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Mathematics and Computer Science

in English

Учебно-методическое пособие

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Учебно-методическое пособие предназначено для студентов бакалавриата направлений подготовки «Прикладная математика и информатика», «Математика и компьютерные науки», «Механика и математическое моделирование», «Математика» для изучения дисциплины «Профессиональный иностранный язык». Пособие ориентировано на формирование навыков и умений перевода математических текстов с английского языка на русский, их реферирования и пересказа. Работа с тестами по математике и компьютерным наукам способствует расширению профессионального словарного запаса студентов.

Пособие рекомендуется использовать на практических занятиях по английскому языку, для самостоятельного изучения тем, а также для переводческой практики студентов, получающих дополнительную квалификацию по направлению «переводчик в сфере профессиональной коммуникации».

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Предисловие

Данное учебно-методическое пособие предназначено для студентов бакалавриата направлений «Прикладная математика и информатика», «Математика и компьютерные науки», «Механика и математическое моделирование». Пособие соответствует программным требованиям Федерального государственного образовательного стандарта для дисциплины «Профессиональный иностранный язык (английский)».

Актуальность создания данного пособия обусловлена тем, что в нём представлен материал профессиональной направленности, который способствует формированию коммуникативной, когнитивной и лингвистических компетенций у студентов.

Темы, предложенные в двух разделах и приложении данной работы, помогут студентам ориентироваться в английской научной литературе, овладеть терминологией по математике и компьютерным наукам, освоить чтение математических примеров и формул на английском языке. Пособие способствует формированию таких универсальных компетенций, как умение анализировать аутентичный материал, извлекать информацию для дальнейшего практического применения, умение понимать узкоспециальную литературу, умение составлять словарь по математическим и IT терминам, умение участвовать в обсуждении тем, связанных со специальностью.

В пособие включены темы, раскрывающие основные понятия, названия и фактический материал из области теоретической и прикладной математики и компьютерных наук.

Каждый текст снабжён предтекстовыми словами и выражениями для самостоятельного перевода и дальнейшего заучивания. Профессионально-ориентированные тексты также направлены на совершенствование навыков различных видов чтения и расширение словарного запаса обучающихся.

После каждого текста представлены лексико-грамматические упражнения. Их количество зависит от сложности самого текста, лексики и грамматики. В пособии грамматический материал повторяется студентами при переводе текстов.

Пособие «Mathematics and Computer Science in English» подходит для решения следующих учебных задач: во-первых, научить студентов читать математическую литературу, извлекая при этом научную информацию с нужной степенью полноты и точности, во-вторых, переводить аутентичные математические тексты с английского языка на русский язык, в-третьих, достичь определённого уровня владения устной речью, который позволил бы студентам вести беседу по специальности и делать устные научные сообщения.

Автор

CHAPTER 1 MATH STUDY

Text 1. What is Mathematics?

1. Read the following words and try to remember them.

1. processes – процессы
2. algebra – алгебра
3. geometry – геометрия
4. cognition – познание
5. deduce –выводить (*заключение, следствие, формулу*)
6. encompass – заключать
7. symbolic – символический
8. deduction – вычитание
9. inference – вывод, заключение
10. postulate – постулат
11. axiom – аксиома
12. theorem – теорема
13. measure – измерять
14. constitute – составлять
15. regard - рассматривать

2. Read and translate the text "What is Mathematics?"

Mathematics is the product of many lands and it belongs to the whole of mankind. We know how necessary it was even for the early people to learn to count and to become familiar with mathematical ideas, processes and facts. In the course of time, counting led to *arithmetic* and measuring led to *geometry*. *Arithmetic* is the study of number, while *geometry* is the study of shape, size and position. These two subjects are regarded as the foundations of mathematics.

It is impossible to give a concise definition of mathematics as it is a multifield subject. Mathematics in the broad sense of the word is a peculiar form of the general process of human cognition of the real world. It deals with the space forms and quantity relations abstracted from the physical world.

Contemporary mathematics is a mixture of much that is very old and still important (e. g., counting, the Pythagorean theorem) with new concepts such as sets, axiomatics, structure. The totality of all abstract mathematical sciences is called *Pure Mathematics.* The totality of all concrete interpretations is called *Applied Mathematics.* Together they constitute *Mathematics* as a science.

One of the **modern definitions** of mathematics runs as follows: mathematics is the study of relationships among quantities, magnitudes, and properties of logical operations by which unknown quantities, magnitudes and properties may be deduced.

In the past, mathematics was regarded as the science of *quantity*, whether of magnitudes, as in geometry, or of numbers, as in arithmetic, or the generalization of these two fields, as in algebra. Toward the middle of the 19th century, however, mathematics came to be regarded increasingly as the science of *relations,* or as the science that draws necessary conclusions. The latter view encompasses mathematical or symbolic logic, the science of using symbols to provide an exact theory of logical deduction and inference based on definitions, axioms, postulates, and rules for combining and transforming positive elements into more complex relations and theorems.

3. Match the words on the left with their translation on the right.

1. foundations	a) наука о
2. concise	b) измерение (*действие*)
3. the study of	c) прикладной
4. measuring	d) совокупность
5. to deal with	e) краткий
6. applied	f) основы
7. pure	g) множества
8. contemporary	h) понятие
9. concept	i) теоретический
10. mixture	j) рассматривать
11. to transform	k) величина
12. to regard	l) количество
13. to constitute	m) преобразовывать
14. magnitude	n) современный
15. sets	o) составлять
16. quantity	p) иметь дело с

4. Complete the following sentences

1. Contemporary mathematics is a mixture of …
2. In the past, mathematics was regarded as …
3. Toward the middle of the 19th century, mathematics …
4. Mathematics deals with the space forms and quantity relations …
5. Arithmetic is the study of …
6. Geometry is the study of …
7. Mathematics is the product of …
8. One of the modern definitions of mathematics …

5. Answer the following questions.

1. What two subjects did counting lead to?
2. What is mathematics in the broad sense of the word?
3. What does it deal with?
4. What is *Pure Mathematics?*
5. How is *Applied Mathematics* defined?
6. What is one of the modern definitions of mathematics?
7. How was mathematics interpreted in the past?
8. What is it considered to be now?

Text 2. Basic Operations of Arithmetic

1. Learn the vocabulary of the lesson

1. addition – сложение
2. subtraction – вычитание
3. multiplication – умножение
4. division – деление
5. an equation – уравнение
6. to add – прибавить, добавить
7. addend/ summand – слагаемое суммы (любой член суммы)
8. the *sum* - сумма
9. the sign – знак
10. equality – равенство
11. an operation of *subtraction* – операция вычитания
12. minuend – уменьшаемое
13. subtrahend – вычитаемое
14. the *difference* - разница
15. inverse – обратный
16. multiplier – множитель
17. multiplicand – множимое
18. the *product* - произведение
19. dividend – делимое
20. divisor – делитель
21. quotient – частное

22. a whole number – целое число
23. the *remainder* – остаток
24. inverse operations – обратные операции

2. Read and translate the text "Basic Operations of Arithmetic"

There are four basic operations of arithmetic. They are: *addition, subtraction, multiplication* and *division.* In arithmetic, an operation is a way of thinking of two numbers and getting one number. An equation like 3 + 5 = 8 represents an operation of *addition*. Here you add 3 and 5 and get 8 as a result. 3 and 5 are *addends (*or *summands*) and 8 is the *sum.* There is also a plus (+) sign and the sign of equality (=). They are mathematical symbols.

An equation like 7 – 2 = 5 represents an operation of *subtraction.* Here 7 is the *minuend* and 2 is the *subtrahend.* As a result of the operation, you get the *difference*.

There is also the mathematical symbol of the minus (-) sign. We may say that subtraction is the inverse operation of addition since 5 + 2 = 7 and 7 – 2 = 5. The same may be said about division and multiplication, which are also inverse operations.

In *multiplication*, there is a number that must be multiplied. It is the *multiplicand.* There is also a *multiplier.* It is the number by which we multiply. If we multiply the multiplicand by the multiplier, we get the *product* as a result. In the equation 5 × 2 = 10 (five multiplied by two is ten) *five* is the multiplicand, *two* is the multiplier, *ten* is the product; (×) is the multiplication sign.

In the operation of *division,* there is a number that is divided and it is called the *dividend* and the number by which we divide that is called the *divisor*. When we are dividing the dividend by the divisor, we get the *quotient.* In the equation 6 : 2 = 3, *six* is the *dividend* , *two* is the divisor and *three* is the *quotient*; (:) is the division sign.

But suppose you are dividing 10 by 3. In this case, the divisor will not be contained a whole number of times in the dividend. You will get a part of the dividend left over. This part is called the *remainder.* In our case, the remainder will be 1. Since multiplication and division are inverse operations, you may check division by using multiplication.

3. Match the terms in Table A with their Russian equivalents in Table B.

A	B
1. addend	a) уменьшаемое
2. subtrahend	b) слагаемое
3. minuend	c) частное
4. multiplier	d) уравнение
5. multiplicand	e) делимое
6. quotient	f) множимое
7. divisor	g) остаток
8. dividend	h) обратное действие
9. remainder	i) делитель
10. inverse operation	j) вычитаемое
11. equation	k) разность
12. product	l) произведение
13. difference	m) множитель

4. Read the following equations aloud. Give examples of your own.

Model:

9 + 3 = 12 (nine plus three is twelve)
10 – 4 = 6 (ten minus four is six)
15 × 4 = 60 (fifteen multiplied by four is sixty)
50 : 2 = 25 (fifty divided by two is twenty five)

1. 16 + 22 = 38
2. 280 – 20 = 260

3. $1345 + 15 = 1360$

4. $2017 – 1941 = 76$
5. $70 \times 3 = 210$
6. $48 : 8 = 6$
7. $3419 \times 2 = 6838$
8. $4200 : 2 = 2100$

5. The italicized words are all in the wrong sentences. Correct the mistakes.

1. *Multiplication* is an operation inverse of subtraction.
2. The product is the result given by the operation of *addition.*
3. The part of the dividend which is left over is called the *divisor*.
4. *Division* is an operation inverse of addition.
5. The difference is the result of the operation of *multiplication*.
6. The quotient is the result of the operation of *subtraction.*
7. The sum is the result of the operation of *division.*
8. *Addition* is an operation inverse of multiplication.

Text 3. Algebra

1. The vocabulary of the text:

1. a branch of mathematics
2. letters
3. basic arithmetic relations
4. extraction of roots
5. Pythagorean theorem
6. the sum of the squares of the sides
7. a right triangle
8. a square
9. to fulfil the conditions of the theorem
10. a superscript/ a subscript
11. to be concerned with
12. to solve:
    - linear and quadratic equations

- interminate equations
- arbitrary quadratic equations
- inderterminate equations

13. to evolve / evolution
14. to increase attention to
15. to consider
16. a set of objects
17. theory of equations
18. proof
19. the basic laws of identities
20. ancient civilizations
21. medieval times
22. the basic algebra of polynomials
23. to express roots of cubic equations
24. to use a method of successive approximation
25. to find an exact solution to equation
26. significant contribution to math
27. the discovery of analytic geometry
28. groups and quaternions
29. the properties of number systems

30, systems of permutations and combinations of roots of polynomials

2. Read and translate the text:

Algebra, branch of mathematics in which letters are used to represent basic arithmetic relations. As in arithmetic, the basic operations of algebra are ***addition, subtraction, multiplication, division, and the extraction of roots.*** Arithmetic, however, cannot generalize mathematical relations such as the Pythagorean theorem, which states that the sum of the squares of the sides of any right triangle is also a square. Arithmetic can only produce specific instances of these relations (for example, 3, 4, and 5, where $3^2 + 4^2 = 5^2$). But algebra can make a purely general statement that fulfills the conditions of the theorem: $a^2 + b^2 = c^2$. Any number multiplied by itself is termed *squared* and is indicated by a ***superscript*** number 2. For example, 3×3 is notated 3^2; similarly, $a \times a$ is equivalent to a^2 (*see* Exponent; Power; Root).

Classical algebra, which is concerned with solving equations, uses symbols instead of specific numbers and uses arithmetic operations to establish ways of handling symbols. Modern algebra has evolved from classical algebra by increasing its attention to the structures within mathematics. Mathematicians consider modern algebra to be a set of objects with rules for connecting or relating them. As such, in its most general form, algebra may fairly be described as the language of mathematics.

History

The history of algebra began in ancient Egypt and Babylon, where people learned to solve linear ($ax = b$) and quadratic ($ax^2 + bx = c$) equations, as well as *indeterminate equations* such as $x^2 + y^2 = z^2$, whereby several unknowns are involved. The ancient Babylonians solved *arbitrary quadratic equations* by essentially the same procedures taught today. They also could solve some indeterminate equations.

The Alexandrian mathematicians Hero of Alexandria and Diophantus continued the traditions of Egypt and Babylon, but Diophantus's book *Arithmetica* is on a much higher level and gives many surprising solutions to difficult indeterminate equations. This ancient knowledge of solutions of equations in turn found a home early in the Islamic world, where it was known as the “science of restoration and balancing.” (The Arabic word for restoration, *al-jabru,* is the root of the word *algebra.*) In the 9th century, the Arab mathematician al-Khwārizmī wrote one of the first Arabic algebras, a systematic exposé of the basic theory of equations, with both examples and proofs. A Latin translation of Al-Khwarizmi's *Algebra* appeared in the 12th century.

By the end of the 9th century, the Egyptian mathematician Abu Kamil had stated and proved the basic laws and identities of algebra and solved such complicated problems as finding x, y, and z such that $x + y + z = 10$, $x^2 + y^2 = z^2$, and $xz = y^2$.

Ancient civilizations wrote out algebraic expressions using only occasional abbreviations, but by medieval times Islamic mathematicians were able to talk about arbitrarily high powers of the unknown x and work out the basic algebra of polynomials (without yet using modern symbolism). This included the ability to multiply, divide, and find square roots of polynomials as well as a knowledge of the binomial theorem.

The Persian mathematician, astronomer, and poet Omar Khayyam showed how to express roots of cubic equations by line segments obtained by intersecting conic sections, but he could not find a formula for the roots.

In the early 13th century, the great Italian mathematician Leonardo Fibonacci achieved a close approximation to the solution of the cubic equation $x^3 + 2x^2 + cx = d$. Because Fibonacci had traveled in Islamic lands, he probably used an Arabic method of successive approximations.

Early in the 16th century, the Italian mathematicians Scipione del Ferro, Niccolò Tartaglia, and Gerolamo Cardano solved the general cubic equation in terms of the constants appearing in the equation. Cardano's pupil, Ludovico Ferrari, soon found an exact solution to equations of the fourth degree, and as a result, mathematicians for the next several centuries tried to find a formula for the roots of equations of degree five, or higher. Early in the 19th century, however, the Norwegian mathematician Niels Abel and the French mathematician Évariste Galois proved that no such formula exists.

An important development in algebra in the 16th century was the introduction of symbols for the unknown and for algebraic powers and operations. As a result of this development, Book III of *La géometrie* (1637), written by the

French philosopher and mathematician René Descartes, looks much like a modern algebra text. Descartes's most significant contribution to mathematics, however, was his discovery of analytic geometry, which reduces the solution of geometric problems to the solution of algebraic ones. His geometry text also contained the essentials of a course on the theory of equations, including his so-called *rule of signs* for counting the number of what Descartes called the “true” (positive) and “false” (negative) roots of an equation. Work continued through the 18th century on the theory of equations, but not until 1799 was the proof published, by the German mathematician Carl Friedrich Gauss, showing that every polynomial equation has at least one root in the complex plane.

By the time of Gauss, algebra had entered its modern phase. Attention shifted from solving polynomial equations to studying the structure of abstract mathematical systems whose axioms were based on the behavior of mathematical objects, such as complex numbers, that mathematicians encountered when studying polynomial equations. Two examples of such systems are groups and quaternions, which share some of the properties of number systems but also depart from them in important ways.

Groups began as systems of permutations and combinations of roots of polynomials, but they became one of the chief unifying concepts of 19th-century mathematics. Important contributions to their study were made by the French mathematicians Galois and Augustin Cauchy, the British mathematician Arthur Cayley, and the Norwegian mathematicians Niels Abel and Sophus Lie. Quaternions were discovered by British mathematician and astronomer William Rowan Hamilton, who extended the arithmetic of complex numbers to quaternions while complex numbers are of the form $a + bi$, quaternions are of the form $a + bi + cj + dk$.

Immediately after Hamilton's discovery, the German mathematician Hermann Grassmann began investigating vectors. Despite its abstract character, American physicist J. W. Gibbs recognized in vector algebra a system of great utility for physicists, just as Hamilton had recognized the usefulness of quaternions. The widespread influence of this abstract approach led George Boole to write *The Laws of Thought* (1854), an algebraic treatment of basic logic. Since that time, modern algebra—also called abstract algebra—has continued to develop. Important new results have been discovered, and the subject has found applications in all branches of mathematics and in many of the sciences as well.

3. Match the left column with the right one.

Leonardo Fibonacci	the Italian mathematicians
Hero of Alexandria and Diophantus	the Arab mathematician
Omar Khayyam	the Norwegian mathematician
Abu Kamil	the Alexandrian mathematicians
Scipione del Ferro, Niccolò Tartaglia, and Gerolamo Cardano	the Persian mathematician
Niels Abel	the Italian mathematician
al-Khwārizmī	the Egyptian mathematician
Évariste Galois	the German mathematician
René Descartes	the French mathematicians
Carl Friedrich Gauss	the French mathematician
Galois and Augustin Cauchy	the French philosopher and mathematician

Niels Abel and Sophus Lie	the British mathematician
Arthur Cayley	the Norwegian mathematicians
William Rowan Hamilton	the British mathematician and astronomer
Hermann Grassmann	the American physicist
J. W. Gibbs	the German mathematician

4. Identify the underlined verb forms:

1. Letters are used to represent basic arithmetic relations.
2. The Pythagorean theorem states that the sum of the squares of the sides of any right triangle is also a square.
3. Modern algebra has evolved from classical algebra by increasing its attention to the structures within mathematics.
4. Mathematicians consider modern algebra to be a set of objects with rules for connecting or relating them.
5. Algebra may be described as the language of mathematics.
6. The history of algebra began in ancient Egypt and Babylon.
7. They also could solve some indeterminate equations.
8. By the end of the 9th century, the Egyptian mathematician Abu Kamil had stated and proved the basic laws and identities of algebra.
9. Axioms were based on the behavior of mathematical objects, such as complex numbers.
10. Important new results have been discovered, and the subject has found applications in all branches of mathematics and in many of the sciences as well.

Text 4 Basic algebraic terms

1. Learn the vocabulary of the lesson

1. an equation
2. mathematical operators
3. assert
4. the equality of two mathematical expressions
5. a variable
6. a quantity
7. a value
8. one variable equation
9. two variable equation
10. a power or exponent of 1
11. degree
12. the highest power of the variable
13. three variable equation
14. comprise
15. linear equations in three variables
16. a monomial
17. a product of powers of variables
18. a single variable
19. a positive integer
20. nonzero constant values
21. a polynomial
22. a finite set of monomials
23. the operators of addition and subtraction
24. the order of the polynomial
25. the order of the highest degree monomial
26. the mathematical statement
27. multiple variables
28. exponentiation
29. the base
30. power or index or exponent
31. the process of exponentiation

2. Read and translate the text "Basic algebraic terms"

An equation can be defined as a statement involving symbols (variables), numbers (constants) and mathematical operators (Addition, Subtraction, Multiplication, Division etc.) that asserts the equality of two mathematical expressions. The equality of the two expressions is shown by using a symbol "=" read as "**is *equal to***". For example: $3x + 7 = 16$ is an equation in the variable X.

A variable is a symbol that represents a quantity in an algebraic expression. It is a value that may change with time and scope of the concerned problem. For example: in the equation $3x + 7 = 16$, x is the variable. Also in the polynomial $x^2 + 5xy - 3y^2$, both x and y are variables.

One variable equation. An equation that involves only one variable is knows as a One Variable Equation. $3x + 7 = 16$ is an example of it.

