Specification of the test on Mathematics for Unified National Testing and Complex Testing

(Approved for use in the Unified National Testing and Complex Testing from 2018)

The document was developed in accordance with the State Educational Standards of secondary education and with educational programs in general subjects

- **1.** The purpose of the development of the test: Determination of preparedness level of entrants for Mathematics to admit to higher educational institutions of the Republic of Kazakhstan.
- **2.** The content of the test: The test consists of 30 test items. There are 3 difficulty levels, which are as follows: 15 test items of the first level, 8 of the second level, 7 of the third level.

The test includes educational material of Mathematics in accordance with the curriculum for the general education school.

№	Chapter	№	Topic	№	Subtopic
01	Arithmetic evaluations. Working with	01	Arithmetic evaluations. Operations with numbers. Operations	01	Operations on natural and rational numbers. Operations on Fractions and Decimals. Repeating Decimals
	Expressions		with fractions. Prime and Composite Numbers	02	Prime and Composite Numbers. Greatest Common Divisor and Least Common Multiple
				03	Mixed problems
		02	Percentage. Basic problems related to percentage. Proportion (Direct and Inverse Proportion)	01	Finding a percentage of a number. Finding a number with given percentage. Finding a percentage from the ratio
		03	Formulas. Basic Identities. Power of a fraction. Factorization	01	Degree of monomials and polynomials, their standard forms. Operations on polynomials
			of polynomials. Simplifying algebraic expressions.	02	Factorization of quadratic trinomial. Factorization of polynomials by taking out a common factor. Factorization by grouping. Working with polynomials. Basic Identities
				03	Rational Expressions and operations on rational expressions.
				04	Mixed problems
		04	Operations on radicals. Expressions involving numbers and variables.	01	Square root. Irrational number. Simplifying expressions with square roots. Mixed and Pure Radicals
				02	Rationalizing denominators.
				03	Mixed problems
		05	Absolute values	01	Absolute value of a number. Working with expressions involving absolute value.
		06	Operations on Powers	01	Operations on Powers (Exponents)
				02	Basic properties of exponential expressions. Working with exponential expressions

		07	Properties of logarithms. Working with logarithmic expressions.	01	Evaluating logarithm of a number. Working with functions involving logarithm.
		08	Trigonometric identities	01	Degree and Radian angle measures. Sine, Cosine, Tangent and Cotangent of angles
				02	Trigonometric Identities. Simplifying trigonometric expressions
				03	Finding the value of expressions involving inverse trigonometric functions
				04	Mixed problems
02	Equations	01	Linear Equations	01	Linear equations with one variable
				02	Linear equations with 2 variables
		02	Quadratic Equations and equations reducible to quadratic form.	01	Quadratic equations. Viet's theorem. Deriving quadratic equations. Equations reducible to quadratic form
			Equations of higher order	02	Special cases of quadratic equations. Biquadratic Equations
		03	Equations involving	01	Basic equations involving absolute
			absolute value		value
				02	Equations involving more than two absolute values
		04	Rational equations	01	Rational equations of the form $P(x)=0$. Rational equations of the form $P(x)/Q(x)=0$
		05	Trigonometric	01	Simplest trigonometric equations
			equations	02	Trigonometric equations
		06	Exponential equations	01	Simplest exponential equations
				02	Exponential equations
		07	Irrational equations (A group problems only)	01	Irrational equations
		08	Logarithmic equations	01	Simplest logarithmic equations
				02	Logarithmic equations
		09	Mixed equations	01	Mixed equations
03	Systems of	01	Systems of linear	01	Systems of linear equations with two
	equations		equations	L	variables
		02	Systems of nonlinear equations	01	Systems of nonlinear equations with 2 variables
		03	Systems of	01	Systems of equations, where one
			trigonometric equations		trigonometric equation
				02	Systems of equations, where both
		04	Systems of exponential	01	equations are trigonometric Systems of equations, where one
		04	equations	UI	equation is exponential
			-1344-04-0	02	Systems of equations, where both
					equations are exponential

02 Systems of equations, where both equations are irrational 03 Mixed problems 04 Word problems 07 Mixed Systems of Equations 08 Systems of Equations 09 Systems of Equations 01 Mixed Systems of Equations 02 Systems of Equations 03 Mixed Systems of Equations 04 Mixed Systems of Equations 05 Problems on proportion, Problems on properniages, Basic mixture problems 06 Systems of Equations 07 Problems on properniages 08 Mixed problems 09 Problems on inverse proportion 09 Problems on precentages 09 Mixed problems 09 Mixed problems 09 Mixed problems 09 Motion problems, Work problems 09 Motion problems 00 Motion problems 00 Motion problems 01 Linear inequalities in one variable 02 Linear inequalities in 2 variables 04 Mixed problems 07 Mixed problems 08 Mixed problems 09 Mixed problems 09 Mixed problems 00 Mixed problems 01 Simplest inequalities involving absolute values 04 Rational inequalities 05 Mixed problems 06 Mixed problems 07 Mixed problems 08 Mixed problems 08 Mixed problems 09 Mixed problems 01 Mixed problems 02 Mixed problems 03 Mixed problems 04 Mixed problems 05 Mixed problems 06 Mixed problems 07 Mixed problems 08 Mixed problems 08 Mixed problems 09 Mixed problems 09 Mixed problems 09 Mixed problems 01 Mixed problems 02 Mixed problems 03 Mixed problems 04 Mixed problems 05 Mixed problems 06 Mixed problems 07 Mixed problems 08 Mixed problems 08 Mixed problems 09 Mixed probl			05	Systems of irrational equations	01	Systems of equations, where one equation is irrational
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					03	Systems of inequalities in 2 variables

