Ministry of Education and Science of Ukraine

MATHEMATICS
(ALGEBRA AND THE BEGINNING OF ANALYSIS AND GEOMETRY)

Curriculum for comprehensive schools
Grades 10-11

Standard level

Grade 10 ***ALGEBRA AND THE BEGINNING OF ANALYSIS***

(54 hours I semester - 16 hours, 1 hour per a week,
II semester - 38 hours, 2 hours per week, Reserve - 7 hours)

Expected learning and cognitive outcomes of students	Content of study material
Topic 1. FUNCTIONS, THEIR FEATURES AND GRAPHICS, 15 hours	
Student: **uses** different ways of defining functions; **finds** the range of definition of functional relationships; the value of a function at given values of the argument and the value of the argument at which the function **acquires** a given value; **identifies** the basic properties of a function in a function chart; **identifies** the properties of functions; **calculates** and compares the value of expressions containing degrees with rational exponents and roots; **recognises** and diagrams graphs of power functions; **simulates** real processes with the help of power functions.	Numerical functions and their properties. Ways of defining functions. Paired and odd functions. Root of the nth degree. The arithmetical root of the n-th degree and its properties. The power with a rational exponent and its properties Power functions, their properties and graphs.
Topic 2. TRIGONOMETRIC FUNCTIONS 18 hours	
Student: **is able** to pass from a radian measure of an angle to degree and vice versa; **establishes** correspondence between real numbers and points on a unit circle; **recognizes** and schematically plots graphs of trigonometric functions; **illustrates** the properties of trigonometric functions using graphs; **converts** simple trigonometric expressions; **applies** trigonometric functions to describe real processes; **solves** the simplest trigonometric equations.	Sine, cosine, tangent, angle. Radial measurement of angles. Trigonometric functions of a numerical argument. Basic relationships between the trigonometric functions of a single argument. Formulas for summation. Periodicity of functions. Properties and graphs of trigonometric functions. Summation formulas for trigonometric functions and their consequences. The simplest trigonometric equations.
Topic 3. DERIVATIVE AND ITS APPLICATION 14 hours	
Student: **understands** the importance of the concept of derivative to describe real processes, including mechanical motion; **finds** the rate of change of magnitude at a point; the angular coefficient and the angle of inclination of the tangent to the graph of the function at a given point; **differentiates** functions using a table of derivatives and differentiation rules; **uses** the derivative to find the intervals of monotonicity and extrema of the function, plotting; **finds** the largest and smallest values of the function; **solves** simple applied problems to find the largest and smallest values of real quantities.	Derivative of a function, its geometric and physical meaning. Rules of differentiation. A sign of the constancy of the function. Sufficient conditions for growth and decline of the function. Extremes of the function. Application of the derivative to the study of functions and construction of their graphs. The largest and smallest values of the function in the interval.

Grade 11 ***ALGEBRA AND THE BEGINNING OF ANALYSIS***

(54 years I semester - 16 hours, 1 hour per week,
II semester - 38 hours, 2 hours per week, Reserve - 18 hours)

Expected learning and cognitive outcomes of students	Content of study material
Topic 1. INDICATIVE AND LOGARITHMIC FUNCTIONS 16 hours	
Student: **recognizes** and plots graphs of exponential and logarithmic functions; **illustrates** the properties of exponential and logarithmic functions using graphs; **applies** exponential and logarithmic functions to describe real processes; **solves** the simplest exponential and logarithmic equations and inequalities.	Properties and graphs of the exponential function. Logarithms and their properties. Properties and graph of a logarithmic function. The simplest exponential and logarithmic equations and inequalities.
Topic 2. INTEGRAL AND ITS APPLICATION 10 hours	
Student: **finds** the initials with the help of a table of initials and their properties; identifies an initial that satisfies the given initial conditions; **calculates** an integral with the help of the table of initials and their properties; **finds** areas of curvilinear trapezoids.	The initial and its properties. Identified Integral, its geometrical meaning. Calculation of densities of flat figures.
Topic 3. ELEMENTS OF COMBINATORICS, PROBABILITY THEORY AND MATHEMATICAL STATISTICS 10 hours	
Student: **understands** what permutations, placements, combinations (without repetitions), the classical definition of probability, what is the general population and the sample, the definition of the mean, modes and medians of the sample **calculates** the relative frequency of the event; number of permutations, placements, combinations; probability of an event, using its definition and combinatorial schemes; **explains** the content of averages and characteristics of the sample; **finds** the numerical characteristics of the data sample. uses the probabilistic characteristics of environmental phenomena to make decisions	Elements of combinatorics. Permutations, placements, combinations (without repetitions). Classic definition of the probability of a random event. Sample characteristics: sample size, mode, median, mean. Graphical representation of sampling information.