Two variable equation. An equation that involves two variables is knows as a Two Variable Equation. $2x + y = 10$ is a Two Variable Equation of where x and y are variables. Please note that here both x and y have a power or exponent of 1. Hence it is an equation with degree 1. The degree is equal to the highest power of the variable(s) invloved. $x^2 + 5xy - 3y^2 = 25$ is an example of a Two Variable Equation of degree 2.

Three variable equation. An equation that comprises three variables / symbols is called a Three Variable Equation

$x + y - z = 1$ -------------(1)

$8x + 3y - 6z = 1$ -------------(2)

$-4x - y + 3z = 1$ -------------(3)

The above three equations form a system of 3 equations in 3 variables x, y and z. Each of these equations is a Three Variable Equation of degree 1. Also these equations are called ***Linear equations*** in three variables.

A monomial is a product of powers of variables. A monomial in a single variable is of the form $\mathbf{x}^n$ where X is **a** variable and **n**

is a positive integer. There can also be monomials in more than one variable. For example $\mathbf{x}^m\ \mathbf{y}^n$ is a monomial in two variables where m, n are any positive integers. Monomials can also be multiplied by nonzero constant values. $24x^2y^5z^3$ is a monomial in three variables x,y,z with exponents 2, 5 and 3 respectively.
A polynomial is formed by a finite set of monomials that relate with each other through the operators of addition and subtraction. The order of the polynomial is defined as the order of the highest degree monomial present in the mathematical statement. $2x^3 + 4x^2 + 3x – 7$ is a polynomial of order 3 in a single variable.
Polynomials also exist in multiple variables. $x^3 + 4x^2y + xy^5 + y^2 – 2$ is a polynomial in variables x and y.
Exponentiation is a mathematical operation written as $\mathbf{a}^{\mathbf{n}}$ where **a** is the base and **n** is called ***power*** or ***index*** or ***exponent*** and it is a positive number. We can say that in the process of exponentiation, a number is repeatedly multiplied by itself, and the exponent represents the number of times it is multiplied. In a^3, **a** is multiplied with itself 3 times i.e. a x a x a. a^5 translates to a x a x a x a x a (a multiplied with itself 5 times).

3. Make questions to the sentences in the Passive Voice

1. An equation can be defined as a statement involving symbols (variables), numbers (constants) and mathematical operators.
2. The equality of the two expressions is shown by using a symbol "=" read as "**is *equal to***".
3. An equation that involves only one variable is knows as a One Variable Equation.
4. An equation that comprises three variables / symbols is called a Three Variable Equation
5. These equations are called ***Linear equations*** in three variables.

6. Monomials can also be multiplied by nonzero constant values.
7. A polynomial is formed by a finite set of monomials that relate with each other through the operators of addition and subtraction.
8. The order of the polynomial is defined as the order of the highest degree monomial present in the mathematical statement.
9. In the process of exponentiation, a number is repeatedly multiplied by itself.

Text 5. Laws of Math

1. Learn the vocabulary of the lesson

1. real numbers
2. a quantity
3. terms
4. carry out
5. the associative law of addition
6. additive identity
7. the additive inverse of *a*
8. apply
9. the multiplicative identity and inverse.
10. the product of any two real numbers
11. the associative law of multiplication
12. the commutative law of addition.
13. the multiplicative identity
14. the multiplicative inverse
15. the commutative law of multiplication
16. a set of elements
17. to obey these five laws
18. to be an Abelian group under multiplication
19. the set of all real numbers, excluding zero
20. property of the set of real numbers

21. distributive laws
22. an equality relation
23. to constitute a field

2. Read and translate the text “Laws of Math”

Let a, b, c be three variables. Then the followings are some basic rules of algebra applicable to these variables.

Laws of addition

The sum of any two real numbers a and b is again a real number, denoted $a + b$. The real numbers are closed under the operations of addition, subtraction, multiplication, division, and the extraction of roots; this means that applying any of these operations to real numbers yields a quantity that also is a real number.

No matter how terms are grouped in carrying out additions, the sum will always be the same: $(a + b) + c = a + (b + c)$. This is called the associative law of addition.

Given any real number a, there is a real number zero (0) called the additive identity, such that $a + 0 = 0 + a = a$.

Given any real number a, there is a number $(-a)$, called the additive inverse of a, such that $(a) + (-a) = 0$.

No matter in what order addition is carried out, the sum will always be the same: $a + b = b + a$. This is called the commutative law of addition.

Laws of multiplication

Laws similar to those for addition also apply to multiplication. Special attention should be given to the multiplicative identity and inverse. The product of any two real numbers a and b is again a real number, denoted $a \cdot b$ or ab.

No matter how terms are grouped in carrying out multiplications, the product will always be the same: $(ab)c = a(bc)$. This is called the associative law of multiplication.

Given any real number a, there is a number one (1) called the multiplicative identity, such that $a(1) = 1(a) = a$.

Given any nonzero real number a, there is a number (a^{-1}), or ($1/a$), called the multiplicative inverse, such that $a(a^{-1}) = (a^{-1})\,a = 1$.

No matter in what order multiplication is carried out, the product will always be the same: $ab = ba$. This is called the commutative law of multiplication.

Any set of elements obeying these five laws is said to be an Abelian, or commutative, group under multiplication. The set of all real numbers, excluding zero (because division by zero is inadmissible), forms such a commutative group under multiplication.

Distributive laws

Another important property of the set of real numbers links addition and multiplication in two distributive laws as follows:

D1. $a(b + c) = ab + ac$

D2. $(b + c)\,a = ba + ca$

Any set of elements with an equality relation and for which two operations (such as addition and multiplication) are defined, and which obeys all the laws for addition, the laws for multiplication, and the distributive laws, constitutes a *field*.

3. Identify the italicized words in the sentences:

1. The sum of any two real numbers a and b is again a real number, *denoted* $a + b$.
2. This means that *applying* any of these operations to real numbers yields a quantity that also is a real number.
3. No matter how terms are grouped in *carrying out* additions, the sum will always be the same.
4. *Given* any real number a, there is a real number zero (0) *called* the additive identity, such that $a + 0 = 0 + a = a$.
5. Any set of elements *obeying* these five laws is said to be an Abelian.

6. The set of all real numbers, *excluding* zero forms a commutative group under multiplication.

Text 6. Numerals

1. Learn the vocabulary of the lesson:

1. graphic representation of numbers
2. number notation
3. straight lines
4. vertical or horizontal lines
5. to deal with large numbers
6. cuneiform notation
7. the value of the numeral
8. from the mathematical point of view
9. a bar
10. the advantage
11. the disadvantage
12. Roman numerals
13. rapid written calculations
14. the use of positional notation

2. Read and translate the text "**Numerals**"

Numerals, signs or symbols are for graphic representation of numbers. The earliest forms of number notation were simply groups of straight lines, either vertical or horizontal, each line corresponding to the number 1. Such a system is inconvenient when dealing with large numbers, and as early as 3400 BC in Egypt and 3000 BC in Mesopotamia a special symbol was adopted for the number 10. The addition of this second number symbol made it possible to express the number 11 with 2 instead of 11 individual symbols and the number 99 with 18 instead of 99 individual symbols. Later numeral systems introduced extra symbols for a number between 1 and 10, usually either 4 or 5, and additional symbols for numbers greater than 10. In Babylonian cuneiform notation the numeral used for 1 was also used for 60 and for powers of 60; the value of the numeral was indicated by its context. This was a logical arrangement from the mathematical point of view because $60^0 = 1$, $60^1 = 60$, and $60^2 = 3600$. The Egyptian hieroglyphic system used special symbols for 10, 100, 1000, and 10,000.

The ancient Greeks had two parallel systems of numerals. The earlier of these was based on the initial letters of the names of numbers: The number 5 was indicated by the letter pi; 10 by the letter delta; 100 by the antique form of the letter *H;* 1000 by the letter chi; and 10,000 by the letter mu. The later system, which was first introduced about the 3rd century BC, employed all the letters of the Greek alphabet plus three letters borrowed from the Phoenician alphabet as number symbols. The first nine letters of the alphabet were used for the numbers 1 to 9, the second nine letters for the tens from 10 to 90, and the last nine letters for the hundreds from 100 to 900. Thousands were indicated by placing a bar to the left of the appropriate numeral, and tens of thousands by placing the appropriate letter over the letter *M.* The late Greek system had the advantage that large numbers could be expressed with a minimum of symbols, but it had the disadvantage of requiring the user to memorize a total of 27 symbols.

Roman numerals

The system of number symbols created by the Romans had the merit of expressing all numbers from 1 to 1,000,000 with a total of seven symbols: I for 1, V for 5, X for 10, L for 50, C for 100, D for 500, and M for 1000. Roman numerals are read from left to right. The symbols representing the largest quantities are placed at the left; immediately to the right of those are the symbols representing the next largest quantities, and so on. The symbols are usually added together. For example, LX = 60, and MMCIII = 2103. When a numeral is smaller than the numeral to the right, however, the numeral on the left should be subtracted from the numeral on the right. For instance, XIV = 14 and IX = 9 represents 1,000,000—a small bar placed over the numeral multiplies the numeral by 1000. Thus, theoretically, it is possible, by using an infinite number of bars, to express the numbers from 1 to infinity. In practice, however, one bar is usually used; two are rarely used, and more than two are almost never used. Roman numerals are still used today, more than 2000 years after their introduction. The Roman system's one drawback, however, is that it is not suitable for rapid written calculations.

Arabic numerals

The common system of number notation in use in most parts of the world today is the Arabic system. This system was first developed by the Hindus and was in use in India in the 3rd century BC. At that time the numerals 1, 4, and 6 were written in substantially the same form used today. The Hindu numeral system was probably introduced into the Arab world about the 7th or 8th century AD. The first recorded use of the system in Europe was in 976 AD. The important innovation in the Arabic system was the use of positional notation, in which individual number symbols assume different values according to their position in the written numeral. Positional notation is made possible by the use of a symbol for zero. The symbol 0 makes it possible to differentiate between 11, 101, and 1001 without the use of additional symbols, and all numbers can be expressed in terms of ten symbols, the numerals from 1 to 9 plus 0. Positional notation also greatly simplifies all forms of written numerical calculation.

3. Open the brackets using the correct form of the verb (Active or Passive)

1. The earliest forms of number notation (to be) simply groups of straight lines, either vertical or horizontal, each line corresponding to the number 1.

2. As early as 3400 BC in Egypt and 3000 BC in Mesopotamia a special symbol (to adopt) for the number 10.
3. Later numeral systems (to introduce) extra symbols for a number between 1 and 10, usually either 4 or 5, and additional symbols for numbers greater than 10.
4. The Egyptian hieroglyphic system (to use) special symbols for 10, 100, 1000, and 10,000.
5. The ancient Greeks (to have) two parallel systems of numerals.
6. The number 5 (to indicate) by the letter pi; 10 by the letter delta; 100 by the antique form of the letter *H;* 1000 by the letter chi; and 10,000 by the letter mu.
7. The late Greek system (to have) the advantage that large numbers could be expressed with a minimum of symbols.
8. Roman numerals (to read) from left to right.
9. Arabic system first (to develop) by the Hindus and was in use in India in the 3rd century BC.
10. Roman numerals still (to use) today, more than 2000 years after their introduction.

Text 7. Types of numbers

1. Learn the vocabulary of the text

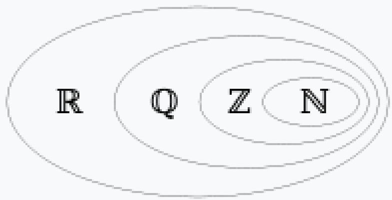
1. natural numbers
2. counting numbers
3. non-negative integers
4. cardinal numbers
5. ordinal numbers
6. nominal numbers
7. Integers
8. positive and negative counting numbers
9. a fractional component
10. rational numbers
11. a ratio of an integer to a non-zero integer

12. the quotient or fraction p/q of two integers
13. a numerator
14. a denominator
15. the set of all rational numbers
16. real numbers
17. a distance
18. a value of a continuous quantity
19. real and imaginary roots of polynomials
20. the transcendental numbers
21. to measure quantities
22. time, mass, energy, velocity
23. irrational numbers
24. the numbers constructed from ratios of integers
25. imaginary numbers
26. a complex number
27. property

2. Read and translate the text “Types of numbers”

Natural numbers : The counting numbers {1, 2, 3, ...} are commonly called natural numbers; however, other definitions include 0, so that the non-negative integers {0, 1, 2, 3, ...} are also called natural numbers.
In mathematics, the natural numbers are those used for counting and ordering. In common mathematical terminology, words colloquially used for counting are **"cardinal numbers"** and words connected to ordering represent **"ordinal numbers".** The natural numbers can, at times, appear as a convenient set of codes; that is, as what linguists call nominal numbers, foregoing many or all of the properties of being a number in a mathematical sense.
Integers : Positive and negative counting numbers, as well as zero: {..., −3, −2, −1, 0, 1, 2, 3, ...}. An integer is a number that can be written without a fractional component. For example, 21, 4, 0, and −2048 are integers, while 9.75, 5 1/2, and √2 are not.

Rational numbers : Numbers that can be expressed as a ratio of an integer to a non-zero integer. All integers are rational, but the converse is not true.
In mathematics, a rational number is any number that can be expressed as the quotient or fraction *p*/*q* of two integers, a numerator *p* and a non-zero denominator *q*. Since *q* may be equal to 1, every integer is a rational number. The set of all rational numbers, often referred to as "**the rationals**", the **field of rationals** or the **field of rational numbers** is usually denoted by a boldface **Q** ; it was thus denoted in 1895 by Giuseppe Peano after *quoziente*, Italian for "quotient".



The rational numbers (ℚ) are included in the real numbers (ℝ). On the other hand, they include the integers (ℤ), which in turn include the natural numbers (ℕ).
Real numbers : Numbers that can represent a distance along a line. They can be positive, negative, or zero. All rational numbers are real, but the converse is not true. In mathematics, a **real number** is a value of a continuous quantity that can represent a distance along a line. The adjective *real* in this context was introduced in the 17th century by René Descartes, who distinguished between real and imaginary roots of polynomials. The real numbers include all the rational numbers, such as the integer −5 and the fraction 4/3, and all the irrational numbers, such as √2. Included within the irrationals are the

transcendental numbers, such as π (3.14159265...). In addition to measuring distance, real numbers can be used to measure quantities such as time, mass, energy, velocity, and many more.

Irrational numbers : In mathematics, the **irrational numbers** are all the real numbers which are not rational numbers, the latter being the numbers constructed from ratios of integers. When the ratio of lengths of two line segments is an irrational number, the line segments are also described as being *incommensurable*, meaning that they share no "measure" in common, that is, there is no length, no matter how short, that could be used to express the lengths of both of the two given segments as integer multiples of itself.

Imaginary numbers: Numbers that equal the product of a real number and the square root of -1. The number 0 is both real and imaginary. An imaginary number is a complex number that can be written as a real number multiplied by the imaginary unit i, which is defined by its property $i^2 = -1$. The square of an imaginary number bi is $-b^2$. For example, $5i$ is an imaginary number, and its square is -25. Zero is considered to be both real and imaginary.

Complex numbers : Includes real numbers, imaginary numbers, and sums and differences of real and imaginary numbers.

A complex number is a number that can be expressed in the form $a + bi$, where a and b are real numbers, and i is a solution of the equation $x^2 = -1$. Because no real number satisfies this equation, i is called an imaginary number. For the complex number $a + bi$, a is called the **real part**, and b is called the **imaginary part**. Despite the historical nomenclature "imaginary", complex numbers are regarded in the mathematical sciences as just as "real" as the real numbers and are fundamental in many aspects of the scientific description of the natural world.

3. Translate the text into English.

Число — абстракция, используемая для количественной характеристики объектов. Числа возникли еще в первобытном обществе в связи с потребностью людей считать предметы. С течением времени по мере развития науки число превратилось в важнейшее математическое понятие.

Для решения задач и доказательства различных теорем необходимо понимать, какие бывают виды чисел. Основные виды чисел включают в себя: натуральные числа, целые числа, рациональные числа, действительные числа.

Натуральные числа – это числа, получаемые при естественном счёте предметов, а вернее при их нумерации («первый», «второй», «третий»...). Множество натуральных чисел обозначается латинской буквой $\boldsymbol{N}$ (можно запомнить, опираясь на английское слово natural). Можно сказать, что $\boldsymbol{N} = \{1,2,3,....\}$

Целые числа – это числа из множества $\{0, 1, -1, 2, -2, ...\}$. Это множество состоит из трех частей – натуральные числа, отрицательные целые числа (противоположные натуральным числам) и число 0 (нуль). Целые числа обозначаются латинской буквой $\boldsymbol{Z}$. Можно сказать, что $\boldsymbol{Z}=\{1,2,3,....\}$.

Действительные (вещественные) числа – это числа, которое применяются для измерения непрерывных величин. Множество действительных чисел обозначается латинской буквой **R**. Действительные числа включают в себя рациональные числа и иррациональные числа. Иррациональные числа – это числа, которые получаются в результате выполнения различных операций с рациональными числами (например, извлечение корня, вычисление логарифмов), но при этом не являются рациональными. Любое действительное число можно отобразить на числовой прямой.

Для перечисленных выше множеств чисел справедливо следующее высказывание: то есть множество натуральных чисел входит во множество целых чисел. Множество целых чисел входит во множество рациональных чисел. А множество рациональных чисел входит во множество действительных чисел. Это высказывание можно проиллюстрировать с помощью кругов Эйлера.

Text 8. Axiom

1. The vocabulary of the lesson

1. axiom
2. a basic principle
3. proof
4. to assume
5. to stem from
6. pure mathematics
7. the principle of contradiction
8. equals
9. unproved assumptions
10. proposition
11. to derive
12. procedure
13. to avoid circularity
14. infinite regression
15. to be consistent
16. to lead to contradictions
17. self-evident truth
18. to be used synonymously
19. deductive system
20. infrequently

2. Read and translate the text.

Axiom, in logic and mathematics, a basic principle that is assumed to be true without proof. The use of axioms in mathematics stems from the ancient Greeks, most probably during the 5th century BC, and represents the beginnings of pure mathematics as it is known today. Examples of axioms are the following: “No sentence can be true and false at the same time” (the principle of contradiction); “If equals are added to equals, the sums are equal”; “The whole is greater than any of its parts.”

Logic and pure mathematics begin with such unproved assumptions from which other propositions (theorems) are derived. This procedure is necessary to avoid circularity, or an infinite regression in reasoning. The axioms of any system must be consistent with one another, that is, they should not lead to contradictions.

They should be independent in the sense that they cannot be derived from one another. They should also be few in number. Axioms have sometimes been interpreted as self-evident truths. The present tendency is to avoid this claim and simply to assert that an axiom is assumed to be true without proof in the system of which it is a part.

The terms *axiom* and *postulate* are often used synonymously. Sometimes the word *axiom* is used to refer to basic principles that are assumed by every deductive system, and the term *postulate* is used to refer to first principles peculiar to a particular system, such as Euclidean geometry. Infrequently, the word *axiom* is used to refer to first principles in logic, and the term *postulate* is used to refer to first principles in mathematics.

3. Answer the questions:

1. What is axiom?
2. What are the examples of axioms?
3. Why should not axioms lead to contradictions?

4. Axioms should also be few in number, shouldn't they?
5. What terms are often used synonymously?

4. Try to remember the following verbs:
to stem from, to derive from, to be consistent with, to lead to, to refer to.

Text 9. Sequence and series

1. Read, translate and learn the vocabulary of the lesson.

1. sequence
2. series
3. an ordered succession of numbers
4. quantities
5. term
6. a last term
7. the sequence is finite
8. the sequence is infinite
9. a rule
10. positive integer
11. the sum of the two preceding terms
12. to determine the sequence
13. the Fibonacci sequence
14. arithmetic sequences/ arithmetic progressions
15. to form an arithmetic progression
16. successive terms
17. geometric sequences / geometric progressions
18. the ratios of successive terms
19. a limiting value
20. the limit of the sequence
21. the indicated sum
22. the case of power series
23. theory of convergence

2. Read and translate the text.

Sequence and Series, in mathematics, are an ordered succession of numbers or other quantities, and the indicated sum of such a succession, respectively.

