MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

MATHEMATICS

Grades 5-9

Curriculum for General Education Institutions[1]

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Characteristics of Educational Content and Features of Its Implementation

The content of mathematical education in the secondary school is structured according to the following content lines: *numbers; expressions; equations and inequalities; functions; geometric figures; and geometric quantities.* Each of them develops taking into account the tasks of studying mathematics at this stage of school education, in which there are two main phases: Grades 5-6 and Grades 7-9. Educational tasks in the first phase are implemented in the process of studying a single course of mathematics, in the second phase are implemented in two courses: Algebra and Geometry.

***The mathematics course of Grades* 5-6** provides for the development, enrichment and deepening of students' knowledge about numbers and actions on them, numerical and alphabetic expressions, quantities and their measurements, equations, numerical inequalities, as well as ideas about individual geometric shapes on a plane and in space.

In Grades 7–9, the following two courses are studied Algebra and Geometry.

The main tasks of the ***Algebra course*** are to form the skills of performing identical transformations of whole and fractional expressions, solving equations and inequalities and their systems, sufficient for their conscious use in the study of mathematics and related subjects, as well as for practical applications.

The main line of the ***Geometry course*** is geometric figures and their properties. The basic concepts of the course are a point, a straight line, a plane, to belong to, to lie between. The first three concepts are basic geometric figures, and the last two are basic relations.

Grade 5

MATHEMATICS

(*140 h, 4 h per week, Reserve: 40 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: NATURAL NUMBERS AND ACTIONS THEREWITH. GEOMETRIC FIGURES AND VALUES (*40 h*)	
Student: **provides examples of** natural numbers; scales; numerical and alphabetic expressions, formulas; equations; **finds in the figures:** a section of a given length and the angle of a given degree measure; geometric figures specified in the content; **recognizes** in space and correlates with objects of the surrounding reality: a cube, a rectangular parallelepiped, a pyramid; **distinguishes between digits** and numbers **reads and writes**: natural numbers within a billion; **uses:** properties of arithmetic actions with natural numbers; **records and explains** the formulas: the perimeter of the geometric shapes specified in the content; the area of the rectangle, square; the volume of the rectangular parallelepiped and cube; **explains** the following, namely: a natural number; a square and a cube of a natural number; a straight line; a beam; a coordinate beam; an angle; a triangle; a square; a rectangle; a rectangular parallelepiped; a cube; an equation; solve an equation; **explains the following rules:** adding, subtracting, multiplying, dividing,	Natural numbers. The Zero number. Digits. A decimal record of natural numbers. Comparison of natural numbers. Arithmetic actions with natural numbers and their properties. The square and the cube of a natural number. Division with the remainder. Numerical expressions. Letter expressions and formulas. Equations. Segment, straight line, beam. Scale. Coordinate beam. The angle and its degree measure. Types of angles. Triangle and its perimeter. Types of triangles around corners. Rectangle. Square.

comparing; performing division with the remainder; **classifies** angles by degree measure; triangles by types of their angles; **depicts** a section of this length and the angle of this degree measure; the geometric figures indicated in the content using a ruler, a cosine, a transporter; a coordinate beam, and natural numbers on the coordinate beam; **measures and calculates:** the length of the segment; the degree measure of the angle; the perimeter of the triangle and rectangle; **solves exercises that involve:** writing a number as the sum of bit additions; performing four arithmetic actions with natural numbers; raising a natural number to a square and a cube; comparing natural numbers; dividing with the remainder; calculating the values of numerical and alphabetic expressions, the perimeter and area of a rectangle, a square and the volume of a rectangular parallelepiped and a cube; **solves:** equations based on dependencies between components and the result of arithmetic actions; text problems, including combinatorial	The area and perimeter of a rectangle and a square. Rectangular parallelepiped. Cube. The volume of rectangular parallelepiped and cube. Pyramid

Theme #2: FRACTIONAL NUMBERS AND ACTIONS WITH THEM (*60 h*)

Student: **gives examples of** ordinary and decimal fractions; **distinguishes between** ordinary and decimal fractions; correct and incorrect fractions **explains what** is numerator and denominator of the fraction; mixed number; **reads and writes** ordinary and decimal fractions; mixed numbers;	Normal fractions. Correct and incorrect fractions. Ordinary fractions and divisions of natural numbers. Mixed numbers. Comparison of ordinary fractions with the same denominators. Addition and subtraction of ordinary fractions with the same denominators.