Grade 10 GEOMETRY

(51 hours. I semester - 32 hours, 2 hours a week,
II semester - 19 hours, 1 hour per week, Reserve - 7 hours)

Expected learning and cognitive outcomes of students	Content of study material
Topic 1. PARALLELISM OF LINES AND PLANES IN SPACE 17 hours	
Student: **names** the basic concepts of stereometry; distinguishes between denoted and non-denoted concepts, axioms and theorems; **formulates** axioms of stereometry and their consequences; **applies** axioms of stereometry and their consequences to solve simple problems; **classifies** according to certain features the mutual placement of lines, lines and planes, planes in space by the number of their common points; **establishes** the parallelism of straight lines, straight lines and planes, two planes; **finds out** if two lines are incidental; depicts figures in space; applies the relationship of parallelism between lines and planes in space to describe the relationship between objects in the world	Basic concepts, axioms of stereometry and the simplest consequences of them. Mutual placement of lines in space. Parallel design and its properties. Images of figures in stereometry. Parallel line and plane. Parallel planes.
Topic 2. PERPENDICULARITY OF LINES AND PLANES IN SPACE 17 hours	
Student: establishes and substantiates the perpendicularity of straight lines, straight lines and planes, two planes; formulates the definition of the angle between straight lines, straight lines and planes, planes; the theorem on three perpendiculars; applies the relationship between lines and planes in space, distances and angles in space to the description of objects in the world; solves problems of finding distances and angles in space, including a practical place.	Perpendicularity of lines. Perpendicularity of a line and a plane. The theorem on three perpendiculars. Perpendicularity of planes. Dihedral angle. Measurement of distances in space: from point to plane, from line to plane, between planes. Measurement of angles in space: between lines, between a line and a plane, between planes.
Topic 3. COORDINATES AND VECTORS 10 hours	
Student: **uses** the analogy between vectors and coordinates in the plane and in space; **is aware** of the importance of the vector-coordinate method in mathematics; performs operations on vectors; **uses** vectors to model and calculate geometric and physical quantities; **finds** the distance between two points, the coordinates of the middle of the segment, the coordinates of points symmetrical about the origin and coordinate planes; **uses** coordinates in space to measure distances, angles;	Rectangular coordinates in space. Coordinates of the middle of the segment. The distance between two points. Vectors in space. Operations on vectors. Formulas for calculating the length of a vector, the angle between vectors, the distance between two points. Symmetry with respect to the origin and coordinate planes

Grade 11 GEOMETRY

(51 years. I semester - 32 hours, 2 hours a week,
II semester - 19 hours, 1 hour per week, Reserve - 14 hours)

Expected learning and cognitive outcomes of students	Content of study material
Topic 1. POLYHEDRA 14 hours	
Student: **recognizes** the main types of polyhedra and their elements; **depicts** the main types of polyhedra and their elements; has an idea of the cross sections of the polyhedron plane; formulates the definition of polyhedra specified in the content; **writes** formulas for calculating the area of the side and full surfaces of the prism and pyramid **calculates** the values of the main elements of polyhedra; applies the studied formulas and properties to solve problems, in particular applied content.	Polyhedron and its elements. Convex polyhedra. Prism. Straight and correct prisms. Parallelepiped. Pyramid. The correct pyramid. Sections of polyhedra. Areas of the side and full surfaces of the prism, pyramid.
Topic 2. SOLIDS OF REVOLUTION 12 hours.	
Student: **calculates** the values of the basic elements of solids of revolution: **calculates** the values of the basic elements of solids of revolution; **applies** the properties of bodies of revolution to solving problems; **recognises** types of solids of revolution, their elements; polyhedrons and solids of revolution in their combinations in the objects of the world around them.	Cylinder, cone, their elements. Cylinder and cone cross-sections: axial cross-section of cylinder and cone; cross-sections of the cylinder and cone planes parallel to the base. Bullet and sphere. Section of a sphere with a plane.
Topic 3. VOLUMES AND AREAS OF SURFACES OF GEOMETRIC BODIES 11 hours	
Student: **writes** formulas for calculating the volumes of a parallelepiped, prism, pyramid, cylinder, cone, sphere, area of lateral and complete surfaces of a cylinder, cone, area of a sphere; **has** an idea of the volume of the body and its basic properties; **solves** problems for calculating the volumes and surface areas of geometric bodies, in particular applied content.	The concept of body volume. Basic properties of volumes. Volumes of a prism, parallelepiped, pyramid, cylinder, cone, sphere. Areas of lateral and full surfaces of the cylinder, cone. Sphere area.