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		03	Systems of	01	Systems of simplest trigonometric
			trigonometric		inequalities
			inequalities (A and B		
			group problems only)		
		04	Systems of exponential	01	Systems of inequalities, where one
			inequalities		inequality is exponential
				02	Systems of inequalities, where both
					inequalities are exponential
		05	Systems of irrational	01	Systems of inequalities, where one
			inequalities (A group		inequality is irrational
			problems only)	02	Systems of inequalities, where both
					inequalities are irrational
		06	System of logarithmic	01	Systems of inequalities, where one
			inequalities		inequality is logarithmic
				02	Systems of inequalities, where both
				0_	inequalities are logarithmic
		07	Mixed systems of	01	Systems of inequalities, containing
		07	inequalities	01	exponential and logarithmic
			inequarties		inequalities
07	Functions, its	01	Concept of a function.	01	Function of the form y=kx+b.
07	properties and	01	Domain, range of a	01	Function of the form $y=ax^2$, $y=ax^3$,
	graphs.		function. Composite		$y = ax^2 + n (a \neq 0)$ $y = a(x-m)^2 + n$
	Derivative,		function.		$y = ax^2 + n \ (a \ne 0), y = a(x-m)^2 + n$ $(a \ne 0), y = a(x-m)^2 \ (a \ne 0),$
	primitive,		Properties of functions:		$y=ax^2+ex+c$ ($a \ne 0$). Function of the
	integral and		- even and odd		-
	their		functions,		form $y = \frac{k}{x}$ ($k \neq 0$), $y = \sqrt{x}$
	applications		- monotone functions,		X
	applications		- minimum and	02	Exponential function. Logarithmic
			maximum value of a		function
			function,	03	Trigonometric function
			- periodic function,	04	Mixed problems
			- inverse functions and		
			their properties,		
			- properties of graphs of		
			functions		
		02	Derivative and its	01	Formulas of finding derivatives and
			properties. Derivative		derivation rules. Derivative of
			of a composite function		composite functions. Derivative of
					trigonometric functions.
				02	Derivative of exponential functions.
					Derivative of logarithmic functions.
				03	Mixed problems
		03	Application of a	01	Critical points. Extremums of a
			derivative		function. Finding intervals of increase
					and decrease. Local maximum and
					minimum
				02	Physical meaning of derivative. Slope
					of a line. Equation of a tangent line.
					Slope of a tangent line.
		04	Primitive of a function.	01	Primitive of a function. Basic
			Evaluation of primitive		properties of a primitive.
			· manual or prining vo	1	FP

			(indefinite integral)	02	Indefinite integral
		05	Evaluation of an	01	Integral. Fundamental Theorem of
			integral, Fundamental		Calculus
			Theorem of Calculus.	02	Finding the area under a curve.
			Application of an		Calculating the volume of a solid of
			integral.		revolution. Integration. Application of
					definite integral in physical and
					geometrical problems.
				03	Mixed problems
08	Plane	01	Triangles: types of	01	Types of triangles. Finding the
	geometry	01	triangles, relation	01	auxiliary elements (altitude, median,
	geometry		between sides and		angle bisector and midline).
			angles, exterior angle,	02	Inscribed and circumscribed circles of
			congruence and	02	a triangle
			similarity, special	03	Č
			points	03	Similarity and congruence of triangles
		02	Quadrilaterals:	01	Quadrilaterals and their properties
		02	parallelogram,	02	Inscribed and circumscribed
			rectangle, rhombus,	02	quadrilaterals.
			1		quadmaterais.
		02	square, trapezoid	01	Circle and its assertions alamants
		03	Circle: center, chord,	01	Circle and its auxiliary elements
			diameter and radius.		(chord, diameter, radius, arc).
			Inscribed angle. Central		Proportionality of chord segments and
			angle. Circumference,		circle sections. Circumference, arc
			arc length.		and chord lengths. Tangent of a circle
					and its properties
				02	Mutual positions of line and circle,
					mutual positions of two circles.
					Central angle. Inscribed angle
				03	Mixed problems
		04	Finding areas of:	01	Area of a triangle
			triangle, quadrilaterals,	02	Area of a quadrilateral
			parallelogram,	03	Area of a circle and its parts
			rhombus, square,	04	Mixed problems
			trapezoid. Area of a		1
			circle, sector and		
			segment		
		05	Convex polygons,	01	Convex polygons. Sum of angles of a
			regular polygons		convex polygon. Regular polygons.
			128mm boileon		Inscribed and circumscribed circles of
					regular polygons.
		06	Using Pythagorean	01	Using Pythagorean theorem. Using
		00	theorem, Laws of sine	01	law of sine. Using law of cosine.
			and cosine		law of sinc. Using law of cosine.
		07	Vectors	01	Vectors and appretions on vectors
		07	VECTORS	UI	Vectors and operations on vectors.
				02	Collinearity of vectors
				02	Angle between two vectors. Cosine of
					an angle between two vectors. Dot
				02	product
		00	TT .	03	Mixed problems
		09	Using vectors and	01	Using vectors in solving problems of