A sequence is represented as a_1, a_2..., a_n, ... The *a*s are numbers or quantities, distinct or not; a_1 is the first term, a_2 the second term, and so on. If the expression has a last term, the sequence is finite; otherwise, it is infinite. A sequence is established or defined only if a rule is given that determines the *n*th term for every positive integer *n;* this rule may be given as a formula for the *n*th term. For example, all the positive integers, in natural order, form an infinite sequence; this sequence is defined by the formula $a_n=n$. The formula $a_n = n^2$ determines the sequence 1, 4, 9, 16, ... The rule of starting with 0, 1, then letting each term be the sum of the two preceding terms determines the sequence 0, 1, 1, 2, 3, 5, 8, 13, ...; this is known as the Fibonacci sequence.

Important types of sequences include arithmetic sequences (also known as arithmetic progressions) in which the differences between successive terms are constant, and geometric sequences (also known as geometric progressions) in which the ratios of successive terms are constant. Examples arise when a sum of money is invested. If the money is invested at a simple interest of 8 percent, then after *n* years an initial principal of *P* dollars grows to $a_n = P + n \times (0.08) P$ dollars. Since (0.08) *P* dollars is added each year, the amounts a_n form an arithmetic progression. If the interest is instead compounded, the amounts present after a sequence of years form a geometric progression, $g_n = P \times (1.08)^n$. In both of these cases, it is clear that a_n and g_n will eventually become larger than any preassigned whole number *N*, however large *N* may be.

Terms in a sequence, however, do not always increase without limit. For example, as *n* increases, the sequence $a_n = 1/n$ approaches 0 as a limiting value, and $b_n = A + B/n$ approaches A. In any such case some finite number L exists such that whatever tolerance e is specified, the values of the sequence all eventually lie within a distance e of L. For example, in the case of the sequence $2 + (-1)^n/2n, L = 2$. Even if e is as small as 1/10,000, it can be seen that if n is greater than 5000, all values of n are within e of 2. The number L is called the limit of the sequence, since even though individual terms of the sequence may be bigger or smaller than L, the terms eventually cluster closer and closer to L. When the sequence has a limit L, it is said to converge to L. For the sequence a_n, for example, this is written as lim $a_n = L$, which is read as "the limit of a_n as n goes to infinity is L."

The term *series* refers to the indicated sum, $a_1 + a_2 + ... + a_n$, or $a_1 + a_2 + ... + a_n + ...$, of the terms of a sequence. A series is either finite or infinite, depending on whether the corresponding sequence of terms is finite or infinite.

The sequence $s_1 = a_1$, $s_2 = a_1 + a_2$, $s_3 = a_1 + a_2 + a_3$, ..., $s_n = a_1 + a_2 + ... + a_n$, ..., is called the sequence of partial sums of the series $a_1 + a_2 + ... + a_n + ...$ The series converges or diverges as the sequence of partial sums converges or diverges. A constant-term series is one in which the terms are numbers; a series of functions is one in which the terms are functions of one or more variables. In particular, a power series is the series $a_0 + a_1(x - c) + a_2(x - c)^2 + ... + a_n (x - c)^n + ...$, in which c and the as are constants. In the case of power series, the problem is to describe what values of x they converge for. If a series converges for some x, then the set of all x for which it converges consists of a point or some connected interval. The basic theory of convergence was worked out by the French mathematician Augustin Louis Cauchy in the 1820s.

The theory and application of infinite series are important in virtually every branch of pure and applied mathematics.

3. **Open the brackets:**
   1. The basic theory of convergence (work out) by the French mathematician Augustin Louis Cauchy in the 1820s.
   2. The theory and application of infinite series (to be) important in virtually every branch of pure and applied mathematics.
   3. A sequence (represent) as a_1, a_2..., a_n, ...
   4. If the expression (to have) a last term, the sequence is finite.
   5. Examples arise when a sum of money (to invest).
   6. Terms in a sequence, however, (not to increase) without limit.
4. **Give the negative form of the verbs:**
   is established, may be given, determines, arise, grows, will eventually become, lie, is called, goes, is written, refers to, consists of, was worked out, are.

Text 10. Fractions

1. **Learn the vocabulary of the lesson:**
   1. a fraction
   2. a whole number/ integer
   3. equal parts
   4. a common, vulgar, or simple fraction
   5. an integer numerator
   6. displayed above a line /below that line
   7. a non-zero integer denominator
   8. compound fractions
   9. complex fractions
   10. mixed numerals
   11. a representation of a non-integer as a ratio of two integers
   12. improper fractions
   13. mixed numbers

14. a common denominator
15. the least common denominator
16. to have the same denominators
17. to add fractions
18. to multiply two or more fractions together
19. to multiply the numerators together
20. to multiply the denominators together
21. a cardinal number
22. an ordinal number
23. decimal fractions
24. sign
25. the point
26. read separately
27. may be omitted

2. Read and translate the text.

A **fraction** represents a part of a whole or, more generally, any number of equal parts. When spoken in everyday English, a fraction describes how many parts of a certain size there are, for example, **one-half, eight-fifths, three-quarters.** A *common*, *vulgar*, or *simple* fraction consists of an integer numerator displayed above a line, and a non-zero integer denominator, displayed below that line. Numerators and denominators are also used in fractions that are not *common*, including compound fractions, complex fractions, and mixed numerals.

The first thing to note is that all fractions can be represented in many different ways.

A fraction is a representation of a non-integer as a ratio of two integers. These include improper fractions as well as mixed numbers.

In many problems different fractions need to be written to a common denominator and the least common denominator is often the best.

If fractions are to be added, then they must have the same denominators. To multiply two or more fractions together, multiply the numerators together and multiply the denominators together.

Common fractions

Common (simple, vulgar) fractions nowadays more often than not are written on one line:
1/2, 5 3/5, 4/7, 1/3 in printing. But there are printed works where traditional writing is used:
$\frac{5}{7}, \frac{4}{8}, 3\frac{5}{8}$ etc.
Common fractions are read in the same way as we, Russians do, i. e.: **the numerator** is read as **a cardinal number** and **the denominator** as **an ordinal number**. If the numerator is greater than one the denominator takes the plural ending -s: 3/7 – three sevenths, 5/8 – five eighths etc.

In mixed fractions (numbers) **the integer** is read as a cardinal number and fraction must be added with "and". E. g.: 3 2/5: three and two fifths; 10 2/7: ten and two sevenths.

The reading of small fractions is often simplified: 1/2 is read a half, one half, 1/3 – a third, 1/4 – a quarter; instead of: one the second, one the third, one the fourth.
In decimal fractions the point (.) is used after the whole number in distinction from Russian, where comma (,) is used and where this sign is not read. But in Russian we must always say – десятых, сотых, тысячных и т. д., in English it is suffice to write (.) and to say "point": 0.5 – nought or O [ou] point five or.5 – point five; 1.3 – one point three; 10.35 – ten point three five; 5.253 – five point two five three; 0.001 – point OO one, or point nought nought one; point two noughts one; point two Oes one. After the point (.) all numbers are read separately. Nought, O may often be omitted but the point (.) is never omitted because it shows that the number is a decimal

fraction. In the USA “O” is preffered to be read as “zero”. The point (.) may be written in the upper, middle or down part of the decimal fraction:

3. 5; 2·5; 2.5.

4. Examples of spelling

1/2 – one-half / a half;
1/3 – one third;
1/4 – one-fourth / a quarter;
1/5 – one-fifth;
1/8 – one-eighth;
1/9 – one-ninth;
1/10 – one-tenth;
1/12 – one-twelfth;
1/20 – one twentieth;
1/32 – one thirty-second;
1/100 – one-hundredth;
1/1000 – one-thousandth;
2/3 – two-thirds;
4/5 – four-fifths;
3/4 – three-fourths / three-quarters;
5/8 – five-eighths;
9/10 – nine-tenths;
7/36 – seven thirty-sixths;
33/100 – thirty-three hundredths;
65/1000 – sixty-five thousandths;
1 1/2 – one and a half;
1 1/4 – one and a quarter;
3 2/5 – three and two-fifths;
6 3/7 – six and three-sevenths.

5. **Fill in the gaps using the words given bellow:**

1. One of the sum of several fractional units is called a … .
2. The number above the fraction line is the numerator and that below is the … of the fraction.
3. The numerator and denominator of a fraction taken together are sometimes called the … of the fraction.
4. A fraction whose numerator is less than its denominator is caller a … .
5. A number which is expressed by a whole number and a fraction is called a ….
6. A part of unity or several equal parts of unity is a … .
7. In general, a fraction can be reduced to lower terms if the numerator and the denominator have a … .
8. When writing decimal there is no need to indicate the name of the … .
9. The digits which come after the decimal point on the right are termed the … .
10. If the denominators of fractions are tenths, hundredths, thousandths, etc, the fractions are called … .

(fraction, decimal fractions, denominator, numerator, terms, common divisor, proper fraction, fraction, mixed number, denominator)

Text 11. Equations and identities

1. **Learn the vocabulary of the lesson:**

1. an equation
2. an equality
3. a variable
4. x squared
5. x cubed
6. the square root of
7. b to the fourth power
8. identity

9. valid at all admissible values of its variables
10. a symbolic statement
11. conditional equations
12. identical equations
13. to solve an equation in one unknown
14. that make the left member equal to the right member
15. to satisfy the equation
16. the solution or the root of the equation
17. to have the same roots
18. permissible
19. an equivalent operation called transposition
20. to change signs
21. equations of the first degree
22. the solution is incomplete

2. Read and translate the text:

There are different kinds of equations. In general, the equation is an equality with one or several unknown variable(s). The reading of equations is the same as in Russian: $30 + 15 + x^2 + x^3 = 90$ – is read: thirty plus fifteen plus x squared plus x cubed is equal to ninety.

$2 + b + \sqrt{6} + b^4 = 160$ – is read: two plus b plus the square root of six plus b to the fourth power is equal one hundred and sixty.

The identity is an equality, valid at all admissible values of its variables.

The identities are read: $a + b = b + a$ – a plus b equals b plus a; $\sin^2 x + \cos^2 x = 1$ – sine squared x plus cosine squared x is equal to one.

An equation is a symbolic statement that two expressions are equal. Thus $x + 3 = 8$ is an equation, stating that $x + 3$ equals 8.

There are two kinds of equations: *conditional equations*, which are generally called equations and *identical equations* which are generally called identities.

An identity is an equality whose two members (sides) are equal for all values of the unknown quantity (or quantities) contained in it.

An equation in one unknown is an equality which is true for only one value of the unknown.

To solve an equation in one unknown means to find values of the unknown that make the left member equal to the right member.

Any such value which satisfies the equation is called the solution or the root of the equation. Two equations are equivalent if they have the same roots. Thus, $x - 2 = 0$ and $3x - 6 = 0$ are equivalent equations, since they both have the single root $x = 2$.

In order to solve an equation it is permissible to:

a) add the same number to both members;

b) subtract the same number from both members;

c) multiply both members by the same number;

d) divide both members by the same number with the single exception
of the number zero.

These operations are permissible because they lead to equivalent equations.

Operations a) and b) are often replaced by an equivalent operation called transposition. It consists in changing a term from one member of the equation to the other member and changing its signs.

An equation of the form $ax + b = 0$ where a 0 is an equation of the first degree in the unknown x. Equations of the first degree are solved by the permissible operations listed in this text. The solution is incomplete until the value of the unknown so found is substituted in the original equation and it is shown to satisfy this equation.

Example: Solve: $3x = 6$

Solution: Divide both members by 3: $x = 2$

Check: Substitute 2 for x in the original equation: $3 \cdot 2 = 6$, $6 = 6$.

3. **Make up questions to the sentences:**

1. To solve an equation in one unknown means to find values of the unknown that make the left member equal to the right member.
2. There are different kinds of equations.
3. The reading of equations is the same as in Russian.
4. Identical equations are generally called identities.
5. Any such value which satisfies the equation is called the solution or the root of the equation.
6. Two equations are equivalent if they have the same roots.
7. These operations are permissible because they lead to equivalent equations.
8. Equations of the first degree are solved by the permissible operations listed in this text.
9. The solution is incomplete until the value of the unknown so found is substituted in the original equation and it is shown to satisfy this equation.
10. In order to solve an equation, it is permissible to add the same number to both members.

Text 12. Differential equations

1. **Learn the vocabulary of the lesson:**

1. a differential equation
2. to relate some function with its derivatives
3. application
4. to represent physical quantities
5. rate of change
6. to define
7. a relationship
8. to be extremely common
9. to play a prominent role
10. pure mathematics
11. solution
12. the set of functions

13. satisfy the equation
14. to be solvable
15. some properties of solutions
16. a given differential equation
17. determine
18. a self-contained formula
19. to be available
20. to be numerically approximated
21. to put emphasis on…
22. qualitative analysis of systems
23. to develop
24. accurate/ accuracy
25. pure and applied mathematics
26. the existence and uniqueness of solutions
27. the rigorous justification of the methods
28. virtually
29. celestial motion
30. interactions between neurons
31. to solve real-life problems
32. to model the behavior of complex systems
33. propagation of light and sound in the atmosphere
34. second-order partial differential equation
35. ordinary differential equations
36. independent variables

2. Read and translate the text.

A **differential equation** is a mathematical equation that relates some function with its derivatives. In applications, the functions usually represent physical quantities, the derivatives represent their rates of change, and the equation defines a relationship between the two. Because such relations are extremely common, differential equations play a prominent role in many disciplines including engineering, physics, economics, and biology.

In pure mathematics, differential equations are studied from several different perspectives, mostly concerned with their solutions—the set of functions that satisfy the equation. Only the simplest differential equations are solvable by explicit formulas; however, some properties of solutions of a given differential equation may be determined without finding their exact form.

If a self-contained formula for the solution is not available, the solution may be numerically approximated using computers. The theory of dynamical systems puts emphasis on qualitative analysis of systems described by differential equations, while many numerical methods have been developed to determine solutions with a given degree of accuracy.

Applications

The study of differential equations is a wide field in pure and applied mathematics, physics, and engineering. All of these disciplines are concerned with the properties of differential equations of various types. Pure mathematics focuses on the existence and uniqueness of solutions, while applied mathematics emphasizes the rigorous justification of the methods for approximating solutions. Differential equations play an important role in modelling virtually every physical, technical, or biological process, from celestial motion, to bridge design, to interactions between neurons. Differential equations such as those used to solve real-life problems may not necessarily be directly solvable, i.e. do not have closed form solutions. Instead, solutions can be approximated using numerical methods.

Many fundamental laws of physics and chemistry can be formulated as differential equations. In biology and economics, differential equations are used to model the behavior of complex systems. The mathematical theory of differential equations was first developed together with the sciences where the equations had originated and where the results found application. However, diverse problems, sometimes originating in quite distinct scientific fields, may give rise to identical differential equations. Whenever this happens, mathematical theory behind the equations can be viewed as a unifying principle behind diverse phenomena. As an example, consider propagation of light and sound in the atmosphere, and of waves on the surface of a pond. All of them may be described by the same second-order partial differential equation, the wave equation, which allows us to think of light and sound as forms of waves, much like familiar waves in the water.

Conduction of heat, the theory of which was developed by Joseph Fourier, is governed by another second-order partial differential equation, the heat equation. It turns out that many diffusion processes, while seemingly different, are described by the same equation; the Black–Scholes equation in finance is, for instance, related to the heat equation.

An ordinary differential equation (or ODE) is a relation that contains functions of only one independent variable, and one or more of its derivatives with respect to that variable. Ordinary differential equations are to be distinguished from partial differential equations where there are several independent variables involving partial derivatives. Ordinary differential equations arise in many different contexts including geometry, mechanics, astronomy and population modeling. There are many important classes of differential equations for which detailed information is available. A function $y = f(x)$ is said to be a solution of a differential equation if the latter is satisfied when y and its derivatives are replaced throughout by $f(x)$ and its corresponding derivatives.

3. Make the following sentences negative:

1. In applications, the functions usually represent physical quantities, the derivatives represent their rates of change, and the equation defines a relationship between the two.
2. Differential equations play a prominent role in many disciplines including engineering, physics, economics, and biology.
3. In pure mathematics, differential equations are studied from several different perspectives.

4. The solution may be numerically approximated using computers.
5. The study of differential equations is a wide field in pure and applied mathematics, physics, and engineering.
6. Pure mathematics focuses on the existence and uniqueness of solutions.
7. Differential equations play an important role in modelling physical, technical, or biological process.
8. Many fundamental laws of physics and chemistry can be formulated as differential equations.
9. In biology and economics, differential equations are used to model the behavior of complex systems.
10. Ordinary differential equations arise in geometry, mechanics, astronomy and population modeling.

Text 13. Pure mathematics

1. Learn the vocabulary of the text:

1. underlying laws of logic
2. to be taken for granted
3. the tools of mathematics
4. to expand
5. rapid/rapidly
6. divide/subdivide
7. proof theory
8. Gödel's incompleteness theorems
9. the idea of Turing machines
10. unorthodox view of the nature of logic
11. framework
12. a collection of distinct things
13. to treat
14. to have an internal organic structure
15. a new generation of mathematicians
16. the study of integers
17. Calculus and complex analysis

18. notions
19. lattices and ordered algebraic structures
20. field theory
21. a mathematical entity
22. ring theory
23. combinatorics
24. spatial relationships
25. polytopes and polyhedra
26. convex geometry
27. study of semi-algebraic sets
28. points, straight lines, curves, surfaces, and solids
29. mapping
30. Coefficient

2. Read and translate the text "Pure mathematics"

Foundations, including set theory and mathematical logic

Mathematicians have always worked with logic and symbols, but for centuries the underlying laws of logic were taken for granted, and never expressed symbolically. Mathematical logic, also known as symbolic logic, was developed when people finally realized that the tools of mathematics can be used to study the structure of logic itself. Areas of research in this field have expanded rapidly, and are usually subdivided into several distinct departments.

Proof theory and constructive mathematics

Proof theory grew out of David Hilbert's ambitious program to formalize all the proofs in mathematics. The most famous result in the field is encapsulated in Gödel's incompleteness theorems. A closely related and now quite popular concept is the idea of Turing machines. Constructivism is the outgrowth of Brouwer's unorthodox view of the nature of logic itself; constructively speaking, mathematicians cannot assert "Either a circle is round, or it is not" until they have actually exhibited a circle and measured its roundness.

Model theory

Model theory studies mathematical structures in a general framework. Its main tool is first-order logic.

Set theory

A set can be thought of as a collection of distinct things united by some common feature. Set theory is subdivided into three main areas. Naive set theory is the original set theory developed by mathematicians at the end of the 19th century. Axiomatic set theory is a rigorous axiomatic theory developed in response to the discovery of serious flaws (such as Russell's paradox) in naive set theory. It treats sets as "whatever satisfies the axioms", and the notion of collections of things serves only as motivation for the axioms. Internal set theory is an axiomatic extension of set theory that supports a logically consistent identification of *illimited* (enormously large) and *infinitesimal*(unimaginably small) elements within the real numbers.

History and biography

The history of mathematics is inextricably intertwined with the subject itself. This is perfectly natural: mathematics has an internal organic structure, deriving new theorems from those that have come before. As each new generation of mathematicians builds upon the achievements of our ancestors, the subject itself expands and grows new layers, like an onion.

Recreational mathematics

From magic squares to the Mandelbrot set, numbers have been a source of amusement and delight for millions of people throughout the ages. Many important branches of "serious" mathematics have their roots in what was once a mere puzzle and/or game.

Number Theory

Number theory is the study of numbers and the properties of operations between them. Number theory is traditionally concerned with the properties of integers, but more recently, it has come to be concerned with wider classes of problems that have arisen naturally from the study of integers.

Arithmetic

An elementary part of number theory that primarily focuses upon the study of natural numbers, integers, fractions, and decimals, as well as the properties of the traditional operations on them: addition, subtraction, multiplication and division. Up until the 19th century, *arithmetic* and *number theory* were synonyms, but the evolution and growth of the field has resulted in arithmetic referring only to the elementary branch of number theory.

Elementary number theory

The study of integers at a higher level than arithmetic, where the term 'elementary' here refers to the fact that no techniques from other mathematical fields are used.

Analytic number theory

Calculus and complex analysis are used as tools to study the integers.

Algebraic number theory

The study of algebraic numbers, the roots of polynomials with integer coefficients.

Other number theory subfields

Geometric number theory; combinatorial number theory; transcendental number theory; and computational number theory.

