. Kolmogorov A.N. et al. (2008, 384 p.)
9. Independent and test papers in Algebra and Introductory Calculus for Grades 10-11.
Ershova A.P., Goloborodko V.V. (2005, 208 p.)
10. Algebra and Introductory Calculus. Grade 10. Didactic materials. Potapov M.K., Shevkin A.V. (2008, 159 p.)
11. Algebra and Introductory Calculus. Grade 11. Didactic materials. Potapov M.K., Shevkin A.V. (2008, 189 p.)
12. Algebra and Introductory Calculus. Didactic materials for Grade 11. Ivlev B.M. et al. (2007, 192 p.)
13. Didactic materials in algebra and mathematical analysis with answers and solutions for Grades 10-11. Ryzhik V.I., Cherkasova T.Kh. (2008, 428 p.)
14. Compendium of tasks for preparing and conducting written examinations in Mathematics, Algebra and Introductory Calculus. Grade 11. Dorofeyev G.V. et al. (2008, 160 p.)
15. Geometry. Grades 7-9. Textbook. Atanasyan L.S. et al .(2010, 384 p.)
16. Geometry. Grades 10-11. Textbook. Atanasyan L.S. et al. (2009, 255 p.)
17. Geometry. Textbook for Grades 7-9. Pogorelov A.V. (2001, 224 p.)
18. Geometry. Textbook for Grades 7-11. Pogorelov A.V. (1995, 383 p.)
19. We repeat and systematize the school course of Algebra and Introductory Calculus. Kramor V.S. (1990, 416 p.)

Contents of the Examination Paper in Mathematics

1. Simple mathematical problems.

2. Graphs and charts.

3. Square lattice, coordinate plane.

4. *Probability theory.*
5. *Planimetry.*
6. *Derivative of a function, applications of the derivative.*
7. *Calculations and transformations.*
8. *Stereometry.*
9. *Equations.*
10. *Inequalities.*

III. DEMONSTRATION VERSION OF THE EXAMINATION PAPER (TEST)

Ministry of Science and Higher Education of the Russian Federation
Volga State University of Technology
Test in Mathematics
Run time 60 minutes

Form No. 024 Code _____

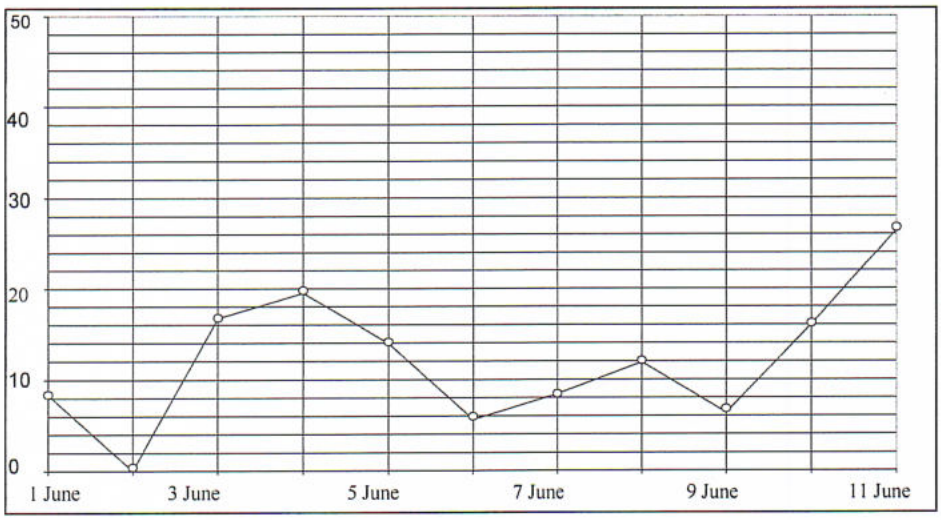
Direction: For each task, give a <u>complete solution</u> and the answer.

1) The dress cost 2,700 rubles. Then the price was reduced by 15%. How many rubles of change from 2,500 rubles should the customer receive when buying this dress after the price reduction?

Answer:_____

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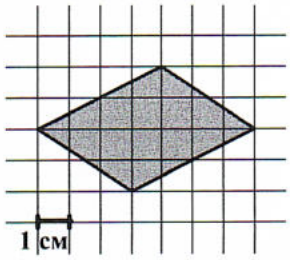
2) The figure shows the average rainfall for 11 days in June. Dates are given horizontally, rainfall amounts (in mm) are given vertically. Using the figure determine how many days had precipitations **not less** than normal (the norm for June is 8 mm).



Answer:_____

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3) Find the area of the parallelogram drawn on checkered paper with a cell size of 1 *cm* x 1 *cm*. Give your answer in square centimeters.



Answer:_____

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4) There are 7 red, 3 green, 6 blue and 4 black pencils in a pencil case. Dima randomly takes one pencil. Find the probability that it is a blue pencil.

Answer:_____

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5) Find the circumference of the circle inscribed in a regular triangle with a perimeter of 18 cm.

Answer:_____

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6) The body moves in a straight line so that the distance S (in meters) from it to the point M of this straight line changes according to the law: $s(t) = 0{,}5t^2 + 4t + 8$ (t – movement time in seconds). How many seconds after the start of motion will the body's velocity be 5 m/s in?

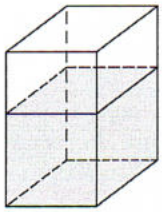
Answer:_____

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7) Simplify the expression: $\frac{a}{a+2} - \frac{a^2+6}{a^2-a-6}$.

Answer:_____

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8) 

The vessel is of a rectangular parallelepiped shape, the base of the vessel is a square. The liquid level in the vessel reaches 12 cm. Find the height of the liquid level if poured into another similar vessel, the base side of which being 2 times larger than that of the first vessel.

Answer:_____

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9) Solve the equation: $2\sin^2 x + 3\cos^2 x + 2\sin x = 0$.

Answer:_____

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10) Solve the inequality: $3^{\frac{x+3}{3}} - 13 \cdot 3^{\frac{x}{6}} + 4 \le 0$

Answer:_____

IV. MARKING SCALE OF EXAMINATION PAPERS (TESTS)

Papers are evaluated on a 100-point scale.
Each task is scored from 0 to 10 points:

10 points - the task was completed correctly with all the necessary justifications;

8-9 points - the task as a whole was completed correctly, a typo or a minor inaccuracy being present;

7 points - when solving the task, an error was made that did not affect the answer;

5 points - when solving the task, an error was made that affected the answer, for example, the loss of part of the solution or the inclusion of extraneous solutions;

3 points - the method of solving the task is chosen correctly, there are elements of the correct solution;

1 point - there is only an idea for solving the task, not a single stage has been completed;

0 points - the applicant did not start the task, or gross errors were made.

Each paper is checked by the examination panel, i.e. one of the members of the subject panel checks one part of the assignments of all applicants, the other member of the panel checks the other part, etc. Points for the task are set in a table on a separate form, attached to the examination paper with tasks and answers, signed by the member of the subject panel who verified the completion of the task.

The final score for the paper is calculated by summing the scores for the tasks. The final score is set on the first page of the paper signed by the chairman of the subject panel.