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 Expressions	01	Arithmetic evaluations. Operations with numbers. Operations with fractions. Prime and Composite Numbers	01	Operations on natural and rational numbers.Operations on Fractions and Decimals. Repeating Decimals
				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 of polynomials. Simplifying algebraic expressions.	01	Degree of monomials and polynomials, their standard forms. Operations on polynomials
				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. Equations of higher order	01	Quadratic equations. Viet's theorem. Deriving quadratic equations. Equations reducible to quadratic form
				02	Special cases of quadratic equations. Biquadratic Equations
		03	Equations involving absolute value	01	Basic equations involving absolute 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 equations	01	Simplest trigonometric 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 equations	01	Systems of linear equations	01	Systems of linear equations with two variables
		02	Systems of nonlinear equations	01	Systems of nonlinear equations with 2 variables
		03	Systems of trigonometric equations	01	Systems of equations, where one trigonometric equation
				02	Systems of equations, where both equations are trigonometric
		04	Systems of exponential equations	01	Systems of equations, where one equation is exponential
				02	Systems of equations, where both equations are exponential

		05	Systems of irrational equations	01	Systems of equations, where one equation is irrational
				02	Systems of equations, where both equations are irrational
				03	Mixed problems
		06	Systems of logarithmic equations	01	Systems of equations, where one equation is logarithmic
				02	Systems of equations, where both equations are logarithmic
		07	Mixed Systems of Equations	01	Mixed Systems of Equations
04	Word problems	01	Problems on proportion. Problems on percentages. Basic mixture problems (solutions and alloys)	01	Problems on direct proportion. Problems on inverse proportion
				02	Problems on percentages
				03	Mixture problems (solutions an alloys)
				04	Mixed problems
		02	Number problems. Motion problems. Work problems	01	Number problems
				02	Motions problems (river problems)
				03	Work problems
				04	Mixed problems
05	Inequalities	01	Linear inequalities	01	Linear inequalities in one variable
				02	Linear inequalities in 2 variables
		02	Quadratic inequalities. Higher order inequalities	01	Quadratic inequalities. Intervals method
				02	Solving inequalities of higher orders
				03	Mixed problems
		03	Inequalities involving absolute values *(A group problems only)*	01	Simplest inequalities involving absolute value
				02	Inequalities involving more than one absolute values
		04	Rational inequalities	01	Rational inequalities. Rational inequalities (given as fraction)
		05	Trigonometric Inequalities	01	Simplest trigonometric inequalities
				02	Trigonometric inequalities
		06	Exponential inequalities	01	Simplest exponential inequalities
				02	Exponential inequalities
		07	Basic irrational inequalities	01	Basic irrational inequalities
		08	Logarithmic inequalities	01	Simplest logarithmic inequalities
				02	Logarithmic inequalities
06	Systems of inequalities	01	Systems of linear inequalities	01	Simplest Systems of linear inequalities
		02	Systems of nonlinear inequalities	01	Systems of nonlinear inequalities in 1 variable
				02	Systems of nonlinear inequalities in 2 variables
				03	Systems of inequalities in 2 variables

		03	Systems of trigonometric inequalities *(A and B group problems only)*	01	Systems of simplest trigonometric inequalities
		04	Systems of exponential inequalities	01	Systems of inequalities, where one inequality is exponential
				02	Systems of inequalities, where both inequalities are exponential
		05	Systems of irrational inequalities *(A group problems only)*	01	Systems of inequalities, where one inequality is irrational
				02	Systems of inequalities, where both inequalities are irrational
		06	System of logarithmic inequalities	01	Systems of inequalities, where one inequality is logarithmic
				02	Systems of inequalities, where both inequalities are logarithmic
		07	Mixed systems of inequalities	01	Systems of inequalities, containing exponential and logarithmic inequalities
07	Functions, its properties and graphs. Derivative, primitive, integral and their applications	01	Concept of a function. Domain, range of a function. Composite function. Properties of functions: - even and odd functions, - monotone functions, - minimum and maximum value of a function, - periodic function, - inverse functions and their properties, - properties of graphs of functions	01	Function of the form y=kx+*b*. Function of the form $y=ax^2$, $y=ax^3$, y= ax^2+*n (a $\neq$ 0)*, y= *a(x-m)^2+n (a $\neq$ 0)*, y= *a(x-m)^2 (a $\neq$ 0)*, y=ax^2+*6x+c (a $\neq$ 0)*. Function of the form y=$\dfrac{k}{x}$ (k $\neq$ 0), y=$\sqrt{x}$
				02	Exponential function. Logarithmic function
				03	Trigonometric function
				04	Mixed problems
		02	Derivative and its properties. Derivative of a composite function	01	Formulas of finding derivatives and derivation rules. Derivative of composite functions. Derivative of trigonometric functions.
				02	Derivative of exponential functions. Derivative of logarithmic functions.
				03	Mixed problems
		03	Application of a derivative	01	Critical points. Extremums of a 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. Evaluation of primitive	01	Primitive of a function. Basic properties of a primitive.

			(indefinite integral)	02	Indefinite integral
		05	Evaluation of an integral, Fundamental Theorem of Calculus. Application of an integral.	01	Integral. Fundamental Theorem of Calculus
				02	Finding the area under a curve. Calculating the volume of a solid of revolution. Integration. Application of definite integral in physical and geometrical problems.
				03	Mixed problems
08	Plane geometry	01	Triangles: types of triangles, relation between sides and angles, exterior angle, congruence and similarity, special points	01	Types of triangles. Finding the auxiliary elements (altitude, median, angle bisector and midline).
				02	Inscribed and circumscribed circles of a triangle
				03	Similarity and congruence of triangles
		02	Quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid	01	Quadrilaterals and their properties
				02	Inscribed and circumscribed quadrilaterals.
		03	Circle: center, chord, diameter and radius. Inscribed angle. Central angle. Circumference, arc length.	01	Circle and its auxiliary elements (chord, diameter, radius, arc). Proportionality of chord segments and circle sections. Circumference, arc 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: triangle, quadrilaterals, parallelogram, rhombus, square, trapezoid. Area of a circle, sector and segment	01	Area of a triangle
				02	Area of a quadrilateral
				03	Area of a circle and its parts
				04	Mixed problems
		05	Convex polygons, regular polygons	01	Convex polygons. Sum of angles of a convex polygon. Regular polygons. Inscribed and circumscribed circles of regular polygons.
		06	Using Pythagorean theorem, Laws of sine and cosine	01	Using Pythagorean theorem. Using law of sine. Using law of cosine.
		07	Vectors	01	Vectors and operations on vectors. Collinearity of vectors
				02	Angle between two vectors. Cosine of an angle between two vectors. Dot product
				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 and total surface are. Volumes of polyhedrons	01	Finding the element of prisms
				02	Finding the elements of pyramid and frustum of a pyramid
				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. Lateral and total surface. Volumes of solids of revolution	01	Finding the elements of a cylinder
				02	Finding the elements of a cone and frustum of a cone
				03	Finding the elements of a sphere
				04	Mixed problems evaluating the volume of solids of revolution
				05	Inscribed and circumscribed polyhedrons
		04	Vectors	01	Operations on vectors. Dot product
10	Sequences and Series	01	Sequences	01	Sequence, its properties and types. Recursively defined sequences
		02	Arithmetic sequence	01	Arithmetic sequence. General term 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 sequences	01	Mixed problems

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 n^{th} 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.