Algebra

The study of structure begins with numbers, first the familiar natural numbers and integers and their arithmetical operations, which are recorded in elementary algebra. The deeper properties of these numbers are studied in number theory. The investigation of methods to solve equations leads to the field of abstract algebra, which, among other things, studies rings and fields, structures that generalize the properties possessed by everyday numbers. Long standing questions about compass and straightedge construction were finally settled by Galois theory. The physically important concept of vectors, generalized to vector spaces, is studied in linear algebra.

Order theory

For any two distinct real numbers, one must be greater than the other. Order Theory extends this idea to sets in general. It includes notions like lattices and ordered algebraic structures.

General algebraic systems

Given a set, different ways of combining or relating members of that set can be defined. If these obey certain rules, then a particular algebraic structure is formed. Universal algebra is the more formal study of these structures and systems.

Field theory and polynomials

Field theory studies the properties of fields. A field is a mathematical entity for which addition, subtraction, multiplication and division are well-defined. A polynomial is an expression in which constants and variables are combined using only addition, subtraction, and multiplication.

Commutative rings and algebras

In ring theory, a branch of abstract algebra, a commutative ring is a ring in which the multiplication operation obeys the commutative law. This means that if a and b are any elements of the ring, then $a \times b = b \times a$. Commutative algebra is the field of study of commutative rings and their ideals, modules and algebras. It is foundational both for algebraic geometry and for algebraic number theory. The most prominent examples of commutative rings are rings of polynomials.

Combinatorics

Combinatorics is the study of finite or discrete collections of objects that satisfy specified criteria. In particular, it is concerned with "counting" the objects in those collections (enumerative combinatorics) and with deciding whether certain "optimal" objects exist (extremal combinatorics). It includes graph theory, used to describe inter-connected objects (a graph in this sense is a network, or collection of connected points). A *combinatorial flavour* is present in many parts of problem-solving.

Geometry and topology

Geometry deals with spatial relationships, using fundamental qualities or axioms. Such axioms can be used in conjunction with mathematical definitions for points, straight lines, curves, surfaces, and solids to draw logical conclusions. See also List of geometry topics

Convex geometry and discrete geometry

Includes the study of objects such as polytopes and polyhedra.

Discrete or combinatorial geometry

The study of geometrical objects and properties that are discrete or combinatorial, either by their nature or by their representation. It includes the study of shapes such as the Platonic solids and the notion of tessellation.

Differential geometry

The study of geometry using calculus. It is very closely related to differential topology. Covers such areas as Riemannian geometry, curvature and differential geometry of curves.

Algebraic geometry

Given a polynomial of two real variables, then the points on a plane where that function is zero will form a curve. An algebraic curve extends this notion to polynomials over a field in a given number of variables. Algebraic geometry may be viewed as the study of these curves.

Arithmetic geometry

The study of schemes of finite type over the spectrum of the ring of integers. Alternatively defined as the application of the techniques of algebraic geometry to problems in number theory.

Diophantine geometry

The study of the points of algebraic varieties with coordinates in fields that are not algebraically closed and occur in algebraic number theory, such as the field of rational numbers, number fields, finite fields, function fields, and *p*-adic fields, but not including the real numbers.

Real algebraic geometry

The study of semi-algebraic sets, i.e. real-number solutions to algebraic inequalities with-real number coefficients, and mappings between them.

3. Identify grammar tenses:

1. Mathematicians have always worked with logic and symbols.
2. The underlying laws of logic were taken for granted.
3. Mathematical logic was developed when people finally realized that the tools of mathematics can be used to study the structure of logic itself.
4. Proof theory grew out of David Hilbert's ambitious program to formalize all the proofs in mathematics.
5. Model theory studies mathematical structures in a general framework.
6. A set can be thought of as a collection of distinct things united by some common feature.
7. The history of mathematics is inextricably intertwined with the subject itself.
8. From magic squares to the Mandelbrot set, numbers have been a source of amusement and delight for millions of people throughout the ages.
9. Number theory is traditionally concerned with the properties of integers.

10. Calculus and complex analysis are used as tools to study the integers.
11. The investigation of methods to solve equations leads to the field of abstract algebra.
12. Algebraic geometry may be viewed as the study of these curves.
13. The physically important concept of vectors, generalized to vector spaces, is studied in linear algebra.
14. Long standing questions about compass and straightedge construction were finally settled by Galois theory.
15. In ring theory, a branch of abstract algebra, a commutative ring is a ring in which the multiplication operation obeys the commutative law.

Text 14. Mathematics as a science

1. Learn the vocabulary of the text:

1. science
2. scientific
3. a scientist
4. computational techniques
5. to fall into
6. broad
7. to be sharply defined
8. to overlap
9. to advance
10. to develop
11. to recognize
12. to seek
13. to increase
14. to consider
15. to produce
16. to further
17. achievements

18. to employ
19. university faculty
20. to conduct research
21. mathematical modeling
22. computational methods
23. to formulate and solve practical problems
24. government
25. social sciences
26. the most efficient way
27. to schedule airline routes
28. safety
29. the cost-effectiveness
30. enhance mathematical methods
31. cryptanalysts
32. to decipher encryption systems
33. to use mathematics extensively
34. to collaborate with
35. to do rigorous mathematics
36. use mathematical expertise
37. significant use of mathematics
38. sophisticated mathematical models
39. actuary
40. a cryptologist
41. a statistician
42. an operations researcher
43. an agricultural economist
44. a numerical analyst
45. a marketing manager
46. a data analyst
47. a software developer
48. a market researcher
49. an inventory strategist
50. mathematics of finance specialist
51. measurements researcher
52. an information systems consultant

53. elementary or high school teacher
54. college or university professor
55. a research scientist

2. Read and translate the text.

Mathematics is one of the oldest and most fundamental sciences. Mathematicians use mathematical theory, computational techniques, algorithms, and the latest computer technology to solve economic, scientific, engineering, physics, and business problems. The work of mathematicians falls into two broad classes - theoretical (pure) mathematics and applied mathematics. These classes, however, are not sharply defined and often overlap.

Theoretical mathematicians advance mathematical knowledge by developing new principles and recognizing previously unknown relationships between existing principles of mathematics. Although these workers seek to increase basic knowledge without necessarily considering its practical use, such pure and abstract knowledge has been instrumental in producing or furthering many scientific and engineering achievements. Many theoretical mathematicians are employed as university faculty, dividing their time between teaching and conducting research.

Applied mathematicians use theories and techniques, such as mathematical modeling and computational methods, to formulate and solve practical problems in business, government, engineering, and the physical life, and social sciences. For example, they may analyze the most efficient way to schedule airline routes between cities, the effects and safety of new drugs, the aerodynamic characteristics of an experimental automobile, or the cost-effectiveness of alternative manufacturing processes.

Applied mathematicians working in industrial research and development may develop or enhance mathematical methods when solving a difficult problem. Some mathematicians, called cryptanalysts, analyze and decipher encryption systems—codes—designed to transmit military, political, financial, or law-enforcement-related information.

Applied mathematicians start with a practical problem, envision its separate elements, and then reduce the elements to mathematical variables. They often use computers to analyze relationships among the variables, and they solve complex problems by developing models with alternative solutions.

Individuals with titles other than mathematician also do work in applied mathematics. In fact, because mathematics is the foundation on which so many other academic disciplines are built, the number of workers using mathematical techniques is much greater than the number formally called mathematicians. For example, engineers, computer scientists, physicists, and economists are among those who use mathematics extensively. Some professionals, including statisticians, actuaries, and operations research analysts, are actually specialists in a particular branch of mathematics. Applied mathematicians frequently are required to collaborate with other workers in their organizations to find common solutions to problems.

The world is full of places to do rigorous mathematics. As you begin to identify potential outlets for your talent, it may be useful to get a sense of the dimensions of the 'field' in its entirety. Business, industry, and government use mathematical expertise, often in the context of applications.

However, the job titles often do not include the word "mathematics" or "mathematician," but do involve significant use of mathematics and/or quantitative reasoning. For people with advanced degrees in mathematics, careers involve development of new mathematical methods and theories and application to almost every area of science, engineering, industry and business. Those who major in mathematics in undergraduate institutions find a broad variety of opportunities. Some use their mathematical training directly and some use their training in rigorous thinking and analysis indirectly to solve problems in the business sector.

Many of the contributions and uses of mathematics are closely related to the need for mathematical modeling and simulation of physical phenomena on the computer. In addition, the analysis and control of processes, and optimization and scheduling of resources use significant mathematics. For example, the finance industry uses sophisticated mathematical models for pricing of securities, while the petroleum industry models the flow of oil in underground rock formations to help in oil recovery. Image processing, whether producing clear pictures from satellite imagery or making medical images (CAT, MRI) to detect and diagnose, all use significant mathematics. Industrial design, whether structural components for airplanes or automobile parts, uses a tremendous amount of mathematical modeling; much of which is embodied in CAD/CAM computer software. Such techniques were used in the design of the Boeing 777, as well as in the design of automobiles. Computational modeling is also used in airplane and automobile design to analyze the flow of air over vehicles to determine fuel economy and efficiency.

The use of mathematics is pervasive in modern industry. The result is that mathematicians are found in almost every sector of the job market, including engineering research, telecommunications, computer services and software, energy systems, computer manufacturers, aerospace and automotive, chemicals and pharmaceuticals, and government laboratories, among others.

Mathematics and Statistics is used throughout the world as an essential tool in many subject fields such as natural science, engineering, medicine, economics, etc.

There are many career opportunities for mathematics and statistics graduates, such as the follows:

- actuary
- cryptologist
- statistician
- operations researcher

- agricultural economist
- numerical analyst
- marketing manager
- data analyst
- software developer
- market researcher
- inventory strategist
- mathematics of finance specialist
- measurements researcher
- information systems consultant
- elementary or high school teacher
- college or university professor
- research scientist (Research at universities, Bureau of Meteorology, government laboratories, consulting companies, etc).

3. Identify Participle I or Participle II or Gerund in the sentences below:

1. Theoretical mathematicians advance mathematical knowledge by developing new principles and recognizing previously unknown relationships between existing principles of mathematics.
2. Although these workers seek to increase basic knowledge without necessarily considering its practical use, such pure and abstract knowledge has been instrumental in producing or furthering many scientific and engineering achievements.
3. Many theoretical mathematicians are employed as university faculty, dividing their time between teaching and conducting research.
4. Applied mathematicians use theories and techniques, such as mathematical modeling and computational methods, to formulate and solve practical problems

in business, government, engineering, and the physical life, and social sciences.

5. They may analyze the cost-effectiveness of alternative manufacturing processes.
6. Applied mathematicians working in industrial research and development may develop or enhance mathematical methods when solving a difficult problem.
7. Some mathematicians, called cryptanalysts, analyze and decipher encryption systems - codes—designed to transmit military, political, financial, or law-enforcement-related information.
8. They solve complex problems by developing models with alternative solutions.
9. The number of workers using mathematical techniques is much greater than the number formally called mathematicians.
10. Some professionals, including statisticians, actuaries, and operations research analysts, are actually specialists in a particular branch of mathematics.
11. For people with advanced degrees in mathematics, careers involve development of new mathematical methods and theories.
12. The finance industry uses sophisticated mathematical models for pricing of securities.

Text 15. Applied mathematics

1. Learn the vocabulary of the text:

1. the branch
2. to focus on
3. to apply
4. to include
5. partial and ordinary differential equations

6. linear algebra
7. numerical analysis
8. operations research
9. discrete mathematics
10. optimization
11. control
12. probability
13. to use mathematical modeling techniques
14. to solve real-world problems
15. the application of mathematical methods
16. to describe the professional specialty
17. to formulate and study mathematical models
18. practical applications
19. the subject of study in pure mathematics
20. abstract concepts
21. cryptography
22. to consider
23. *per se*
24. to distinguish between
25. to be applicable
26. consensus
27. to be concerned with
28. mathematical biologists
29. to pose problems
30. the growth
31. to deny the existence
32. to claim
33. non-mathematicians
34. to blend
35. the success
36. numerical mathematical methods
37. computational science
38. computational engineering
39. use high-performance computing
40. the simulation of phenomena

41. the solution of problems
42. interdisciplinary

2. **Read and translate the text.**

Applied mathematics is the branch of mathematics that is focused on developing mathematical methods and applying them to science, engineering, industry, and society. It includes mathematical topics such as partial and ordinary differential equations, linear algebra, numerical analysis, operations research, discrete mathematics, optimization, control, and probability. Applied mathematics uses mathematical modeling techniques to solve real-world problems.

Applied mathematics is the application of mathematical methods by different fields such as science, engineering, business, computer science, and industry. Thus, applied mathematics is a combination of mathematical science and specialized knowledge. The term "applied mathematics" also describes the professional specialty in which mathematicians work on practical problems by formulating and studying mathematical models. In the past, practical applications have motivated the development of mathematical theories, which then became the subject of study in pure mathematics where abstract concepts are studied for their own sake. The activity of applied mathematics is thus intimately connected with research in pure mathematics.

Today, the term "applied mathematics" is used in a broader sense. It includes the classical areas noted above as well as other areas that have become increasingly important in applications. Even fields such as number theory that are part of pure mathematics are now important in applications (such as cryptography), though they are not generally considered to be part of the field of applied mathematics *per se*. Sometimes, the term "applicable mathematics" is used to distinguish between the traditional applied mathematics that developed alongside physics and the many areas of mathematics that are applicable to real-world problems today.

There is no consensus as to what the various branches of applied mathematics are. Such categorizations are made difficult by the way mathematics and science change over time, and also by the way universities organize departments, courses, and degrees.

Many mathematicians distinguish between "applied mathematics”, which is concerned with mathematical methods, and the "applications of mathematics" within science and engineering. A biologist using a population model and applying known mathematics would not be *doing* applied mathematics, but rather *using* it; however, mathematical biologists have posed problems that have stimulated the growth of pure mathematics. Mathematicians such as Poincaré and Arnold deny the existence of "applied mathematics" and claim that there are only "applications of mathematics." Similarly, non-mathematicians blend applied mathematics and applications of mathematics. The use and development of mathematics to solve industrial problems is also called "industrial mathematics".

The success of modern numerical mathematical methods and software has led to the emergence of computational mathematics, computational science, and computational engineering, which use high-performance computing for the simulation of phenomena and the solution of problems in the sciences and engineering. These are often considered interdisciplinary.

3. Complete the sentences:

1. Applied mathematics uses mathematical modeling techniques to …
2. Applied mathematics is the application of mathematical methods by…
3. Mathematicians such as Poincaré and Arnold deny the existence of…

4. Many mathematicians distinguish between…
5. The success of modern numerical mathematical methods and software has led to…
6. In the past, practical applications have motivated the development of…
7. Mathematical biologists have posed problems that have stimulated the growth of…
8. The use and development of mathematics to solve industrial problems is also called…
9. Non-mathematicians blend applied mathematics and…
10. Applied mathematics is a combination of …

Text 16. Applied Mathematics and Computational Science

1. Learn the vocabulary of the text:

1. an emerging discipline
2. to utilize
3. to produce problem-solving techniques and methodologies
4. to advance scientific knowledge and practice
5. to rely on
6. the design and manufacture of aircraft, automobiles, textiles, computers, communication systems, prescription drugs
7. to lead to
8. to contribute to diverse areas of science
9. simulation and prototype testing
10. to use computer-aided design
11. to test for performance, safety and ergonomics
12. to lower the cost of constructing
13. to analyze the lift and drag of airfoil designs
14. essential tools in the design and manufacture of an aircraft
15. to enable
16. swamps, forests, grasslands and the tundra

17. to predict long-term change
18. to provide input
19. accurate simulation of combustion systems
20. to improve efficiency
21. to meet the needs
22. to require high-performance computing
23. to estimate and manage uncertainty in models and computations
24. to design trading strategy, assist in asset allocation, and assess risk
25. hedge fund companies
26. actuary, statistician, scientific programmer, systems engineer, analyst, research associate, and technical consultant
27. software publishers
28. a liberal arts education
29. a cornerstone of logic and the inductive and deductive methods

2. **Read and translate the text.**

Computational Science

Computational science is an emerging discipline focused on integrating applied mathematics, computer science, engineering, and the sciences to create a multidisciplinary field utilizing computational techniques and simulations to produce problem-solving techniques and methodologies. Computational science has become a third partner, together with theory and experimentation, in advancing scientific knowledge and practice.

How Are They Used?

Applied mathematics and computational science are utilized in almost every discipline of science, engineering, industry, and technology. Industry relies on applied mathematics and computational science for the design and manufacture of aircraft, automobiles, textiles, computers, communication systems, prescription drugs, and more. Work with applied mathematics often leads to the development of new mathematical models, theories, and applications that contribute to diverse areas of science.

Some examples of the use of applied mathematics and computational science follow.

1. Simulation and prototype testing are used in manufacturing design and evaluation. For example, automotive companies are using computer-aided design to test for performance, safety and ergonomics. In doing so, they dramatically lower the cost of constructing and testing prototypes.
2. Computational simulations in aircraft design have been used to analyze the lift and drag of airfoil designs since the early days of computing. Advanced computation and simulation are now essential tools in the design and manufacture of an aircraft.
3. A major advance in computing power will enable scientists to incorporate knowledge about interactions between the oceans, the atmosphere and living ecosystems, such as swamps, forests, grasslands and the tundra, into the models used to predict long-term change. Climate modeling at the global, regional and local levels can reduce uncertainties regarding long-term climate change, provide input for the formulation of energy and environmental policy, and abate the impact of violent storms.
4. Accurate simulation of combustion systems offers the promise of developing the understanding needed to improve efficiency and reduce emissions as mandated by U.S. public policy. Achieving predictive simulation of combustion processes will require terascale computing and an unprecedented level of integration among disciplines including physics, chemistry, engineering, mathematics, and computer science.
5. Meeting the needs of nuclear stockpile stewardship and management for the near future requires high-performance computing far beyond our current level of performance. The ability to estimate and manage uncertainty in models and

computations is critical for this application and increasingly important for many others.

6. Applied mathematics and computational science is also useful in finance to design trading strategy, assist in asset allocation, and assess risk. Many large and successful hedge fund companies have successfully employed mathematics to do quantitative portfolio management and trading.

Where Could I Work?

Applied mathematicians and computational scientists often hold jobs with titles such as actuary, statistician, scientific programmer, systems engineer, analyst, research associate, and technical consultant. Applied mathematicians and computational scientists work for federal and state governments, financial services, scientific research and development services, and management, scientific, and technical consulting services. Software publishers, insurance companies and aerospace, pharmaceutical, and other manufacturing companies also employ applied mathematicians and computational scientists. Many work in academia, teaching the next generation and developing innovations through their own research.

Applied Mathematics and Informatics

Mathematics is a part of human culture and a basis for a liberal arts education essential to every modern person. The application of mathematical methods enlarges the possibilities of each specialist and thus, for students, mathematics is a cornerstone of logic and the inductive and deductive methods. By studying mathematics, students form their professional thinking.

Google runs on math. Finance and banking run on math. The digital world is math. Galileo Galilei even said that nature itself formulates its laws from the language of mathematics. Applied Mathematics and Informatics will give you the tools that you need to understand the complex systems that run the world, and build the systems that will run the 21st century.

What is taught?

In short, you will study mathematical models. Underlying these models is a concrete foundation of mathematics taught at a university, including: *mathematical analysis, differential equations, probability theory, mathematical statistics, numerical mathematics, data structures and algorithms, programming in high-level languages, basics of software engineering and many others.*

3. Identify the underlined forms:

1. Computational science is an emerging discipline focused on integrating applied mathematics, computer science, engineering, and the sciences to create a multidisciplinary field utilizing computational techniques and simulations to produce problem-solving techniques and methodologies.
2. Computational science has become a third partner, together with theory and experimentation, in advancing scientific knowledge and practice.
3. In doing so, they dramatically lower the cost of constructing and testing prototypes.
4. Advanced computation and simulation are now essential tools in the design and manufacture of an aircraft.
5. Achieving predictive simulation of combustion processes will require terascale computing and an unprecedented level of integration among disciplines including physics, chemistry, engineering, mathematics, and computer science.
6. Meeting the needs of nuclear stockpile stewardship and management for the near future requires high-performance computing far beyond our current level of performance.
7. By studying mathematics, students form their professional thinking.
8. Underlying these models is a concrete foundation of mathematics taught at a university, including: *mathematical analysis, differential equations, probability theory, mathematical statistics, numerical mathematics, data*

structures and algorithms, programming in high-level languages, basics of software engineering and many others.