formulates the meaning of correct and incorrect fraction; percentage; arithmetic mean; **solves exercises that involve comparing,** adding, and subtracting regular fractions with the same denominators; comparing, rounding, adding, multiplying, and dividing decimal fractions; converting a mixed number into an incorrect fraction; converting an incorrect fraction into a mixed number or a natural number; finding a percentage of a number and a number by its percentage; finding the arithmetic mean of several numbers, an average value	Decimal Fraction. Writing decimals. Comparison of decimals. Rounding of decimals. Arithmetic actions with decimals. Rates. Arithmetic mean. The average value of the magnitude
Student solves story problems with real data on the use of natural resources of the native land; traffic safety; finding the perimeters and areas of land plots, the floor of the classroom, the volume of objects that have the shape of a rectangular parallelepiped; calculating the family budget, the possibility of making large-scale purchases; calculations related to the calendar and clock, etc.	

Grade 6

MATHEMATICS

(*140 h, 4 h per week, Reserve: 40 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: DIVISION OF NATURAL NUMBERS (*10 h*)	
Student: **provides examples** of prime and compound numbers; even and odd numbers; integers divisible by 2, 3, 5, 9, and 10; **distinguishes between** prime and compound numbers; divisors and multiples of a natural number; **formulates** the meaning of the concepts: divisor, multiple, prime number, compound number, common divisor; signs of division into 2, 3, 5, 9 and 10; **solves the exercises that involve:** using the signs of division of numbers by 2, 3, 5, 9, 10; decomposition of natural numbers into prime factors; finding common divisions of two numbers; the largest common divisor (LCD) of two numbers within a hundred; finding the smallest common multiple (SCM) of two numbers within a hundred	Dividers and multiples of the natural number. Signs of division into 2, 3, 5, 9, 10. Simple and compound numbers. Decomposition of numbers into prime factors. Greatest common divisor. Least common multiple
Theme #2: NORMAL FRACTIONS (*26 h*)	
Student: **provides examples of** finite and infinite periodic decimals; mutually inverted numbers; **distinguishes between** finite and infinite periodic decimals; **reads and writes** infinite periodic fractions;	The main property of the fraction. Reducing fractions. The lowest common denominator of fractions. Reducing fractions to a common denominator. Comparison of fractions. Arithmetic operations with normal fractions.

understands the rules: comparing, adding, subtracting, multiplying and dividing ordinary fractions; finding a fraction of a number and a number by its fraction; **formulates** the basic property of the fraction; **solves exercises that involve** reducing fractions; reducing fractions to a common denominator; comparing fractions; adding, subtracting, multiplying, and dividing regular fractions; writing a regular fraction as a decimal; finding a fraction of a number and a number by its fraction	Finding a fraction of a number and a number by its fraction. Conversion of normal fractions to decimals. Endless periodic decimals. Decimal approximations of normal fraction

Topic #3: RATIO AND PROPORTION (*24 h*)	

Student: **Gives examples** of proportional quantities; **distinguishes** between a circular disk and a circle; direct and inverse proportionality; types of diagrams; **understands** the following: relation; direct and inverse proportional dependence; scale; circle, circular disk, circular sector; diagram; **formulates** the meaning of the proportion; the basic property of the proportion; **depicts and finds in the pictures** circle and circle; circular sector; column and pie charts; **solves exercises that involve** finding the ratio of numbers and quantities; using scale; finding an unknown term of proportion; recording percentages in the form of ordinary and decimal fractions; finding the length of a circle and the area of a circle; analysing column and circular diagrams;	Relations. Proportion. The main property of the proportion. Direct and inverse proportional dependence. The division of a number in this respect. Scale. The percentage ratio of two numbers. Percentage settlements Circle. Circumference. Circular disk. Circle area. Circular sector. Bar charts and pie charts

solves: the main problems by percent; problems by proportional values and proportional division	