			coordinates methods in solving problems of plane geometry		plane geometry. Length of a line segment, Dividing a line segment in given ratio. Midpoint of a line segment. Equation of a line. Equation of a circle.
09	Space geometry	01	Parallelity and perpendicularity in space. Three-perpendicularity theorem. Dihedral and polyhedral angles	01	Parallelity in space. Perpendicularity in space. Using three-perpendicularity theorem. Finding the angle between line and plane
		02	Polyhedrons. Lateral	01	Finding the element of prisms
			and total surface are.	02	Finding the elements of pyramid and
			Volumes of		frustum of a pyramid
			polyhedrons	03	Finding the volume of a prism
				04	Finding the volume of a pyramid and
					a frustum of a pyramid
				05	Mixed problems on polyhedrons
		03	Solids of revolution.	01	Finding the elements of a cylinder
			Lateral and total	02	Finding the elements of a cone and
			surface. Volumes of	0.0	frustum of a cone
			solids of revolution	03	Finding the elements of a sphere
				04	Mixed problems evaluating the
				0.5	volume of solids of revolution
				05	Inscribed and circumscribed
		04	Vactors	01	polyhedrons Operations on vectors. Det product
10	Cassanasaad		Vectors	-	Operations on vectors. Dot product
10	Sequences and Series	01	Sequences	01	Sequence, its properties and types. Recursively defined sequences
	Series	02	Arithmetic sequence	01	Arithmetic sequence. General term
		02	Arminene sequence	01	formula. Sum of first terms of an
					arithmetic sequence
		03	Geometric sequence	01	Geometric sequence. General term
					formula. Sum of first terms of a
					geometric sequence
				02	Infinite sum of a geometric sequence
		04	Mixed problems on	01	Mixed problems
			sequences		•

3. Characteristics of the content of test items:

By the end of mathematics course entrant must:

Arithmetical expressions: be able to do operations on rational numbers; solve basic problems on % and proportion; simplify the trigonometric expressions, using basic trigonometric identities.

Equations and Systems of equations: be able to solve linear, exponential, logarithmic, irrational, trigonometric equations and their systems.

Word problems: be able to solve word problems in terms of equations and systems of equations.

Sequence: be able to use general term to find nth terms arithmetic and geometric sequences, sum of first n terms.

Inequalities and Systems of inequalities: be able to use intervals method in solving quadratic and higher order inequalities, inequalities involving absolute value, exponential and logarithmic inequalities and be able to solve systems of inequalities.

Function, derivative, integral: be able to find derivative, evaluate its value, find the extremum of a function, minimum and maximum values, and use the Fundamental Theorem of Calculus in evaluation of area under a curve.

Plane geometry: be able to find auxiliary elements of triangles, quadrilateral, circle; be able to use Pythagorean Theorem; be able to calculate the area, use the properties of vectors.

Space geometry: be able to calculate the lateral and surface area, volume of polyhedrons; calculate the surface and volume of solids of revolution; use the properties of vectors in space.

4. Forms of test items:

The test consists of 20 test items with the choice of one correct answer from 5 proposed and 10 test items with one or more correct answers from multiple choices.

5. Assessment of the test item and the whole test:

The correctly done test item with the choice of one correct answer is given one point, incorrectly done no (zero) points.

In the test items with one or more correct answers (up to three correct answers):

if there is only one correct answer and if a test-taker chooses the correct answer, he/she gets two points;

if there is only one correct answer and if a test-taker chooses the correct answer and one incorrect answer, he/she gets one point;

if there is only one correct answer and if a test-taker chooses two or more incorrect answers, he/she gets no (zero) points;

if there are two correct answers and if a test-taker chooses two correct answers, he/she gets two points;

if there are two correct answers and if a test-taker chooses one correct answer, he / she gets one point;

if there are two correct answers and if a test-taker chooses one correct and one incorrect answer, he/she gets one point;

if there are two correct answers and if a test-taker chooses both correct answers and one incorrect answer, he/she gets one point;

if there are two correct answers and if a test-taker chooses two or more incorrect answers, he/she gets no (zero) points;

if there are three correct answers and if a test-taker chooses all three correct answers, he/she gets two points;

if there are three correct answers and if a test-taker chooses two correct answers, he/she gets one point;

if there are three correct answers and if a test-taker chooses two correct answers and one incorrect answer, he/she gets one point;

if there are three correct answers and if a test-taker chooses three correct answers and one incorrect answer, he/she gets one point;

if there are three correct answers and if a test-taker chooses one correct answer or two and more incorrect answers, he/she gets no (zero) points.

If a test-taker answers the whole test correctly, he / she gets 40 points.