Text 17. Introduction to Mathematical analysis

1. Learn the vocabulary of the text:

1. mathematical analysis
2. the theories of differentiation, integration
3. measure
4. limits
5. infinite series
6. analytic function
7. real and complex numbers
8. to evolve
9. calculus
10. a definition of nearness
11. a topological space
12. a metric space
13. the method of exhaustion
14. to compute the area
15. the area of regular polygons
16. a limit
17. to trace back
18. implicit
19. an infinite geometric sum
20. Zeno's paradox of the dichotomy
21. the concepts of limits and convergence
22. the area and volume of regions and solids
23. explicit use of infinitesimals
24. to find the area of a circle
25. infinite series expansions
26. the power series and the Taylor series
27. functions such as sine, cosine, tangent and arctangent
28. the trigonometric functions

29. to estimate the magnitude of the error terms
30. to truncate the series
31. to give a rational approximation of an infinite series
32. infinitesimal calculus
33. the calculus of variations
34. ordinary and partial differential equations
35. Fourier analysis
36. generating functions
37. to approximate discrete problems
38. the notion of mathematical function
39. the modern definition of continuity
40. to reject the principle of the generality of algebra
41. the concept of the Cauchy sequence
42. theory of integration
43. the "epsilon-delta" definition of limit
44. to create a complete set
45. the study of the "size" of the set of discontinuities of real functions
46. an axiomatic set theory

2. Read and translate the text.

Mathematical analysis is a branch of mathematics that includes the theories of differentiation, integration, measure, limits, infinite series, and analytic function.

These theories are usually studied in the context of real and complex numbers and functions. Analysis evolved from calculus, which involves the elementary concepts and techniques of analysis. Analysis may be distinguished from geometry; however, it can be applied to any space of mathematical objects that has a definition of nearness (a topological space) or specific distances between objects (a metric space).

History

Archimedes used the method of exhaustion to compute the area inside a circle by finding the area of regular polygons with more and more sides. This was an early but informal example of a limit, one of the most basic concepts in mathematical analysis.

Mathematical analysis formally developed in the 17th century during the Scientific Revolution, but many of its ideas can be traced back to earlier mathematicians. Early results in analysis were implicitly present in the early days of ancient Greek mathematics. For instance, an infinite geometric sum is implicit in Zeno's paradox of the dichotomy.

Later, Greek mathematicians such as Eudoxus and Archimedes made more explicit, but informal, use of the concepts of limits and convergence when they used the method of exhaustion to compute the area and volume of regions and solids. The explicit use of infinitesimals appears in Archimedes' The Method of Mechanical Theorems, a work rediscovered in the 20th century. In Asia, the Chinese mathematician Liu Hui used the method of exhaustion in the 3^{rd} century AD to find the area of a circle. Zu Chongzhi established a method that would later be called Cavalieri's principle to find the volume of a sphere in the 5^{th} century. The Indian mathematician Bhaskara II gave examples of the derivative and used what is now known as Rolle's theorem in the 12^{th} century.

In the 14th century, Madhava of Sangamagrama developed infinite series expansions, like the power series and the Taylor series, of functions such as sine, cosine, tangent and arctangent. Alongside his development of the Taylor series of the trigonometric functions, he also estimated the magnitude of the error terms created by truncating these series and gave a rational approximation of an infinite series. His followers at the Kerala school of astronomy and mathematics further expanded his works, up to the 16th century.

The modern foundations of mathematical analysis were established in 17th century Europe. Descartes and Fermat independently developed analytic geometry, and a few decades later Newton and Leibniz independently developed infinitesimal calculus, which grew, with the stimulus of applied work that continued through the 18th century, into analysis topics such as the calculus of variations, ordinary and partial differential equations, Fourier analysis, and generating functions. During this period, calculus techniques were applied to approximate discrete problems by continuous ones.

In the 18th century, Euler introduced the notion of mathematical function. Real analysis began to emerge as an independent subject when Bernard Bolzano introduced the modern definition of continuity in 1816, but Bolzano's work did not become widely known until the 1870s. In 1821, Cauchy began to put calculus on a firm logical foundation by rejecting the principle of the generality of algebra widely used in earlier work, particularly by Euler. Instead, Cauchy formulated calculus in terms of geometric ideas and infinitesimals. Thus, his definition of continuity required an infinitesimal change in x to correspond to an infinitesimal change in y. He also introduced the concept of the Cauchy sequence, and started the formal theory of complex analysis. Poisson, Liouville, Fourier and others studied partial differential equations and harmonic analysis. The contributions of these mathematicians and others founded the modern field of mathematical analysis.

In the middle of the 19th century Riemann introduced his theory of integration. The last third of the century saw the arithmetization of analysis by Weierstrass, who thought that geometric reasoning was inherently misleading, and introduced the "epsilon-delta" definition of limit. Then, mathematicians started worrying that they were assuming the existence of a continuum of real numbers without proof. Dedekind then constructed the real numbers by Dedekind cuts, in which numbers are formally defined, which serve to fill the "gaps" between rational numbers, thereby creating a complete set: the continuum of real numbers, which had already been developed by Simon Stevin in terms of decimal expansions.

Around that time, the attempts to refine the theorems of Riemann integration led to the study of the "size" of the set of discontinuities of real functions.

Jordan developed his theory of measure, Cantor developed what is now called naive set theory, and Baire proved the Baire category theorem. In the early 20^{th} century, calculus was formalized using an axiomatic set theory. Lebesgue solved the problem of measure, and Hilbert introduced Hilbert spaces to solve integral equations. The idea of normed vector space was in the air, and in the 1920s Banach created functional analysis.

3. Answer the questions.

1. What main problems does Mathematical analysis deal with?
2. What sphere of science did analysis evolve from?
3. In what way can analysis be distinguished from geometry and in what way can it be applied to a topological space and to a metric space?
4. What outstanding discoveries in math were made by Chinese and Indian scientists?
5. When were the modern foundations of mathematical analysis established?
6. What European mathematicians developed such branches as analytic geometry, infinitesimal calculus?

4. Name the ancient Greek mathematicians and scientists:

- who described the method of exhaustion?
- who represented paradox of the dichotomy?
- who used the concepts of limits and convergence?
- who introduced the notion of mathematical function, differential equations and harmonic analysis. Expand upon the essence of these mathematical discoveries.

5. Find the suitable term from the opposite column.

1.a pair of elements a, b having the property that (a, b) = (u, v) if and only if a = u, b = v;	a) natural numbers
2. a space that has an associated family of subsets that constitute a topology. The relationships between members of the space are mathematically analogous to those between points in ordinary two- and three-dimensional space;	b) topological space
3.a notional line in which every real number is conceived of as represented by a point;	c) ordered pair
4. a relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output. An example is the function that relates each real number x to its square (x2). The	d) power series

output of a function f corresponding to an input x is denoted by f(x) (read "f of x"). In this example, if the input is .3, then the output is 9, and we may write f (.3) = 9. The input variable(s) are sometimes referred to as the argument(s) of the function;	
5. in logic and mathematics, if and only if is a biconditional logical connective between statements;	e) real line
6. able to be counted;	f) countable
7. the positive integers (whole numbers) 1, 2, 3, etc.;	g) iff
8. a mathematical series whose terms contain ascending positive integral powers of a variable, such as a0 + a1x + a2x2 +...	h) function

Text 18. Main branches of Mathematical Analysis

1. Learn the vocabulary of the text:

1. real analysis
2. the theory of functions of a real variable
3. real-valued functions of a real variable
4. the analytic properties of real functions and sequences
5. convergence and limits of sequences of real numbers
6. the calculus of the real numbers
7. continuity
8. smoothness
9. related properties of real-valued functions
10. complex analysis
11. the theory of functions of a complex variable
12. hydrodynamics
13. thermodynamics
14. mechanical engineering
15. electrical engineering
16. quantum field theory
17. the analytic functions of complex variables
18. to satisfy Laplace's equation
19. functional analysis
20. the study of vector spaces
21. limit-related structure
22. the linear operators
23. the study of differential and integral equations
24. to play a prominent role
25. numerical analysis
26. the study of algorithms
27. numerical approximation
28. to seek exact answers
29. to obtain
30. to obtain approximate solutions
31. stochastic differential equations
32. Markov chains

2. **Read and translate the text.**

Real analysis. Real analysis (traditionally, the theory of functions of a real variable) is a branch of mathematical analysis dealing with the real numbers and real-valued functions of a real variable. In particular, it deals with the analytic properties of real functions and sequences, including convergence and limits of sequences of real numbers, the calculus of the real numbers, and continuity, smoothness and related properties of real-valued functions.

Complex analysis, traditionally known as the theory of functions of a complex variable, is the branch of mathematical analysis that investigates functions of complex numbers. It is useful in many branches of mathematics, including algebraic geometry, number theory, applied mathematics; as well as in physics, including hydrodynamics, thermodynamics, mechanical engineering, electrical engineering, and particularly, quantum field theory. Complex analysis is particularly concerned with the analytic functions of complex variables (or, more generally, meromorphic functions). Because the separate real and imaginary parts of any analytic function must satisfy Laplace's equation, complex analysis is widely applicable to two-dimensional problems in physics.

Functional analysis. Functional analysis is a branch of mathematical analysis, the core of which is formed by the study of vector spaces endowed with some kind of limit-related structure (e.g. inner product, norm, topology, etc.) and the linear operators acting upon these spaces and respecting these structures in a suitable sense.

The historical roots of functional analysis lie in the study of spaces of functions and the formulation of properties of transformations of functions such as the Fourier transform as transformations defining continuous, unitary etc. operators between function spaces. This point of view turned out to be particularly useful for the study of differential and integral equations.

Differential equations. A differential equation is a mathematical equation for an unknown function of one or several variables that relates the values of the function itself and its derivatives of various orders. Differential equations play a prominent role in engineering, physics, economics, biology, and other disciplines.

Differential equations arise in many areas of science and technology, specifically whenever a deterministic relation involving some continuously varying quantities (modeled by functions) and their rates of change in space and/or time (expressed as derivatives) is known or postulated. This is illustrated in classical mechanics, where the motion of a body is described by its position and velocity as the time value varies. Newton's laws allow one (given the position, velocity, acceleration and various forces acting on the body) to express these variables dynamically as a differential equation for the unknown position of the body as a function of time. In some cases, this differential equation (called an equation of motion) may be solved explicitly.

Measure theory. A measure on a set is a systematic way to assign a number to each suitable subset of that set, intuitively interpreted as its size. In this sense, a measure is a generalization of the concepts of length, area, and volume. A particularly important example is the Lebesgue measure on a Euclidean space, which assigns the conventional length, area, and volume of Euclidean geometry to suitable subsets of the -dimensional Euclidean space. For instance, the Lebesgue measure of the interval in the real numbers is its length in the everyday sense of the word – specifically, 1.

Technically, a measure is a function that assigns a non-negative real number or +. to

(certain) subsets of a set. It must assign 0 to the empty set and be (countably) additive: the measure of a 'large' subset that can be decomposed into a finite (or countable) number of 'smaller' disjoint subsets, is the sum of the measures of the "smaller" subsets. In general, if one wants to associate a consistent size to each subset of a given set while satisfying the other axioms of a measure, one only finds trivial examples like the counting measure. This problem was resolved by defining measure only on a sub-collection of all subsets; the so-called measurable subsets, which are required to form a -algebra. This means that countable unions, countable intersections and complements of measurable subsets are measurable. Non-measurable sets in a Euclidean space, on which the Lebesgue measure cannot be defined consistently, are necessarily complicated in the sense of being badly mixed up with their complement. Indeed, their existence is a non-trivial consequence of the axiom of choice.

Numerical analysis. Numerical analysis is the study of algorithms that use numerical approximation (as opposed to general symbolic manipulations) for the problems of mathematical analysis (as distinguished from discrete mathematics).

Modern numerical analysis does not seek exact answers, because exact answers are often impossible to obtain in practice. Instead, much of numerical analysis is concerned with obtaining approximate solutions while maintaining reasonable bounds on errors. Numerical analysis naturally finds applications in all fields of engineering and the physical sciences, but in the 21st century, the life sciences and even the arts have adopted elements of scientific computations. Ordinary differential equations appear in celestial mechanics (planets, stars and galaxies); numerical linear algebra is important for data analysis; stochastic differential equations and Markov chains are essential in simulating living cells for medicine and biology.

3. Answer the questions.

1. What mathematical notions does the Real analysis deal with?
2. What types of functions does the Complex analysis concerned with?
3. What kind of disciplines do the differential equations play a prominent role in?
4. What fields does the Numerical analysis find its applications in?
5.What are the basic forms of Mathematical Analyses their principles.

4. Make up special questions to the following sentences:

1. Some properties are established by way of reasoning (how). 2. Geometry is concerned with the properties and relationships of figures in space (what ... with). 3. Some figures such as cubes and spheres have three dimensions (how many). 4. Many discoveries were made in the nineteenth century (when). 5. The truth of non-mathematical propositions in real life is much less certain (where). 6. The given proposition and its converse can be stated as follows (in what way). 7. Pure mathematics deals with the development of knowledge for its own purpose and need (what ... with). 8. Carl Gauss proved that every algebraic equation had at least one root (who). 9. There are three words having the same meaning (how many). 10. The given definition corresponds to the idea of uniqueness (what).

5. Find the suitable term from the opposite column.

1. A number (symbol i) whose square equals a real negative number. These numbers were invented to allow equations to be solved when they have no real roots. For example, 1 has	a) applied mathematics

two real square roots, +1 and -1. The equation $x^2 = 1$ thus has two real roots, x = 1 and x = -1. The number -1 has no real square roots, so the equation $x^2 = -1$ has no real roots. However, the 'imaginary' number, denoted by i, allows the equation $x^2 =-1$ to have two imaginary roots, x = i and x =-i. By convention i always precedes any coefficient other than 1 or -1.	
2. In mathematics, the limit of a sequence is the value that the terms of a sequence "tend to". If such a limit exists, the sequence is called ____. A sequence which does not converge is said to be ____.	b) differential calculus and integral calculus
3. The branch of mathematics that deals with the properties and relationships of numbers, especially the positive integers is called _________.	c) dot product or scalar product
4. A scalar function of two vectors, equal to the product of their magnitudes and the cosine of the angle between them, also called _________.	d) number theory
5. The branch of mathematics that deals with the finding and	e) divergent, convergent

properties of derivatives and integrals of functions, by methods originally based on the summation of infinitesimal differences. The two main types are_________.	
6.The abstract science of number, quantity, and space, either as abstract concepts (pure mathematics), or as applied to other disciplines such as physics and engineering is called ______.	f) infinitesimal
7. Extremely small. However small a number other than zero may be, it is always possible to find another even closer to zero. The derivative of a continuous function considers the limit to which the ratio between changes in a function and changes in its argument tends as both changes become infinitesimally small.	g) imaginary number

6. Translate the sentences according to the models.

Model 1. There are various ways of evaluating formulae. – Существуют различные способы вычисления формул.

1. There are a lot of important theorems in this book. 2. There are sets containing no
elements. 3. There has been recently developed a new method of proving the theorem. 4. There are many measurements to be

made. 5. There weren't any problems with my term paper last year. 6. There will be enough work for everybody at the next conference.

Model 2. There exist a lot of equivalent relations. – Существует много эквивалентных отношений.

1. There exists no difference between these two expressions. 2. There exists at least one element in a non-empty set. 3. There exist some important statements in the article. 4. There exist many different ways of defining a circle. 5. There exist no solutions to the problem presented.

Model 3. To a pair of numbers there corresponds a point in the plane. – Паре чисел соответствует точка на плоскости.

1. To a linear equation there corresponds a straight line in the Euclidean space. 2. To a point in three dimensional space there correspond its three coordinates. 3. To each number in X there corresponds a unique element in Y. 4. To any two objects a, b there corresponds a new object. 5. If to each member x of a set there corresponds one value of a variable y, then y is a function of x.

7. Complete these sentences by putting the verb in brackets into the Present Simple or the Present Continuous.

1.To solve the problem of gravitation, scientists …………… (consider) time-space geometry in a new way nowadays.

2. Quantum rules …………… (obey) in any system.

3. We …………… (use) Active Server for this project because it ……… (be) Web-based.

4. Scientists …………… (trace and locate) the subtle penetration of quantum effects

into a completely classical domain.

5. Commonly we ………… (use) C + + and JavaScript.

6. At the moment we …………… (develop) a Web–based project.

7. Its domain ………… (begin) in the nucleus and ………… (extend) to the solar
system.

8.Right now I …………. (try) to learn how to use Active Server properly.

8. Put "can", "can not", "could", "could not" into the following sentences.

1. Parents are finding that they … no longer help their children with their arithmetic homework.
2. The solution for the construction problems … be found by pure reason.
3. The Greeks … solve the problem notbecause they were not clever enough, but because the problem is insoluble under the specified conditions.
4. Using only a straight-edge and a compass the Greeks … easily divide any line segment into any number of equal parts.
5. Web pages… offer access to a world of information about and exchange with other cultures and communities and experts in every field.

Text 19. Topology

1. Learn the vocabulary of the text:

1. the properties of a geometric object
2. to preserve
3. continuous deformations
4. stretching

5. twisting
6. crumpling
7. bending
8. tear/tearing
9. glue/gluing
10. a topological space
11. to endow
12. to allow
13. to define continuous deformation of subspaces
14. Euclidean spaces/metric spaces
15. homeomorphisms and homotopies
16. to be invariant
17. a topological property
18. the *dimension*
19. to distinguish between
20. a line
21. a surface
22. compactness
23. a circle
24. connectedness
25. two non-intersecting circles
26. point set topology/general topology)
27. algebraic topology
28. the topology of manifolds
29. open and closed sets
30. compact spaces
31. continuous functions
32. convergence
33. separation axioms
34. metric spaces
35. dimension theory
36. the permanent usage
37. homology theory
38. cohomology theory
39. homotopy theory

40. homological algebra
41. functors
42. homotopy groups
43. simplicial complexes and CW complexes/*cell complexes*
44. curvature
45. large-scale properties
46. genus
47. increasingly sophisticated parts of algebra
48. to investigate spaces
49. mapping
50. to bring into play new methods
51. the arithmetic of elliptic curves
52. new and very powerful tools
53. differentiable functions on differentiable manifolds
54. an *n*-dimensional generalization of a surface
55. the usual 3-dimensional Euclidean space

2. Read and translate the text.

In mathematics, **topology** is concerned with the properties of a geometric object that are preserved under continuous deformations, such as stretching, twisting, crumpling and bending, but not tearing or gluing. A topological space is a set endowed with a structure, called a *topology*, which allows defining continuous deformation of subspaces, and, more generally, all kinds of continuity. Euclidean spaces, and, more generally, metric spaces are examples of topological spaces, as any distance or metric defines a topology. The deformations that are considered in topology are homeomorphisms and homotopies. A property that is invariant under such deformations is a topological property. Basic examples of topological properties are: the *dimension,* which allows distinguishing between a line and a surface; *compactness*, which allows distinguishing between a line and a circle; *connectedness*, which allows distinguishing a circle from two non-intersecting circles.

Deals with the properties of a figure that do not change when the figure is continuously deformed. The main areas are point set topology (or general topology), algebraic topology, and the topology of manifolds, defined below.

General topology

Also called *point set topology*. Properties of topological spaces.

Includes such notions as open and closed sets, compact spaces, continuous functions, convergence, separation axioms, metric spaces, dimension theory.

The term *general topology* means: this is the topology that is needed and used by most mathematicians. The permanent usage in the capacity of a common mathematical language has polished its system of definitions and theorems. Nowadays, studying general topology really more resembles studying a language rather than mathematics: one needs to learn a lot of new words, while proofs of most theorems are quite simple. On the other hand, the theorems are numerous because they play the role of rules regulating usage of words.