Theme #4: RATIONAL NUMBERS AND ACTIONS WITH THEM (*40 h*)	
Student: **provides examples** of positive and negative numbers; opposite numbers; integers and rational numbers; **understands** what is number modulus; opposite numbers; integers; rational numbers; coordinate line; coordinate plane; similar additions; **constructs** a coordinate straight line; a coordinate plane; perpendicular and parallel straight lines using a ruler and a cosine; graphs of dependencies between values by points; **solves exercises that involve:** finding a number module; comparing rational numbers; adding, subtracting, multiplying, and dividing rational numbers; calculating values of numerical expressions containing positive and negative numbers; opening brackets, summarizing similar appendices; finding coordinates of a point on the coordinate plane and constructing a point by its coordinates; analysing graphs of relationships between values (distance, time; temperature, time, etc.); **solves** equations using rules based on the basic properties of the equation; text problems using equations	Positive and negative numbers, the zero number. Coordinate line. Opposite numbers. Number modulus. Integers. Rational numbers. Comparison of rational numbers. Arithmetic actions with rational numbers. Properties of adding and multiplying rational numbers. Uncovering parentheses. Similar appendices and their summaries. Equations. Basic properties of equations. Perpendicular and parallel lines, their construction using a ruler and a cosine. Coordinate plane. Examples of graphs of dependencies between quantities

Student solves story problems on a calculation of the percentage of different values (for example, the working population of the region, calories, etc.); decision-making in the field of financial operations, calculation of own and family finances, utility payments; ability to dispose of own funds, in simple situations to assess expected and real costs, etc.

Grade 7

ALGEBRA

(*70 h, 2 h per week, reserve: 12 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: WHOLE EXPRESSIONS (*30 h*)	

Student:
gives examples of numeric expressions; expressions with variables; monomers; polynomials
explains:
  how to find the numerical value of an expression with variables at given values of variables;
  what are identical expressions, identical expression transformation, monomial of standard appearance, coefficient;
formulates:
  · meaning: monomial, degree with a natural indicator; polynomial, similar members of a polynomial, degree of a polynomial;
  · properties of the degree with a natural indicator;
  · rules: multiplication of a monomial and a polynomial, multiplication of two polynomials;
 	
solves exercises that involve: calculating the values of expressions with variables; reducing the monomial to the standard form; converting the product of the monomial and the polynomial, the sum, the difference, and the product of two polynomials into a polynomial; decomposing the polynomial into multipliers by taking a common factor
	Expressions with variables. Whole rational expressions.
	
	Identity. Identical expression transformations.
	
	Degree with a natural indicator. · Properties of the degree with a natural indicator;
	
	Mononomial. Elevating mononomial to the power. Multiplication of mononomial.
	Polynomial. Similar polynomials and summaries thereof.
	Polynomial power.
	
	Add, subtract, and multiply polynomials.
	
	The formulas of the square are binary, the difference of the squares, the sum and the difference of the cubes.
	
	Decomposition of polynomials into multipliers

out of brackets, by grouping, by abbreviated multiplication formulas and using several methods; using these transformations in the process of solving equations, proving statements	

Theme #2: FUNCTIONS (*10 h*)	

Student: **provides examples** of functional dependencies; linear functions; **explains** what is argument; function; function definition area; function value area; function graph; **formulates the** meaning of the concepts: function; graph of function; linear function; direct proportionality; **lists and illustrates, by way of examples**, methods of setting a function; **describes the** construction of a graph of a function, in particular, a linear function and its separate type as direct proportionality; **solves exercises that involve** finding the scope of the function definition; finding the value of the function by the given value of the argument; plotting a linear function; finding the value of the function by the given value of the argument according to the graph of the function and vice versa; determining individual characteristics of the function by its graph (positive values, negative values, zeros); **draws up and solves problems based on** direct proportionality based on life experience; plotting when modelling real processes using a linear function, etc.	Functional dependence between quantities as a mathematical model of real processes. Function. Definition area and function value area. Methods of setting a function. Function graph. Linear function, its graph and properties

Topic #3: LINEAR EQUATIONS AND THEIR SYSTEMS (*18 h*)	