Algebraic topology

Properties of algebraic objects associated with a topological space and how these algebraic objects capture properties of such spaces. Contains areas like homology theory, cohomology theory, homotopy theory, and homological algebra, some of them examples of functors. Homotopy deals with homotopy groups (including the fundamental group) as well as simplicial complexes and CW complexes (also called *cell complexes*).

Algebra and Topology are core disciplines of Pure Mathematics.

The notion of shape is fundamental in mathematics. Geometry concerns the local properties of shape such as curvature, while topology involves large-scale properties such as genus. Algebraic methods become important in topology when working in many dimensions, and increasingly sophisticated parts of algebra are now being employed. In algebraic topology, we investigate spaces by mapping them to algebraic objects such as groups, and thereby bring into play new methods and intuitions from algebra to answer topological questions. For example, the arithmetic of elliptic curves — which was at the heart of Andrew Wiles' solution of the Fermat conjecture — has been lifted into topology, giving new and very powerful tools for the study of geometric objects.

Differential topology

The field dealing with differentiable functions on differentiable manifolds, which can be thought of as an *n*-dimensional generalization of a surface in the usual 3-dimensional Euclidean space.

3. Answer the questions:

1. What is the usual 3-dimensional Euclidean space?
2. What does differential topology deal with?
3. What are core disciplines of Pure Math?
4. When do algebraic methods become important in topology?
5. What areas does algebraic topology contain?
6. How are spaces investigated in algebraic topology?
7. What is topology concerned with?
8. What does the term topology mean?
9. What are the examples of topological spaces?
10. What is a topological property?

Text 20. Game Theory

1. **Learnt the vocabulary of the text:**
    1. game theory
    2. to fashion
    3. an interplay between parties
    4. to have similar, opposed, or mixed interests
    5. to outsmart one another
    6. to anticipate each other's decisions
    7. a distinct and interdisciplinary approach
    8. collaboration
    9. to be aware of
    10. to make contributions
    11. endurance
    12. eventualities

2. **Read and translate the text.**

Game theory is a branch of applied mathematics fashioned to analyze certain situations in which there is an interplay between parties that may have similar, opposed, or mixed interests. In a typical game, decision-making "players," who each have their own goals try to outsmart one another by anticipating each other's decisions. (*Encyclopedia Britannica*).

Game theory is a distinct and interdisciplinary approach to the study of human behavior. The disciplines most involved in game theory are mathematics, economics and the other social and behavioral sciences. Game theory (like computational theory and so many other contributions) was founded by the great mathematician John von Neumann. The first important book was *The Theory of Games and Economic Behavior*, which von Neumann wrote in collaboration with the great mathematical economist, Oscar Morgenstern. Certainly, Morgenstern brought ideas from neoclassical economics into the partnership, but von Neumann, too, was well aware of them and had made other contributions to neoclassical economics.

What is a game?

Game: A competitive activity involving skill, chance, or endurance on the part of two or more persons who play according to a set of rules, usually for their own amusement or for that of spectators (*The Random House Dictionary of the English Language*, 1967).

A game is the set of rules that describe it. An instance of the game from beginning to end is known as a play of the game. And a pure strategy is an overall plan specifying moves to be taken in all eventualities that can arise in a play of the game. A game is said to have perfect information if, throughout its play, all the rules, possible choices, and past history of play by any player are known to all participants. Games like tick-tack-toe, backgammon and chess are games with perfect information and such games are solved by pure strategies. But whereas one may be able to describe all such pure strategies for tick-tack-toe, it is not possible to do so for chess, hence the latter's age-old intrigue.

Games without perfect information, such as matching pennies, stone-paper-scissors or poker offer the players a challenge because there is no pure strategy that ensures a win. Games such as heads-tails and stone-paper-scissors are also called two-person zero-sum games. Zero-sum means that any money Player 1 wins (or loses) is exactly the same amount of money that Player 2 loses (or wins). That is, no money is created or lost by playing the game. Most parlor games are many-person zero-sum games. Not all zero-sum games are fair, although most two-person zero-sum parlor games are fair games. So why do people then play them? They are fun, everyone likes the competition, and, since the games are usually played for a short period of time, the average winnings could be different than 0.

3. Answer the questions:

1. Why do people play games?
2. What are games without perfect information?
3. What is a game?
4. What is game theory?
5. What disciplines are most involved in game theory?
6. What are the games with perfect information?
7. Who was game theory founded by?
8. What was the name of the book which von Neumann wrote in collaboration with the great mathematical economist, Oscar Morgenstern?

CHAPTER II COMPUTER SCIENCE

Text 1. Computer science

1. **Learn the vocabulary of the lesson:**

1. to process information
2. to trace the roots
3. to propose
4. the advent of
5. to distinguish
6. to separate
7. to sprout
8. to enable
9. efficient
10. approach
11. to perform various calculations
12. to overlap
13. numerical analysis
14. the accuracy and precision of calculations
15. to expand
16. to broaden
17. to include
18. to simplify
19. artificial languages
20. to provide a useful interface
21. computer scientists
22. applications and computer designs
23. to explore
24. computer chip manufacturers
25. the electronic circuitry
26. to reduce the cost
27. to increase the processing speed
28. to result in
29. an explosion
30. the use of computer applications

31. an effort
32. to drive the technological advances in the computing industry
33. to reach the public
34. to derive
35. complex, reliable, and powerful computers
36. to exchange vast amounts of information
37. to behave intelligently
38. an increasingly integral part of modern society
39. strive to solve new problems
40. current problems
41. the goal
42. to range from…to…
43. speculative research into technologies
44. to be viable
45. the improved use of information
46. hardware and software
47. a theory-driven approach
48. software engineering tools
49. to evaluate
50. an artificial neural network
51. the outcome of experiments
52. in advance

2. Read and translate the text.

Introduction

Computer Science, study of the theory, experimentation, and engineering that form the basis for the design and use of computers—devices that automatically process information. Computer science traces its roots to work done by English mathematician Charles Babbage, who first proposed a programmable mechanical calculator in 1837. Until the advent of electronic digital computers in the 1940s, computer science was not generally distinguished as being separate from mathematics and engineering. Since then it has sprouted numerous branches of research that are unique to the discipline.

The development of computer science

Early work in the field of computer science during the late 1940s and early 1950s focused on automating the process of making calculations for use in science and engineering. Scientists and engineers developed theoretical models of computation that enabled them to analyze how efficient different approaches were in performing various calculations. Computer science overlapped considerably during this time with the branch of mathematics known as numerical analysis, which examines the accuracy and precision of calculations.

As the use of computers expanded between the 1950s and the 1970s, the focus of computer science broadened to include simplifying the use of computers through programming languages—artificial languages used to program computers, and operating systems—computer programs that provide a useful interface between a computer and a user. During this time, computer scientists were also experimenting with new applications and computer designs, creating the first computer networks, and exploring relationships between computation and thought.

In the 1970s, computer chip manufacturers began to mass produce microprocessors—the electronic circuitry that serves as the main information processing center in a computer. This new technology revolutionized the computer industry by dramatically reducing the cost of building computers and greatly increasing their processing speed. The microprocessor made possible the advent of the personal computer, which resulted in an explosion in the use of computer applications. Between the early 1970s and 1980s, computer science rapidly expanded in an effort to develop new applications for personal computers and to drive the technological advances in the computing industry. Much of the earlier research that had been done began to reach the public through personal computers, which derived most of their early software from existing concepts and systems.

Computer scientists continue to expand the frontiers of computer and information systems by pioneering the designs of more complex, reliable, and powerful computers; enabling networks of computers to efficiently exchange vast amounts of information; and seeking ways to make computers behave intelligently. As computers become an increasingly integral part of modern society, computer scientists strive to solve new problems and invent better methods of solving current problems. The goals of computer science range from finding ways to better educate people in the use of existing computers to highly speculative research into technologies and approaches that may not be viable for decades. Underlying all of these specific goals is the desire to better the human condition today and in the future through the improved use of information.

Theory and experiment

Computer science is a combination of theory, engineering, and experimentation. In some cases, a computer scientist develops a theory, then engineers a combination of computer hardware and software based on that theory, and experimentally tests it. An example of such a theory-driven approach is the development of new software engineering tools that are then evaluated in actual use. In other cases, experimentation may result in new theory, such as the discovery that an artificial neural network exhibits behavior similar to neurons in the brain, leading to a new theory in neurophysiology. It might seem that the predictable nature of computers makes experimentation unnecessary because the outcome of experiments should be known in advance. But when computer systems and their interactions with the natural world become sufficiently complex, unforeseen behaviors can result. Experimentation and the traditional scientific method are thus key parts of computer science.

3. **Read the text about Charles Babbage in Russian and retell it in English.**

Чарлз Бэббидж родился 26 декабря 1791 года в Лондоне в семье банкира Бенджамина Бэббиджа и Элизабет Тип (англ. *Teape*). В детстве у Чарльза было очень слабое здоровье. В 8 лет его отправили в частную школу в Альфингтоне на воспитание священнику. На тот момент его отец уже был достаточно обеспечен, чтобы позволить обучение Чарльза в частной школе. Бенджамин Бэббидж попросил священника не давать Чарльзу сильных учебных нагрузок из-за слабого здоровья.

После школы в Альфингтоне Чарлз был отправлен в академию в Энфилде, где по существу и началось его настоящее обучение. Именно там Бэббидж начал проявлять интерес к математике, чему поспособствовала большая библиотека в академии.

В 1810 году Бэббидж поступил в Тринити-колледж в Кембридже. Однако основам математики он обучался самостоятельно по книжкам. Он тщательно изучал труды Ньютона, Лейбница, Лагранжа, Лакруа, Эйлера и других математиков академий Санкт-Петербурга, Берлина и Парижа.

Бэббидж очень быстро обогнал своих преподавателей по знаниям и был сильно разочарован уровнем преподавания математики в Кембридже. Более того, он заметил, что Британия в целом заметно отстала от континентальных стран по уровню математической подготовки.

В связи с этим он решил создать общество, целью которого являлось внесение современной европейской математики в Кембриджский университет. В 1812 году Чарлз Бэббидж, его друзья, Джон Гершель (John Herschel) и Джордж Пикок (George Peacock) и ещё несколько молодых математиков основали «Аналитическое общество». Они стали проводить собрания. Обсуждать различные вопросы, связанные с математикой. Начали публиковать свои труды. Например, в 1816 году они опубликовали переведённый ими на английский язык «Трактат по дифференциальному и интегральному исчислению» французского математика Лакруа, а в 1820 году опубликовали два тома примеров, дополняющих этот трактат. Аналитическое общество своей активностью инициировало реформу математического образования вначале в Кембридже, а затем и в других университетах Британии.

В 1812 году Бэббидж перешёл в колледж Св. Петра (Peterhouse), а в 1814 году он получил степень бакалавра.

В 1816 году он стал членом Королевского Общества Лондона. К тому времени им было написано несколько больших научных статей в разных математических дисциплинах. В 1820 году он стал членом Королевского общества Эдинбурга и Королевского астрономического общества. В 1827 году он похоронил отца, жену и двоих детей. В 1827 году он стал профессором математических наук в Кембридже и занимал этот пост в течение 12 лет. После того, как он покинул этот пост, он большую часть своего времени посвятил делу его жизни — разработке вычислительных машин.

Последние годы жизни Бэббидж посвятил философии и политической экономии.

Чарлз Бэббидж умер в возрасте 79 лет 18 октября 1871 года. Похоронен на кладбище Кенсал Грин (англ. *Kensal Green Cemetery*) в Лондоне.

Text 2. Major branches of computer science

1. Learn the vocabulary of the lesson:

1. software development
2. computer architecture (hardware)
3. human- computer interfacing
4. artificial intelligence
5. the best types of programming languages and algorithms
6. to store and retrieve information
7. program performance
8. to sacrifice
9. for the sake of
10. a limited amount of memory
11. to limit the number of features
12. to require
13. to supply
14. to facilitate
15. robust
16. the software life cycle
17. implementation
18. program maintenance
19. programming environments
20. to improve the development process
21. a precise step-by-step procedure
22. matrix multiplication
23. data values
24. lists, arrays, records, stacks, queues, trees
25. determining the inherent efficiency of algorithms
26. computability theory
27. databases and information retrieval
28. to access databases
29. to prevent access by unauthorized users
30. to improve access speed
31. to compress the data

32. to update the data simultaneously
33. reduce access speed
34. information retrieval
35. control the computer's input and output devices

2. Read and translate the text.

Computer science can be divided into four main fields: software development, computer architecture (hardware), human - computer interfacing (the design of the most efficient ways for humans to use computers), and artificial intelligence (the attempt to make computers behave intelligently). Software development is concerned with creating computer programs that perform efficiently. Computer architecture is concerned with developing optimal hardware for specific computational needs. The areas of artificial intelligence (AI) and human-computer interfacing often involve the development of both software and hardware to solve specific problems.

Software development

In developing computer software, computer scientists and engineers study various areas and techniques of software design, such as the best types of programming languages and algorithms to use in specific programs, how to efficiently store and retrieve information, and the computational limits of certain software-computer combinations. Software designers must consider many factors when developing a program. Often, program performance in one area must be sacrificed for the sake of the general performance of the software. For instance, since computers have only a limited amount of memory, software designers must limit the number of features they include in a program so that it will not require more memory than the system it is designed for can supply.

Software engineering is an area of software development in which computer scientists and engineers study methods and tools that facilitate the efficient development of correct, reliable, and robust computer programs. Research in this branch of computer science considers all the phases of the software life cycle, which begins with a formal problem specification, and progresses to the design of a solution, its implementation as a program, testing of the program, and program maintenance. Software engineers develop software tools and collections of tools called programming environments to improve the development process. For example, tools can help to manage the many components of a large program that is being written by a team of programmers.

Algorithms and data structures are the building blocks of computer programs. An algorithm is a precise step-by-step procedure for solving a problem within a finite time and using a finite amount of memory. Common algorithms include searching a collection of data, sorting data, and numerical operations such as matrix multiplication. Data structures are patterns for organizing information, and often represent relationships between data values. Some common data structures are called lists, arrays, records, stacks, queues, and trees.

Computer scientists continue to develop new algorithms and data structures to solve new problems and improve the efficiency of existing programs. One area of theoretical research is called algorithmic complexity. Computer scientists in this field seek to develop techniques for determining the inherent efficiency of algorithms with respect to one another. Another area of theoretical research called computability theory seeks to identify the inherent limits of computation.

Software engineers use programming languages to communicate algorithms to a computer. Natural languages such as English are ambiguous—meaning that their grammatical structure and vocabulary can be interpreted in multiple ways—so they are not suited for programming. Instead, simple and unambiguous artificial languages are used. Computer scientists study ways of making programming languages more expressive, thereby simplifying programming and reducing errors.

A program written in a programming language must be translated into machine language (the actual instructions that the computer follows). Computer scientists also develop better translation algorithms that produce more efficient machine language programs.

Databases and information retrieval are related fields of research. A database is an organized collection of information stored in a computer, such as a company's customer account data. Computer scientists attempt to make it easier for users to access databases, prevent access by unauthorized users, and improve access speed. They are also interested in developing techniques to compress the data, so that more can be stored in the same amount of memory. Databases are sometimes distributed over multiple computers that update the data simultaneously, which can lead to inconsistency in the stored information. To address this problem, computer scientists also study ways of preventing inconsistency without reducing access speed.

Information retrieval is concerned with locating data in collections that are not clearly organized, such as a file of newspaper articles. Computer scientists develop algorithms for creating indexes of the data. Once the information is indexed, techniques developed for databases can be used to organize it. *Data mining* is a closely related field in which a large body of information is analyzed to identify patterns. For example, mining the sales records from a grocery store could identify shopping patterns to help guide the store in stocking its shelves more effectively.

Operating systems are programs that control the overall functioning of a computer. They provide the user interface, place programs into the computer's memory and cause it to execute them, control the computer's input and output devices, manage the computer's resources such as its disk space, protect the computer from unauthorized use, and keep stored data secure. Computer scientists are interested in making operating systems easier to use, more secure, and more efficient by developing new user interface designs, designing new mechanisms that allow data to be shared while preventing access to sensitive data, and developing algorithms that make more effective use of the computer's time and memory.

The study of numerical computation involves the development of algorithms for calculations, often on large sets of data or with high precision. Because many of these computations may take days or months to execute, computer scientists are interested in making the calculations as efficient as possible. They also explore ways to increase the numerical precision of computations, which can have such effects as improving the accuracy of a weather forecast. The goals of improving efficiency and precision often conflict, with greater efficiency being obtained at the cost of precision and vice versa.

Symbolic computation involves programs that manipulate nonnumeric symbols, such as characters, words, drawings, algebraic expressions, encrypted data (data coded to prevent unauthorized access), and the parts of data structures that represent relationships between values. One unifying property of symbolic programs is that they often lack the regular patterns of processing found in many numerical computations. Such irregularities present computer scientists with special challenges in creating theoretical models of a program's efficiency, in translating it into an efficient machine language program, and in specifying and testing its correct behavior.

3. Open the brackets:

1. Computer science (can divide) into four main fields.
2. Often, program performance in one area (must sacrifice) for the sake of the general performance of the software.

3. Research in this branch of computer science (consider) all the phases of the software life cycle.
4. Some common data structures (call) lists, arrays, records, stacks, queues, and trees.
5. One area of theoretical research (call) algorithmic complexity.
6. Instead, simple and unambiguous artificial languages (use).
7. A program written in a programming language (must translate) into machine language.
8. Databases sometimes (distribute) over multiple computers that update the data simultaneously.
9. Computer scientists (develop) algorithms for creating indexes of the data.
10. Data mining is a closely related field in which a large body of information (analyze) to identify patterns.

Text 3. Architecture (computer science)

1. Learn the vocabulary of the lesson:

1. architecture
2. referring to
3. the design of system software
4. the combination of hardware and basic software
5. microprocessors
6. circuits
7. application programs
8. spreadsheets
9. word processing
10. to perform a task
11. to make the system run
12. make up the system's hardware
13. the arithmetic/logic unit
14. control unit

15. memory
16. input
17. output
18. to compare numerical values
19. the computer's circuitry
20. the central processing unit (CPU)
21. to receive and send data
22. to display graphics
23. to conserve battery power in a laptop computer
24. invisible to the user
25. to use different hardware architectures
26. to carry out an instruction
27. to carry out complex instructions
28. to decode the instructions into electronic signals
29. to fetch the data
30. to save the result
31. to decrease
32. to retrieve additional instructions
33. to eliminate
34. to increase overall performance
35. to provide special instruction sets
36. to expand
37. closed architectures
38. a ring configuration
39. a bus configuration
40. a star configuration
41. supplies instructions and data

2. Read and translate the text "Architecture (computer science)"

Introduction

Architecture (computer science), a general term referring to the structure of all or part of a computer system. The term also covers the design of system software, such as the operating system (the program that controls the computer), as well as referring to the combination of hardware and basic software that links the machines on a computer network. Computer architecture refers to an entire structure and to the details needed to make it functional. Thus, computer architecture covers computer systems, microprocessors, circuits, and system programs. Typically, the term does not refer to application programs, such as spreadsheets or word processing, which are required to perform a task but not to make the system run.

Design elements

In designing a computer system, architects consider five major elements that make up the system's hardware: the arithmetic/logic unit, control unit, memory, input, and output. The arithmetic/logic unit performs arithmetic and compares numerical values. The control unit directs the operation of the computer by taking the user instructions and transforming them into electrical signals that the computer's circuitry can understand. The combination of the arithmetic/logic unit and the control unit is called the central processing unit (CPU). The memory stores instructions and data. The input and output sections allow the computer to receive and send data, respectively.

Different hardware architectures are required because of the specialized needs of systems and users. One user may need a system to display graphics extremely fast, while another system may have to be optimized for searching a database or conserving battery power in a laptop computer.

In addition to the hardware design, the architects must consider what software programs will operate the system. Software, such as programming languages and operating systems, makes the details of the hardware architecture invisible to the user. For example, computers that use the C programming language or a UNIX operating system may appear the same from the user's viewpoint, although they use different hardware architectures.

Processing architecture

When a computer carries out an instruction, it proceeds through five steps. First, the control unit retrieves the instruction from memory—for example, an instruction to add two numbers. Second, the control unit decodes the instructions into electronic signals that control the computer. Third, the control unit fetches the data (the two numbers). Fourth, the arithmetic/logic unit performs the specific operation (the addition of the two numbers). Fifth, the control unit saves the result (the sum of the two numbers).

Early computers used only simple instructions because the cost of electronics capable of carrying out complex instructions was high. As this cost decreased in the 1960s, more complicated instructions became possible. Complex instructions (single instructions that specify multiple operations) can save time because they make it unnecessary for the computer to retrieve additional instructions. For example, if seven operations are combined in one instruction, then six of the steps that fetch instructions are eliminated and the computer spends less time processing that operation. Computers that combine several instructions into a single operation are called complex instruction set computers (CISC).

However, most programs do not often use complex instructions, but consist mostly of simple instructions. When these simple instructions are run on CISC architectures they slow down processing because each instruction—whether simple or complex—takes longer to decode in a CISC design. An alternative strategy is to return to designs that use only simple, single-operation instruction sets and make the most frequently used operations faster in order to increase overall performance. Computers that follow this design are called reduced instruction set computers (RISC).

RISC designs are especially fast at the numerical computations required in science, graphics, and engineering applications. CISC designs are commonly used for nonnumerical computations because they provide special instruction sets for handling character data, such as text in a word processing program. Specialized CISC architectures, called digital signal processors, exist to accelerate processing of digitized audio and video signals.

Open and closed architectures

The CPU of a computer is connected to memory and to the outside world by means of either an open or a closed architecture. An open architecture can be expanded after the system has been built, usually by adding extra circuitry, such as a new microprocessor computer chip connected to the main system. The specifications of the circuitry are made public, allowing other companies to manufacture these expansion products.

Closed architectures are usually employed in specialized computers that will not require expansion—for example, computers that control microwave ovens. Some computer manufacturers have used closed architectures so that their customers can purchase expansion circuitry only from them. This allows the manufacturer to charge more and reduces the options for the consumer.

Network architecture

Computers communicate with other computers via networks. The simplest network is a direct connection between two computers. However, computers can also be connected over large networks, allowing users to exchange data, communicate via electronic mail, and share resources such as printers.

Computers can be connected in several ways. In a ring configuration, data are transmitted along the ring and each computer in the ring examines this data to determine if it is the intended recipient. If the data are not intended for a particular computer, the computer passes the data to the next computer in the ring. This process is repeated until the data arrive at their intended destination. A ring network allows multiple messages to be carried simultaneously, but since each message is checked by each computer, data transmission is slowed.

In a bus configuration, computers are connected through a single set of wires, called a bus. One computer sends data to another by broadcasting the address of the receiver and the data over the bus. All the computers in the network look at the address simultaneously, and the intended recipient accepts the data. A bus network, unlike a ring network, allows data to be sent directly from one computer to another. However, only one computer at a time can transmit data. The others must wait to send their messages.

In a star configuration, computers are linked to a central computer called a hub. A computer sends the address of the receiver and the data to the hub, which then links the sending and receiving computers directly. A star network allows multiple messages to be sent simultaneously, but it is more costly because it uses an additional computer, the hub, to direct the data.

Recent advances

One problem in computer architecture is caused by the difference between the speed of the CPU and the speed at which memory supplies instructions and data. Modern CPUs can process instructions in 3 nanoseconds (3 billionths of a second). A typical memory access, however, takes 100 nanoseconds and each instruction may require multiple accesses. To compensate for this disparity, new computer chips have been designed that contain small memories, called caches, located near the CPU. Because of their proximity to the CPU and their small size, caches can supply instructions and data faster than normal memory. Cache memory stores the most frequently used instructions and data and can greatly increase efficiency.

Although a larger cache memory can hold more data, it also becomes slower. To compensate, computer architects employ designs with multiple caches. The design places the smallest and fastest cache nearest the CPU and locates a second larger and slower cache farther away. This arrangement allows the CPU to operate on the most frequently accessed instructions and data at top speed and to slow down only slightly when accessing the secondary cache. Using separate caches for instructions and data also allows the CPU to retrieve an instruction and data simultaneously.

Another strategy to increase speed and efficiency is the use of multiple arithmetic/logic units for simultaneous operations, called superscalar execution. In this design, instructions are acquired in groups. The control unit examines each group to see if it contains instructions that can be performed together. Some designs execute as many as six operations simultaneously. It is rare, however, to have this many instructions run together, so on average the CPU does not achieve a six-fold increase in performance.

Multiple computers are sometimes combined into single systems called parallel processors. When a machine has more than one thousand arithmetic/logic units, it is said to be massively parallel. Such machines are used primarily for numerically intensive scientific and engineering computation. Parallel machines containing as many as sixteen thousand computers have been constructed.

3. Make special questions to the sentences:

1. Computer architecture is the design and analysis of new computer systems.
2. Computer architects study ways of improving computers by increasing their speed, storage capacity, and reliability, and by reducing their cost and power consumption.
3. Computer architects develop both software and hardware models to analyze the performance of existing and proposed computer designs, then use this analysis to guide development of new computers.

4. They are often involved with the engineering of a new computer because the accuracy of their models depends on the design of the computer's circuitry.
5. Many computer architects are interested in developing computers that are specialized for particular applications such as image processing, signal processing, or the control of mechanical systems.
6. The optimization of computer architecture to specific tasks often yields higher performance, lower cost, or both.

Text 4. Artificial intelligence, robotics, human-computer interfacing

1. Learn the vocabulary of the text:

1. Artificial Intelligence (AI)
2. to mimic human intelligence and sensory processing ability
3. model human behavior
4. to improve our understanding of intelligence
5. machine learning
6. inference
7. cognition
8. knowledge representation
9. problem solving
10. case-based reasoning
11. natural language understanding
12. speech recognition
13. computer vision
14. artificial neural networks
15. the use of *heuristics*
16. computer controlled mechanical devices
17. automated factory assembly lines

18. to relieve humans from tedious, repetitive, or dangerous tasks
19. to model the robot's physical properties
20. to simplify the creation of control programs
21. a human-computer interface
22. to improving computer access for people with disabilities
23. to simplify program use
24. to develop three-dimensional input and output devices for virtual reality
25. to improve handwriting and speech recognition
26. to develop heads-up displays for aircraft
27. psychology
28. neurophysiology
29. linguistics
30. a highly interdisciplinary field of study

2. Read and translate the text:

Artificial intelligence (AI) research seeks to enable computers and machines to mimic human intelligence and sensory processing ability, and model human behavior with computers to improve our understanding of intelligence. The many branches of AI research include machine learning, inference, cognition, knowledge representation, problem solving, case-based reasoning, natural language understanding, speech recognition, computer vision, and artificial neural networks.

A key technique developed in the study of artificial intelligence is to specify a problem as a set of states, some of which are solutions, and then search for solution states. For example, in chess, each move creates a new state. If a computer searched the states resulting from all possible sequences of moves, it could identify those that win the game. However, the number of states associated with many problems (such as the possible number of moves needed to win a chess game) is so vast that exhaustively searching them is impractical. The search process can be improved through the use of *heuristics*—rules that are specific to a given problem and can therefore help guide the search. For example, a chess heuristic might indicate that when a move results in checkmate, there is no point in examining alternate moves.

Robotics

Another area of computer science that has found wide practical use is *robotics*—the design and development of computer controlled mechanical devices. Robots range in complexity from toys to automated factory assembly lines, and relieve humans from tedious, repetitive, or dangerous tasks. Robots are also employed where requirements of speed, precision, consistency, or cleanliness exceed what humans can accomplish. Roboticists—scientists involved in the field of robotics—study the many aspects of controlling robots. These aspects include modeling the robot's physical properties, modeling its environment, planning its actions, directing its mechanisms efficiently, using sensors to provide feedback to the controlling program, and ensuring the safety of its behavior. They also study ways of simplifying the creation of control programs. One area of research seeks to provide robots with more of the dexterity and adaptability of humans, and is closely associated with AI.

Human-computer interfacing

Human-computer interfaces provide the means for people to use computers. An example of a human-computer interface is the keyboard, which lets humans enter commands into a computer and enter text into a specific application. The diversity of research into human-computer interfacing corresponds to the diversity of computer users and applications. However, a unifying theme is the development of better interfaces and experimental evaluation of their effectiveness. Examples include improving computer access for people with disabilities, simplifying program use, developing three-dimensional input and output devices for virtual reality, improving handwriting and speech recognition, and developing heads-up displays for aircraft instruments in which critical information such as speed, altitude, and heading are displayed on a screen in front of the pilot's window. One area of research, called visualization, is concerned with graphically presenting large amounts of data so that people can comprehend its key properties.

Connection of computer science to other disciplines

Because computer science grew out of mathematics and electrical engineering, it retains many close connections to those disciplines. Theoretical computer science draws many of its approaches from mathematics and logic. Research in numerical computation overlaps with mathematics research in numerical analysis. Computer architects work closely with the electrical engineers who design the circuits of a computer.

Beyond these historical connections, there are strong ties between AI research and psychology, neurophysiology, and linguistics. Human-computer interface research also has connections with psychology. Roboticists work with both mechanical engineers and physiologists in designing new robots.

Computer science also has indirect relationships with virtually all disciplines that use computers. Applications developed in other fields often involve collaboration with computer scientists, who contribute their knowledge of algorithms, data structures, software engineering, and existing technology. In return, the computer scientists have the opportunity to observe novel applications of computers, from which they gain a deeper insight into their use. These relationships make computer science a highly interdisciplinary field of study.

3. Identify the words in bold italics:

1. A key technique ***developed*** in the study of artificial intelligence is to specify a problem as a set of states, some of which are solutions, and then search for solution states.
2. If a computer searched the states ***resulting*** from all possible sequences of moves, it could identify those that win the game.
3. However, the number of states ***associated with*** many problems (such as the possible number of moves needed to win a chess game) is so vast that exhaustively searching them is impractical.
4. Another area of computer science that has found wide practical use is *robotics*—the design and development of computer ***controlled*** mechanical devices.
5. Robots range in complexity from toys to ***automated*** factory assembly lines.
6. Roboticists—scientists ***involved*** in the field of robotics—study the many aspects of ***controlling*** robots.
7. However, a ***unifying*** theme is the development of better interfaces and experimental evaluation of their effectiveness.
8. Applications ***developed*** in other fields often involve collaboration with computer scientists.

Text 5. Windows

1. Learn the vocabulary of the text:

1. to enter commands with a point-and-click device
2. is a set of programs
3. to manipulate small pictures
4. an extension

5. work environment for the user
6. to point the cursor at icons
7. to click buttons on the mouse
8. to issue commands
9. to perform an action
10. to access a data file
11. to copy a data file
12. pull-down or click-on menu items
13. overlap with other previously active windows
14. immediate commercial success
15. updated and improved
16. subsequent versions
17. the favored platform for software development
18. to run several programs simultaneously
19. to release a new version

2. Read and translate the text:

Windows, in computer science, personal computer operating system sold by Microsoft Corporation that allows users to enter commands with a point-and-click device, such as a mouse, instead of a keyboard. An operating system is a set of programs that control the basic functions of a computer. The Windows operating system provides users with a graphical user interface (GUI), which allows them to manipulate small pictures, called icons, on the computer screen to issue commands.

Windows is the most widely used operating system in the world. It is an extension of and replacement for Microsoft's Disk Operating System (MS-DOS).

The Windows GUI is designed to be a natural, or intuitive, work environment for the user. With Windows, the user can move a cursor around on the computer screen with a mouse. By pointing the cursor at icons and clicking buttons on the mouse, the user can issue commands to the computer to perform an action, such as starting a program, accessing a data file, or copying a data file. Other commands can be reached through pull-down or click-on menu items. The computer displays the active area in which the user is working as a window on the computer screen. The currently active window may overlap with other previously active windows that remain open on the screen. This type of GUI is said to include *WIMP* features: *w*indows, *i*cons, *m*enus, and *p*ointing device (such as a mouse).

Computer scientists at the Xerox Corporation's Palo Alto Research Center (PARC) invented the GUI concept in the early 1970s, but this innovation was not an immediate commercial success. In 1983 Apple Computer featured a GUI in its Lisa computer. This GUI was updated and improved in its Macintosh computer, introduced in 1984.

Microsoft began its development of a GUI in 1983 as an extension of its MS-DOS operating system. Microsoft's Windows version 1.0 first appeared in 1985. In this version, the windows were tiled, or presented next to each other rather than overlapping. Windows version 2.0, introduced in 1987, was designed to resemble IBM's OS/2 Presentation Manager, another GUI operating system. Windows version 2.0 included the overlapping window feature. The more powerful version 3.0 of Windows, introduced in 1990, and subsequent versions 3.1 and 3.11 rapidly made Windows the market leader in operating systems for personal computers, in part because it was prepackaged on new personal computers. It also became the favored platform for software development.

In 1993 Microsoft introduced Windows NT (New Technology). The Windows NT operating system offers 32-bit multitasking, which gives a computer the ability to run several programs simultaneously, or in parallel, at high speed. This operating system competes with IBM's OS/2 as a platform for the intensive, high-end, networked computing environments found in many businesses.

In 1995 Microsoft released a new version of Windows for personal computers called Windows 95. Windows 95 had a sleeker and simpler GUI than previous versions. It also offered 32-bit processing, efficient multitasking, network connections, and Internet access. Windows 98, released in 1998, improved upon Windows 95.

In 1996 Microsoft debuted Windows CE, a scaled-down version of the Microsoft Windows platform designed for use with handheld personal computers. Windows 2000, released at the end of 1999, combined Windows NT technology with the Windows 98 graphical user interface.

Other popular operating systems include the Macintosh System (Mac OS) from Apple Computer, Inc., OS/2 Warp from IBM, and UNIX and its variations, such as Linux.

3. Answer the questions:

1. What corporation sells Windows?
2. What is an operating system?
3. What does the Windows operating system provide users with?
4. What can a user do with Windows?
5. When was Macintosh computer introduced?
6. What do other popular operating systems include?
7. What does GUI stand for?

Text 6. Basic features of database programs

1. Learn the vocabulary of the text:

1. store, organize and retrieve information
2. features and applications of a computer database
3. to enter on a database via fields
4. holds a separate piece of information
5. a record about an employee
6. length of employment
7. hold large amounts of information

8. to find records containing particular information
9. advantages of a database program
10. networking facilities
11. to have direct access to a common database
12. security devices
13. be protected by user-defined passwords
14. to import and export data

2. Read and translate the text:

With a database you can store, organize and retrieve a large collection of related information on computer. If you like, it is the electronic equivalent of an indexed filing cabinet. Let us look at some features and applications of a computer database:

• Information is entered on a database via fields. Each field holds a separate piece of information, and the fields are collected together into records. For example, a record about an employee might consist of several fields, which give his/her name, address, telephone number, age, salary, and length of employment with the company. Records are grouped together into files, which hold large amounts of information. Files can easily be updated: you can always change fields, add new records or delete old ones. With the right database software, you are able to keep track of stock, sales, market trends, orders, invoices and many more details that can make your company successful.

• Another feature of database programs is that you can automatically look up and find records containing particular information. You can also search on more than one field at a time. For example, if a managing director wanted to know all the customers that spend more than £7,000 per month, the program would search on the name field and the money field simultaneously. If we had to summarize the most relevant advantages of a database program over a card index system, we would say that it is much faster to consult and update, occupies a lot less space, and records can be automatically sorted into numerical or alphabetical order using any field. The best packages also include networking facilities, which add a new dimension of productivity to businesses. For example, managers of different departments can have direct access to a common database, which represents an enormous advantage.

Thanks to security devices, you can share part of your files on a network and control who sees the information. Most aspects of the program can be protected by user-defined passwords. For example, if you wanted to share an employee's personal details, but not his commission, you could protect the commission field. Other features like mail merging, layout design and the ability to import and export data are also very useful. In short, a database manager helps you control the data you have at home, in the library or in your business.

3. Open the brackets:

1. Information (enter) on a database via fields.
2. The fields (collect) together into records.
3. Records (group) together into files, which hold large amounts of information.
4. Files (can update): you can always change fields, add new records or delete old ones.
5. Records (can sort) into numerical or alphabetical order using any field.
6. Most aspects of the program (can protect) by user-defined passwords.
7. Most aspects of the program (can protect) by user-defined passwords.
8. Managers of different departments (can have) direct access to a common database, which represents an enormous advantage.
9. A database manager (help) you control the data you have at home, in the library or in your business.

Text 7. Computer graphics

1. Learn the vocabulary of the text:

1. to interpret the input provided by the user
2. to transform something into images
3. to convert the bits of data into precise shapes and colours
4. to use sophisticated programs
5. computer-aided design and computer-aided manufacturing
6. CAD software
7. to develop, model and test car designs
8. to save time and money
9. to present data in a more understandable form
10. to design circuits
11. present information visually
12. effective ways of communicating
13. three-dimensional graphics
14. to present information in a clear visual form.

2. Read and translate the text:

Computer graphics are pictures and drawings produced by computer. A graphics program interprets the input provided by the user and transforms it into images that can be displayed on the screen, printed on paper or transferred to microfilm. In the process the computer uses hundreds of mathematical formulas to convert the bits of data into precise shapes and colours. Graphics can be developed for a variety of uses including presentations, desktop publishing, illustrations, architectural designs and detailed engineering drawings. Mechanical engineers use sophisticated programs for applications in computer-aided design and computer-aided manufacturing. Let us take, for example, the car industry. CAD software is used to develop, model and test car designs before the actual parts are made. This can save a lot of time and money.

Computers are also used to present data in a more understandable form: electrical engineers use computer graphics to design circuits and people in business can present information visually to clients in graphs and diagrams. These are much more effective ways of communicating than lists of figures or long explanations. Today, three-dimensional graphics, along with colour and animation are essential for such applications as fine art, graphic design, computer-aided engineering and academic research. Computer animation is the process of creating objects and pictures which move across the screen; it is used by scientists and engineers to analyze problems. With the appropriate software they can study the structure of objects and how it is affected by particular changes. Basically, computer graphics help users to understand complex information quickly by presenting it in a clear visual form.

3. Answer the questions:

1. What are the key words of the text?
2. What is the main idea of the text?
3. What is computer animation?
4. What is CAD?
5. How can you define “computer graphics”?
6. How is CAD used in car industry?
7. What uses can graphics be developed for?

Text 8. Programming languages

1. Learn the vocabulary of the text:

1. human-based languages
2. an array of computer programming languages
3. compiling
4. a binary
5. distinct features
6. commonalities
7. process large and complex swaths of information
8. a list of randomized numbers

9. to place in ascending order
10. the most important, relevant and in-demand languages
11. back end developers
12. flexible and robust semantics
13. frameworks
14. micro-frameworks
15. advanced content management systems
16. desktop graphical user interfaces
17. a scripting or glue language
18. to develop web-based applications
19. to develop enterprise-level applications

2. Read and translate the text:

Computer programming languages allow us to give instructions to a computer in a language the computer understands. Just as many human-based languages exist, there are an array of computer programming languages that programmers can use to communicate with a computer. The portion of the language that a computer can understand is called a “binary.” Translating programming language into binary is known as “compiling.” Each language, from C Language to Python, has its own distinct features, though many times there are commonalities between programming languages.

These languages allow computers to quickly and efficiently process large and complex swaths of information. For example, if a person is given a list of randomized numbers ranging from one to ten thousand and is asked to place them in ascending order, chances are that it will take a sizable amount of time and include some errors.

There are dozens of programming languages used in the industry today. We've compiled overviews of the most important, relevant and in-demand of these languages below.

PYTHON

Python is an advanced programming language that is interpreted, object-oriented and built on flexible and robust semantics.

Who uses it?

- **Professions and Industries:**
  - Python developers, software engineers, back end developers, Python programmers
  - Used by employers in information technology, engineering, professional services and design
- **Major Organizations:** Google, Pinterest, Instagram, YouTube, DropBox, NASA, ESRI
- **Specializations and Industries:** Web and Internet development (frameworks, micro-frameworks and advanced content management systems); scientific and numeric computing; desktop graphical user interfaces (GUIs)

WHAT MAKES LEARNING IT IMPORTANT?

Python lets you work quickly to integrate systems as a scripting or glue language. It’s also suited for Rapid Application Develop (RAD).