Student: **gives examples:** equations with one and two variables; systems of linear	

equations with one and two variables; systems of two linear equations with two variables; **explains:** · what is a system of two linear equations with two variables; · how many solutions a system of two linear equations with two variables can have; **formulates** the meaning of linear equations with one and two variables; solving the equation with two variables; solving the system of two linear equations with two variables; **builds** graphs of linear equations with two variables; **describes** how to solve a system of two linear equations with two variables; **characterizes** cases when the system of two linear equations with two variables has one solution; has many solutions; or does not have any solutions; **draws up** equations and systems of equations on the condition of a text problem; **solves** linear equations with one variable and equations reduced to them; textual problems using linear equations with one variable; systems of two linear equations with two variables specified in the content methods; textual problems using systems of two linear equations with two variables	Linear equation with one variable. Linear equation with two variables and its graph. · what is a system of two linear equations with two variables; Solving systems of two linear equations with two variables: graphical method; method of substitution; method of addition. Linear equations and their systems as mathematical models of text problems
Student solves plot problems on movement from the point of view of its safety; on the disposal of own and family finances; financial content through the prism of historical events, etc.	

Grade 8

ALGEBRA

(*70 h, 2 h per week, 20 h reserve*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: RATIONAL EXPRESSIONS (*24 h*)	
Student: **provides** **examples** of rational expression; rational fraction; power with an integer; **recognizes** integer rational expressions; fractional rational expressions; **explains**: · how to shorten a fraction; how to reduce a fraction to a new denominator; how to reduce fractions to a common denominator; · what is the standard appearance of a number; **Student formulates:** · the main property of the fraction; properties of the degree with an integer; · rules: adding, subtracting, multiplying, dividing fractions, raising a fraction to a power; · the condition of evenness of a fraction is zero; · meaning: power with a zero indicator; power with a negative integer indicator; **describes the** properties of $y = \dfrac{k}{x}$ the function according to its graph; **solves exercises that involve** fraction reduction; reducing fractions to a common denominator; finding the sum, difference, product, a fraction of fractions; identical transformations of	The degree with the integer and its properties. The standard view of a number. Whole rational expressions. Rational fractions. The main property of the fraction. Arithmetic actions with rational fractions. Rational equations. Equilibrium equations. Function $y = \dfrac{k}{x}$, its graph and properties

rational expressions; solving equations with a variable in the denominator of the fraction; converting power with an integer; writing a number in a standard form; plotting a function $y = \dfrac{k}{x}$	

Theme #2: SQUARE ROOTS. VALID NUMBERS (*10 h*)

Student: **gives examples** of rational numbers; irrational numbers; **explains what** is a rational number; irrational number; real number; **formulates** the meaning of the arithmetic square root of the number; the properties of the arithmetic square root; **characterizes** properties of functions $y = x^2, y = \sqrt{x}$, according to their graphs; **solves exercises that involve:** applying the concept of the arithmetic square root to calculate expression values, simplifying expressions, solving equations, comparing expression values; converting expressions using a multiplier from under the root sign, adding a multiplier under the root sign, exempting from irrationality in the denominator of the fraction; plotting functions $y = x^2, y = \sqrt{x}$;	The function $y = x^2$, its graph and its properties. Arithmetic square root. Properties of the arithmetic square root. Rational numbers. Irrational numbers. Valid numbers. Function $y = \sqrt{x}$, its graph and properties

Topic #3: QUADRATIC EQUATIONS (*16 h*)

Student: **gives examples** of square equations; square trinomials; **formulates:** · the meanings of the quadratic equation and the quadratic trinomial; the root of the quadratic equation; · Viet's theorem; **writes** the formula of the roots of the quadratic equation; the formula of	Quadratic equations. The formula of the roots of the quadratic equation. Viet's theorem. A square three-member.

decomposing the quadratic trinity into linear multipliers; **draws up** a quadratic equation based on the condition of the text problem; **solves exercises that involve** finding the roots of square equations; decomposing a square trinity into factors; finding the roots of equations reduced to square ones; composing and solving square equations and equations reduced to them as mathematical models of applied problems	Decomposition of a square three-dimensional term into linear multipliers. Solving equations that are reduced to square. A quadratic equation and equations that are reduced to quadratic equations, such as mathematical models of applied problems

Student solves plot problems on the use of interrelationships of economic phenomena; types and calculations of taxes, payments; movement; labour productivity; cost of goods; compatible work; mixtures and alloys, etc.

Grade 9

ALGEBRA

(*70 h, 2 h per week, reserve: 18 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: INEQUALITIES (*14 h*)	
Student: **provides examples of** numerical inequalities; inequalities with variables; linear inequalities with one variable; double inequalities; **explains** what is the union and the intersection of numerical intervals; **formulates:** · properties of numerical inequalities, properties of inequalities with a variable; · meaning solution of linear inequality with one variable, equinox inequalities; **substantiates** the properties of numerical inequalities; **depicts** on a coordinate line combining and intersecting numerical intervals, the numerical intervals given by irregularities; performs an inverted task; **records** the solutions of inequalities and their systems in the form of a combination of numerical intervals or the form of corresponding inequalities; **solves** linear inequalities with one variable; systems of linear inequalities with one variable	Numerical inequalities. Basic properties of numerical inequalities. Inequalities with variables. Linear inequalities with one variable. Numerical gaps. Equidistant inequalities. Single Variable Linear Irregularity Systems
Theme #2: QUADRATIC FUNCTION (*20 h*)	
Student: **gives examples** of a quadratic function;	

calculates the value of a function at a point **explains** the conversion of function graphs: $f(x) \rightarrow f(x)+a$; $f(x) \rightarrow f(x+a)$; $f(x) \rightarrow kf(x)$, $f(x) \rightarrow -f(x)$; algorithm for plotting a quadratic function; **characterizes** the function according to its graph **solves exercises that involve** plotting a quadratic function; solving square inequalities; finding solutions to systems of two equations with two variables, of which at least one equation of the second degree; compiling and solving systems of equations with two variables as mathematical models of applied problems	Function Properties. Zero functions, intervals of nostalgia, growth and decline of the function, and the largest and smallest value of the function. Conversion of function graphs. Function, its graph and properties Square inequality. A system of two linear equations with two variables. A system of two equations with two variables as a mathematical model of an applied problem

Topic #3: NUMERICAL SEQUENCES (*10 h*)

Student: **gives examples** of numerical sequence; arithmetic and geometric progressions; **formulates** the meaning and properties of arithmetic and geometric progressions; **records and explains:** · *formulas*: the nth member of the arithmetic and geometric progressions, the sum of the first *n* members of these progressions; · *properties of* arithmetic and geometric progression **solves exercises that involve:** calculating the terms of progression; setting progressions based on the data of their members or ratios between them; calculating the sums of the first *n* members of arithmetic and geometric progressions; using formulas of general members and sums of progressions to find unknown elements of progression	Numerical sequences. Arithmetic and geometric progression, their properties. The formulas of the nth term of the arithmetic and geometric progressions. Formulas of the sum of the first *n* terms of the arithmetic and geometric progressions

Theme #4: FUNDAMENTALS OF COMBINATORICS, PROBABILITY THEORY AND STATISTICS (*8 h*)	
Student: **provides examples of** random events, presentation of statistical data in the form of tables, diagrams, graphs, application of the rules of combinatorics **explains what** is the frequency of a random event, probability of a random event **finds, selects and organizes** information from available sources **solves problems that involve** the use of combinatorial rules of sum and product; finding the probability of a random event; calculation of the frequency of a random event; presentation of statistical data in the form of tables, diagrams, graphs	Basic rules of combinatorics. Frequency and probability of an accidental event. Initial statistics information. Methods of presenting data and their processing
Student solves story problems on calculation and analysis of the financial capacity of the family; calculation of the amount of taxes paid; decision-making concerning personal and collective financial issues, etc.	

Grade 7

GEOMETRY

(*70 h, 2 h per week, reserve: 20 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: ELEMENTARY GEOMETRIC FIGURES AND THEIR PROPERTIES (*8 h*)	
Student: **provides examples** of geometric shapes specified in the content; **explains** what is the point, line, belong, lie between, segment, beam, angle, segment length, degree measure of angle, equal segments, equal angles, angle bisector, and the distance between points; **formulates:** properties: placement of points on a line; measurement and deposition of segments and angles; **classifies** angles (sharp, straight, blunt, unfolded); **measures and calculates:** the length of the segment, the degree measure of the angle, using the properties of their measurement; **depicts and finds in the drawings** the geometric shapes specified in the content and **applies** learned meanings and properties to problem-solving	Geometric Shapes. The point, line, segment, beam, angle. Their properties. Measurement of segments and angles. Angle Bisector Measure the distance between two points
Theme #2: MUTUAL PLACEMENT OF STRAIGHT LINES ON THE PLANE (*12 h*)	
Student: **provides examples of** geometric shapes specified in the content; **correlates** with objects of surrounding reality: adjacent and vertical angles, parallel and perpendicular straight lines;	Adjacent and vertical angles, their properties. Parallel and perpendicular straight lines, their properties.

explains: what is the theorem, meaning, sign, consequence, condition and requirement of the theorem, direct and inverse statement, proving the theorem; the essence of the proof from the adversary; **formulates:** meaning*:* adjacent and vertical angles, parallel and perpendicular straight lines, perpendicular, distance from the point to the straight line; · *properties:* of adjacent and vertical angles; parallel and perpendicular straight lines, angles formed at the intersection of parallel straight lines by a jar; · *signs of parallelism of* straight lines **measures and calculates** the distance from a point to a straight line; **depicts and finds in the pictures:** parallel and perpendicular straight lines; perpendicular; angles formed when two straight lines intersect with the jar; **substantiates** parallelism and perpendicularity of straight lines; **proves** properties of adjacent and vertical angles; parallel straight lines; perpendicular straight lines; **applies** learned meanings and properties to problem solving	Perpendicular. The distance from a point to a straight line. Angle between two lines intersecting. The angles formed at the intersection of the two straight lines by a jar. Signs of parallelism of straight lines. Properties of angles formed when intersecting parallel straight lines with a jar.

Topic #3: TRIANGLES. SIGNS OF EQUALITY OF TRIANGLES (*22 h*)

Student: **provides examples of:** geometric shapes specified in the content; equal shapes; **explains** what the levels of the figure are; **formulates:**	Triangle and its elements. Height, bisector and median of the triangle. Equality of geometric shapes. Signs of equality of triangles. Types of triangles.

meaning: the outer angle of the triangle; different types of triangles; bisector, height, median of the triangle; · *properties:* isosceles and rectangular triangles; *signs of equality:* triangles, isosceles triangle; **classifies** triangles by sides and by corners; **depicts and finds in the pictures:** equilateral, isosceles, rectangular triangles and their elements; the outer corner of the triangle; equal triangles; **substantiates:** the affiliation of a triangle to a certain species; the equality of triangles; **Student proves:** the properties and signs of an isosceles triangle; the property of the angles of the triangle; the property of the outer angle of the triangle; **applies** studied definitions and properties for solving problems of practical content	Isosceles triangle, its properties and features. Triangle inequality. The sum of the angles of a triangle. The outer angle of the triangle and its properties. Properties of rectangular triangles

Theme #4: CIRCLE I CIRCULAR DISK (*8 h*)	
Student: **provides examples of** geometric shapes specified in the content; **formulates:** *the meaning of* circle, circular disk, their elements; touching the circle; the middle perpendicular to the segment; the circle described around the triangle, and the circle inscribed in the triangle; *properties:* the middle perpendicular to the segment; the bisector of the angle; touching the circle; the diameter and chord of the circle; the middle perpendiculars to the sides of the triangle; the bisector of the angles of the triangle; **depicts and finds in the pictures:** a circle and its elements; a circle touching	Circle. Circular disk. Circle-touching and its property. The main tasks to build: - building a triangle on three sides; - constructing an angle equal to this one; - building a bisector of a given angle; - division of a given segment in half; - the construction of a straight line perpendicular to a given point. A circle circumscribed around a triangle.

a circle; a circle inscribed in a triangle; a circle circumscribed around a triangle; **performs** the tasks for construction specified in the content by the circular and ruler; **applies** studied definitions and properties for solving problems of practical content	Circle inscribed in a triangle

Student solves problems of practical content: finding a distance to an inaccessible point; establishing the equidistantness of objects on the surface of the Earth; using the rigidity of a triangle in construction, etc.

Grade 8

GEOMETRY

(*70 h, 2 h per week, reserve: 12 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: QUADRANGLES (*22 h*)	
Student: **provides examples** of geometric shapes specified in the content; **explains what** is quadrilateral; convex and unconvex quadrilateral; quadrilateral elements; **formulates:** · *the meanings and properties* of the quadrangles specified in the content; central and inscribed angles; inscribed and described quadrangles; the middle line of the triangle and the trapezoid; · *features of* the parallelogram; inscribed and described quadrangles; · *theorem:* The Intercept theorem; about the sum of the angles of the quadrilateral; **classifies** quadrangles; **depicts and finds in the drawings** quadrangles of different types and their elements; **substantiates** the affiliation of the quadrilateral to a certain species; **proves** properties and features of the parallelogram; properties of a rectangle, diamond, square;	The quadrilateral, its elements. The sum of the corners of a quadrilateral. Parallelogram, its properties and features. Rectangle, diamond, square and their properties. Trapezoid. Inscribed and center corners. Inscribed and described quadrangles. Intercept theorem. The middle line of the triangle, its properties. Middle line of the trapezoid, its properties

Applies studied definitions and properties for solving problems of practical content	

Theme #2: SIMILARITY OF TRIANGLES (*10 h*)

Student: **provides examples of** similar triangles; **explains** the relationship between equality and similarity of geometric figures; **formulates:** · the *theorem*: about the medians of the triangle; about the property of the bisector of the triangle; · *the* meaning of similar triangles; · *signs of* similarity of triangles; · the *generalized Intercept theorem*; **depicts and finds similar triangles in the drawings**; **substantiates** the similarity of the triangles; **applies** the studied meanings and properties to solving problems, in particular when finding distances on the terrain	The Intercept theorem generalized theorem. Similar triangles. Signs of similarity of triangles Triangle Median and Bisector Property

Topic #3: SOLVING RECTANGULAR TRIANGLES (*14 h*)

Student: **provides examples** of geometric shapes specified in the content; **explains**: what is a slope and its projection; what does it mean to solve a rectangular triangle; **Student formulates:** · *properties of* perpendicular and sloping; · *the* sine, cosine, tangent of the acute angle of a rectangular triangle; · *Pythagorean* theorem;	Sine, cosine, tangent of the acute angle of a right triangle. Pythagorean Theorem Perpendicular and inclined, their properties. The ratio between the sides and corners of a rectangular triangle.

· *the ratio* between the sides and corners of a rectangular triangle; **finds in the figures** the sides of a right triangle, the ratio of which is equal to the sine, cosine, tangent of the specified acute angle; **calculates** the values of sine, cosine, tangent for angles of 30°, 45°, 60°; **proves** the Pythagorean theorem; **solves** rectangular triangles **applies** studied definitions and properties for solving problems of practical content	The sine, cosine, tangent of some angles. Solving rectangular triangles

Theme #4: MULTI-CUTTERS. MULTICIRCLE AREAS (*12 h*)

Student:
provides examples of geometric shapes specified in the content;
explains what is a polygon and its elements; the area of the polygon; a polygon inscribed in a circle and described around the circle;
formulates:
  · meaning*:* a polygon inscribed in a circle; a polygon circumscribed around a circle;
  · *Theorem:* about the area of a rectangle, parallelogram, triangle, trapezoid;
records and explains the formulas of the area of the geometric figures indicated in the content;
depicts and finds in the pictures: a polygon and its elements; a polygon inscribed in a circle; a polygon circumscribed by a circle;
correlates with the object of the surrounding reality specified in the content of the figure;
	Polygon and its elements.
	
	A polygon inscribed in a circle and a polygon circumscribed around the circle.
	
	The concept of the area of a polygon.
	
	Rectangle, parallelogram, diamond, triangle, trapezoid areas

calculates the areas of the figures specified in the table of shapes; **applies** the studied meanings, properties and formulas to solving problems, in particular, finding the areas of real objects; **solves problems** at the level of breaking a polygon into equipotential; examining the equipotentiality of polygons, etc.	
Student solves problems of practical content at determining the distance to an inaccessible point; the height of an object; finding angles (the angle of lifting the road, the slope, the angle at which some object is visible), etc.	

Grade 9

GEOMETRY

(*70 h, 2 h per week, reserve: 24 h*)

Expected Results of Educational and Cognitive Activity of Students	Content of Educational Material
Theme #1: COORDINATES ON THE PLANE *(8 h)*	
Student: **provides examples of** ratios specified in the content; **explains**: · what is the sine, cosine, tangent of the angles from 0° to 180°; the equation of the figure; · *how you can set* on the coordinate plane: a line; a circle; **formulates** theorems about: the distance between two points; coordinates of the middle of the segment; **records and explains:** · formulas for coordinates of the middle of a segment and the distance between two points; · *equation* of circle, straight line; **depicts and finds in the drawings** a geometric figure (straight line, circle) by its equation in a given coordinate system; **calculates:** · coordinates of the middle of the segment; · the distance between two points given by their coordinates; **proves** the theorem about: the distance between two points; coordinates of the middle of the segment; **applies** learned formulas and equations of shapes to problem solving	Sine, cosine, tangent of angles from 0° to 180°. Identity: $\sin(180° - \alpha) = \sin\alpha$; $\cos(180° - \alpha) = -\cos\alpha$. · coordinates of the middle of the segment; Distance between two points with given coordinates. Equation of circle and straight line

Theme #2: VECTORS ON PLANE (*12 h*)	

Student:
gives examples of: equal, opposite, collinear vectors;
explains:
  · *what is* vector; modulus and direction of vector; unit vector; zero vector; collinear vectors; opposite vectors; vector coordinates; sum and difference of vectors; product of vector per number;
  · *how to set* the vector;
  · *how to* deposit a vector from a given point;
  · *by which rules it is found* the sum of vectors; the product of a vector by a number;
formulates:
  · *meaning:* equal vectors; scalar product of vectors;
  · *properties* of actions on vectors;
depicts and finds in the pictures: a vector; a vector equal to or opposite to this one, collinear with the data, including its coordinates; a vector equal to the sum (difference) of the vectors, the product of the vector by a number;
calculates:
  · coordinates of the vector, the sum (difference) of the vectors, the product of the vector by the number;
  · the length of the vector, the angle between the two vectors;
substantiates: equality, collinearity of vectors;
applies learnt meanings and properties to problem solving
	Vector. Vector modulus and direction. The equality of vectors.
	
	Vector coordinates. Adding and subtracting vectors. Multiplying a vector by a number. Collinear vectors. Scalar product of vectors

Topic #3: UNTIING TRIANGLES (*10 h*)	
Student:	Cosine and sine theorems.

explains what does it mean to untie a triangle; **formulates** the theorem: cosines; sines; **records and explains** the formulae of the area of the triangle (Heron; at the two sides and the angle between them); **depicts and finds in the figures** the elements of the triangle necessary for the calculation of its unknown elements; **calculates:** lengths of unknown sides and degree measures of unknown angles of a triangle; area of triangles; **applies** learnt meanings and properties to problem solving	Formulas for finding the area of a triangle

Theme #4: CORRECT POLYGONS. CIRCUMFERENCE. CIRCLE AREA (*10 h*)

Student: **provides examples of** geometric shapes specified in the content; **explains** what is circle arc; circle length; circle area; regular polygon (triangle, quadrilateral, hexagon) inscribed in the circle and described around the circle; **correlates** with the object of the surrounding reality specified in the content of the figure; **calculates** the radius of the circle behind the side of the regular polygon (triangle, quadrilateral, hexagon) written in it and vice versa; the radius of the circle behind the side of the regular polygon described around it (triangle, quadrilateral, hexagon) and vice versa; the length of the circle and the arc of the circle; the area of the circle, sector **build** a regular triangle, quadrilateral, hexagon; **applies** learnt meanings and properties to problem solving	The correct polygon, its types and properties. The correct polygon, inscribed in a circle and described around the circle. Circumference. The length of the circle arc. Area of the circular disk and its parts

Theme #5. GEOMETRIC MOVEMENTS (*6 h*)

Student:
gives examples of· shapes and their images with geometric movements specified in the table of contents; shapes that have a center of symmetry, axis of symmetry; equal shapes;
explains what is movement (motion); image of the figure when geometrically moving; figure symmetrical to a given point (line); symmetry relative to a point (line); parallel transfer; rotation; equality of shapes;
Student formulates:
  · *meaning* of equal figures;
  · *properties*: movement; symmetry relative to a point (straight line); parallel transfer; rotation;
depicts and finds in the figures the shapes into which these shapes are transferred at different types of movements;
substantiates: the symmetry of two figures relative to a point (straight line); the presence of the center (axis) of symmetry of the figure; the equality of the figures with the use of displacements;
applies learned meanings and properties to problem solving
	Displacement (motion) and its properties.
	
	Symmetry with respect to point and line, rotation, parallel transfer.
	
	Equality of shapes

Student solves problems on finding unknown elements of real objects; finding areas of real objects, covering the plane with regular polygons, etc.	