- The game Civilization 4 has all its inner logic, including AI, implemented in Python.
- NASA uses Python in its Integrated Planning System as a standard scripting language.
- Features:
  - Simple to learn and easily read
  - Associated web frameworks for developing web-based applications
  - Free interpreter and standard library available in source or binary on major platforms

WHERE DID IT START?

Python was developed in the late 1980s at CWI in the Netherlands and first released to the public in 1991.

JAVA

Java is a general-purpose, object-oriented, high-level programming language with several features that make it ideal for web-based development.

WHO USES IT?

- **Professions and Industries:**
  - Software engineers, Java developers
  - Used by employers in communications, education, finance, health sciences, hospitality, retail and utilities
- **Major Organizations:** V2COM, Eclipse Information Technologies, eBay, Eurotech
- **Specializations and Industries:** Internet of Things (IoT), Enterprise Architecture, Cloud Computing

WHAT MAKES LEARNING IT IMPORTANT?

Java is used to develop enterprise-level applications for video games and mobile apps, as well as to create web-based applications with JSP (Java Server Pages). When used online, Java allows applets to be downloaded and used through a browser, which can then perform a function not normally available.

- Programs that use or are written in Java include Adobe Creative Suite, Eclipse, Lotus Notes, Minecraft and OpenOffice.
- Java is the core foundation for developing Android apps.
- Features:
  - Application portability
  - Robust and interpreted language
  - Extensive network library

WHERE DID IT START?

Originally known as Oak, Java was developed in 1990 at Sun Microsystems to add capabilities to the C++ language. Java was developed according to the principle of WORA (Write Once Run Anywhere). The language was introduced to the public in 1995 and is now owned by Oracle.

JAVASCRIPT

JavaScript is a client-side programming language that runs inside a client browser and processes commands on a computer rather than a server. It is commonly placed into an HTML or ASP file. Despite its name, JavaScript is not related to Java.

WHO USES IT?

- **Professions and Industries:**
  - JavaScript developers, Web developers, software engineers
  - Used by employers in Information Technology, Engineering, Design, Marketing, Finance and Healthcare
- **Major Organizations:** WordPress, Soundcloud, Khan Academy, Linkedin, Groupon, Yahoo and many others
- **Specializations and Industries Where JavaScript is Used Most:** Front End Website Development, Gaming Development

WHAT MAKES LEARNING IT IMPORTANT?

JavaScript is used primarily in Web development to manipulate various page elements and make them more dynamic, including scrolling abilities, printing the time and date, creating a calendar and other tasks not possible through plain HTML. It can also be used to create games and APIs.

- The agency Cyber-Duck in Britain uses public APIs, created with JavaScript, to pull in data about crime and enables users to review a local area.
- Tweetmap, created by Pete Smart and Rob Hawkes using JavaScript, represents a world map that is proportionally sized according to the number of tweets.
- Features:
  - Basic features are easy to learn
  - Multiple frameworks
  - Users can reference JQuery, a comprehensive Javascript library

WHERE DID IT START?

JavaScript was designed by Netscape and originally known as LiveScript, before becoming JavaScript in 1995.

C++

C++ is a general purpose, object-oriented, middle-level programming language and is an extension of C language, which makes it possible to code C++ in a "C style". In some situations, coding can be done in either format, making C++ an example of a hybrid language.

WHO USES IT?

- **Professions and Industries:**
  - C++ software engineers, C++ software developers, embedded engineers, programmer analysts
  - Used by employers in Information Technology, Engineering, Professional Services, Design, Quality Control and Management
- **Major Company and Organization Users:** Google, Mozilla, Firefox, Winamp, Adobe Software, Amazon, Lockheed Martin
- **Specializations:** System/Application Software, Drivers, Client-Server Applications, Embedded Firmware

WHAT MAKES LEARNING IT IMPORTANT?

The C++ language is used to create computer programs and packaged software, such as games, office applications, graphics and video editors and operating systems.

- The Blackberry OS is developed using C++.
- The newest Microsoft Office suite was developed using C++.
- Features:
  - Often the first programming language taught at college level
  - Quick processing and compilation mechanism
  - Robust standard library (STL)

WHERE DID IT START?

Released in 1983 and often considered an object-oriented version of C language, C++ was created to compile lean, efficient code, while providing high-level abstractions to better manage large development projects.

3. Translate sentences from Russian into English:

Классификация языков программирования

1. На данный момент существует более 300 языков программирования.
2. Каждый из них имеет свои особенности и подходит для одной определенной задачи.
3. Все языки программирования можно условно разделить на несколько групп:
4. Аспектно-ориентированные (основная идея – разделение функциональности для увеличения эффективности программных модулей).
5. Структурные (в основе лежит идея создания иерархической структуры отдельных блоков программы).
6. Логические (в основе лежит теория аппарата математической логики и правил резолюции).
7. Объектно-ориентированные (в таком программировании используются уже не алгоритмы, а объекты, которые принадлежат определенному классу).
8. Мультипарадигмальные (сочетают в себе несколько парадигм, и программист сам решает, каким языком воспользоваться в том или ином случае).
9. Функциональные (в качестве основных элементов выступают функции, которые меняют значение в зависимости от результатов вычислений исходных данных).

Text 9. Debugging a computer program

1. Learn the vocabulary of the text:

1. a bug
2. an error in a software program
3. to quit or behave in an unintended manner
4. a button
5. a program's interface
6. to respond
7. to hang or crash
8. an infinite calculation
9. memory leak.
10. syntax or logic errors
11. the source code of a program
12. to fix
13. a development tool
14. a debugger
15. to negatively affect the usability of a program
16. to go through a lot of testing
17. to release
18. commercial software
19. completely error-free program
20. bug fixes for errors
21. to get rid of all the bugs
22. eliminate errors
23. a windshield at a gas station
24. debuggers
25. to mark the exact lines of code
26. to run a program
27. determine
28. provide detailed information
29. execution

2. Read and translate the text:

In the computer world, **a bug** is an error in a software program. It may cause a program to unexpectedly quit or behave in an unintended manner. For example, a small bug may cause a button within a program's interface not to respond when you click it. A more serious bug may cause the program to hang or crash due to an infinite calculation or memory leak.

From a developer perspective, bugs can be syntax or logic errors within the source code of a program. These errors can often be fixed using a development tool aptly named a debugger. However, if errors are not caught before the program is compiled into the final application, the bugs will be noticed by the user.

Because bugs can negatively affect the usability of a program, most programs typically go through a lot of testing before they are released to the public. For example, commercial software often goes through a beta phase, where multiple users thoroughly test all aspects of the program to make sure it functions correctly. Once the program is determined to be stable and free from errors, it is released the public.

Of course, as we all know, most programs are not completely error-free, even after they have been thoroughly tested. For this reason, software developers often release "point updates," (e.g. version 1.0.1), which include bug fixes for errors that were found after the software was released. Programs that are especially "buggy" may require multiple point updates (1.0.2, 1.0.3, etc.) to get rid of all the bugs.

Computer programmers, like everybody else, are not perfect. This means the programs they write sometimes have small errors, called "bugs," in them. These bugs can be minor, such as not recognizing user input, or more serious, such as a memory leak that crashes the program. Before releasing their software to the public, programmers **"debug"** their programs, eliminating as many errors as possible. This debugging process often takes a long time, as fixing some errors may introduce others. Debugging your windshield at a gas station is much easier than debugging a computer program.

Even the most experienced software programmers usually don't get it right on their first try. Certain errors, often called bugs, can occur in programs, causing them to not function as the programmer expected. Sometimes these errors are easy to fix, while some bugs are very difficult to trace. This is especially true for large programs that consist of several thousand lines of code.

Fortunately, there are programs called **debuggers** that help software developers find and eliminate bugs while they are writing programs. A debugger tells the programmer what types of errors it finds and often marks the exact lines of code where the bugs are found. Debuggers also allow programmers to run a program step by step so that they can determine exactly when and why a program crashes. Advanced debuggers provide detailed information about threads and memory being used by the program during each step of execution.

3. Translate the sentences with the word <u>Bug</u>

1. It's... a *bug*!
2. The *bug* looked to be about two feet long.
3. 'He said it looked like a bed *bug*, monsieur, but not so that the mechanics could hear what he said.
4. Wasn't no bigger'n a *bug* first time he gave me C chord.
5. "Have you sent anyone in to sweep for the *bug*?"
6. "But not our space *bug*."
7. And this *bug* mutated as a direct result of our mass consumption of animals, particularly pork.
8. Okay, *bug* report taken.
9. You mean the *bug*.
10. It's only a nasty *bug*.

11. And if we hit a rough spot, instead of getting mad, just say, "Hey, we found a *bug*," and we report it so it can be fixed.
12. I'll go get *Bug* ready for school.
13. We got a *bug* in the electrical system!
14. We're looking for a *bug*, not a password.
15. You have an "emotional *bug*".
16. Sorry, Mr. Gross, but all programs have *bugs*.
17. We might be getting some interference from the *bug*s.
18. They been chasing *bugs* ever since they installed it.
19. It was a trial run an early experiment to work out the *bugs*, so to speak.
20. It's a complex program, and there's still a *bug* or two to be worked out.

Text 10. Software testing

1. Learn the vocabulary of the text:

1. to find and fix bugs
2. to suit to a career in software testing
3. a software tester
4. to be involved in
5. software development and deployment
6. to conduct automated and manual tests
7. to ensure the software is fit for purpose
8. the analysis of software and systems
9. to avert risk and
10. to prevent software issues
11. to find bugs and issues within a product
12. to work on bespoke
13. to be familiar with programming and using coding languages
14. to assess a code
15. project requirements
16. to assess potential risks

17. a key requirement
18. work more flexibly
19. keep up to date

2. Read and translate the text:

If you love finding and fixing bugs in programming and coding, you could be suited to a career in software testing.

As a software tester, you are involved in the quality assurance stage of software development and deployment. You'll conduct automated and manual tests to ensure the software created by developers is fit for purpose. Software testing involves the analysis of software, and systems, to avert risk and prevent software issues.

Your role is integral to the creation of software systems and technical products including vehicles, electronic goods, defense, and healthcare.

Ultimately software testers are employed to find bugs and issues within a product before it gets deployed to everyday users. You might work on bespoke, individual projects or multinational projects spanning the globe and costing billions of pounds. You will need to be, or become, familiar with programming and using coding languages. Assessing code is one part of the role of a software tester.

Responsibilities

Your role will vary depending on project requirements. You may join a project at the initial implementation stages to assess potential risks, or be brought on to a project midway through, when testing becomes a key requirement.

Large organisations may have software testers dedicated to one project; whereas smaller organisations may have a central team working on multiple projects.

However, your work activities are likely to include:

- meeting with system users to understand the scope of projects

- working with software developers and project support teams
- identifying business requirements
- project planning
- monitoring applications and software systems
- stress testing
- performance testing
- functional testing
- scalability testing
- writing and executing test scripts
- running manual and automated tests
- testing in different environments including web and mobile
- writing bug reports
- resource planning
- reviewing documentation
- working towards departmental and project deadlines
- quality assurance
- providing objective feedback to software development project teams
- problem solving
- designing tests to mitigate risk
- presenting findings to software development and business user teams
- travelling to different project sites
- working on multiple projects at one time
- document analysis
- liaising with project teams in other parts of the world
- communicating findings to technical and non-technical colleagues.

Working hours

Working hours usually follow a standard office day of eight or nine hours, between 8am and 6pm. However, due to the nature of project work you may be required to work outside these times. On occasion this may mean working shifts and weekend work. This would be most likely to occur during periods of software deployment or if a project happens to be taking place across a variety of locations and time zones.

What to expect

- Work is mainly office based and you will spend the majority of your time at a computer.
- Your role may be stressful at times, particularly around the time of project completion.
- Once you have gained adequate experience, you could progress into the freelance and contracting market. This would enable you to select specific projects and work more flexibly. However, working as a contractor may not provide the same benefits and job security in comparison to a permanent employee.
- The IT sector, including software testing roles, has a higher ratio of male to female workers. However, there is a higher ratio of female to male software testers when compared with other IT jobs (such as software development).
- Companies employ software testers in many locations within the UK. The highest concentration is in large cities including London, Manchester, Edinburgh and Birmingham. There are also international opportunities, most notably in the USA and India, where a large number of off-shore software testing companies are based.

Qualifications

Software testers often have a degree in computer science or IT. However, the role is open to graduates from a variety of degree disciplines including:

- chemistry
- electrical engineering
- mathematics
- physics

- software, IT, or engineering diploma may be most highly regarded by companies.

Skills

You will need to have:

- strong verbal and written communication skills with the ability to liaise with a variety of stakeholders
    - problem solving skills
    - the ability to work under pressure
    - attention to detail
    - competent technical skills
    - the ability to work in a team and individually
    - organisational skills with the capability of working towards tight deadlines
- a passion for technology.

Employers

Software testers are required in a variety of organisations and sectors. Large employers with sophisticated software and IT systems will have the most opportunities. Technology companies and smaller organisations also require software testers.

You can find software testing opportunities in:

- financial services
- healthcare
- manufacturing
- media
- professional services
- public sector
- retail
- telecommunications
- transport.

Professional development

As the IT sector is ever changing, it is important that you keep up to date with developments and specific software testing trends. On-the-job training is an ideal way for students and recent graduates to gain an understanding of the software development lifecycle.

3. Translate the passage from Russian into English:

Необходимыми качествами тестировщика являются логическое мышление, внимательность, хорошая память, умение учиться и адаптироваться к существующим задачам, быстро переключаться с одного типа задач на другой. Не менее важны терпение, усидчивость и умение работать в команде.

Кроме того, тестировщик выступает одновременно и как пользователь, и как эксперт, а потому должен иметь определенный склад мышления: уметь воспроизводить поведение

пользователя продукта и анализировать поведение

системы, входящие параметры и полученные результаты с точки зрения инженера.

Некоторые утверждают, что специфика профессии заключается в видимом однообразии и монотонности трудового процесса; по мнению других, тестирование является творческой исследовательской работой (в противовес стандартизированной разработке).

Одной из особенностей профессии является возможность удаленной работы, причем расстояние часто не имеет значения (тестировщик может находиться в другом городе или стране по отношению к разработчику и заказчику)

Text 11. Computer crimes

1. Learn the vocabulary of the text:

1. the study of computer abuse
2. the proverbial tip of the iceberg
3. the pickings
4. dishonest employees
5. a thief
6. to gain access to funds
7. cash-dispensing terminals
8. counterfeit credit cards
9. blackmail
10. unscrupulous competitors
11. crooked computer experts
12. to devise a variety of tricks
13. unauthorized ways
14. use account numbers and passwords
15. embezzlers

2. Read and translate the text:

More and more, the operations of our businesses, governments, and financial institutions are controlled by information that exists only inside computer memories. Anyone clever enough to modify this information for his own purposes can reap substantial rewards. Even worse, a number of people who have done this and been caught at it have managed to get away without punishment.

These facts have not been lost on criminals or would-be criminals. A recent Stanford Research Institute study of computer abuse was based on 160 case histories, which probably are just the proverbial tip of the iceberg. After all, we only know about the unsuccessful crimes. How many successful ones have gone undetected is anybody's guess.

Here are a few areas in which computer criminals have found the pickings all too easy.

Banking. All but the smallest banks now keep their accounts on computer files. Someone who knows how to change the numbers in the files can transfer funds at will. For instance, one programmer was caught having the computer transfer funds from other people's accounts to his wife's checking account. Often, traditionally trained auditors don't know enough about the workings of computers to catch what is taking place right under their noses.

Business. A company that uses computers extensively offers many opportunities to both dishonest employees and clever outsiders. For instance, a thief can have the computer ship the company's products to addresses of his own choosing. Or he can have it issue checks to him or his confederates for imaginary supplies or services. People have been caught doing both.

Credit Cards. There is a trend toward using cards similar to credit cards to gain access to funds through cash-dispensing terminals. Yet, in the past, organized crime has used stolen or counterfeit credit cards to finance its operations. Banks that offer after-hours or remote banking through cash-dispensing terminals may find themselves unwillingly subsidizing organized crime.

Theft of Information. Much personal information about individuals is now stored in computer files. An unauthorized person with access to this information could use it for blackmail. Also, confidential information about a company's products or operations can be stolen and sold to unscrupulous competitors. (One attempt at the latter came to light when the competitor turned out to be scrupulous and turned in the people who were trying to sell him stolen information.)

Software Theft. The software for a computer system is often more expensive than the hardware. Yet this expensive software is all too easy to copy. Crooked computer experts have devised a variety of tricks for getting these expensive programs printed out, punched on cards, recorded on tape, or otherwise delivered into their hands. This crime has even been perpetrated from remote terminals that access the computer over the telephone.

Theft of Time-Sharing Services. When the public is given access to a system, some members of the public often discover how to use the system in unauthorized ways. For example, there are the "phone freakers" who avoid long distance telephone charges by sending over their phones control signals that are identical to those used by the telephone company. Since time-sharing systems often are accessible to anyone who dials the right telephone number, they are subject to the same kinds of manipulation.

Of course, most systems use account numbers and passwords to restrict access to authorized users. But unauthorized persons have proved to be adept at obtaining this information and using it for their own benefit. For instance, when a police computer system was demonstrated to a school class, a precocious student noted the access codes being used; later, all the student's teachers turned up on a list of wanted criminals.

Perfect Crimes. It's easy for computer crimes to go undetected if no one checks up on what the computer is doing. But even if the crime is detected, the criminal may walk away not only unpunished but with a glowing recommendation from his former employers.

Of course, we have no statistics on crimes that go undetected. But it's unsettling to note how many of the crimes we do know about were detected by accident, not by systematic audits or other security procedures. The computer criminals who have been caught may have been the victims of uncommonly bad luck.

For example, a certain keypunch operator complained of having to stay overtime to punch extra cards. Investigation revealed that the extra cards she was being asked to punch were for fraudulent transactions. In another case, disgruntled employees of the thief tipped off the company that was being robbed. An undercover narcotics agent stumbled on still another case. An employee was selling the company's merchandise on the side and using the computer to get it shipped to the buyers. While negotiating for LSD, the narcotics agent was offered a good deal on a stereo!

Unlike other embezzlers, who must leave the country, commit suicide, or go to jail, computer criminals sometimes brazen it out, demanding not only that they not be prosecuted but also that they be given good recommendations and perhaps other benefits, such as severance pay. All too often, their demands have been met.

Why? Because company executives are afraid of the bad publicity that would result if the public found out that their computer had been misused. They cringe at the thought of a criminal boasting in open court of how he juggled the most confidential records right under the noses of the company's executives, accountants, and security staff. And so, another computer criminal departs with just the recommendations he needs to continue his exploits elsewhere.

3. **Identify the following verb forms:**
   are controlled, exists, have done, have been caught, was based, revealed, is detected, noted, have devised, can be stolen and sold, may find, have not been lost, know, was selling, could use, had been misused, departs, have been met.

Text 12. What is information security?

1. **Learn the vocabulary of the text:**
   1. Information security
   2. availability
   3. privacy
   4. integrity of data
   5. the protection of important data

6. security system
7. foolproof
8. easy access to the information
9. approved codes
10. hacking programs
11. to breach
12. to make access as secure as possible
13. a mix of upper and lowercase letters
14. gain access to secure information
15. malware, which includes computer viruses, spyware, worms
16. to steal information
17. antivirus programs
18. strong antivirus software
19. to check for any known malicious software
20. a potential virus
21. a firewall
22. to be vulnerable to attack
23. antivirus packages
24. encoding data
25. encryption systems
26. to encrypt data
27. codes and cyphers
28. legal liability

2. Read and translate the text:

Information security is the process of protecting the availability, privacy, and integrity of data. While the term often describes measures and methods of increasing computer security, it also refers to the protection of any type of important data, such as personal diaries or the classified plot details of an upcoming book. No security system is foolproof but taking basic and practical steps to protect data is critical for good information security.

Password Protection

Using passwords is one of the most basic methods of improving information security. This measure reduces the number of people who have easy access to the information, since only those with approved codes can reach it. Unfortunately, passwords are not foolproof, and hacking programs can run through millions of possible codes in just seconds. Passwords can also be breached through carelessness, such as by leaving a public computer logged into an account or using a too simple code, like "password" or "1234."

To make access as secure as possible, users should create passwords that use a mix of upper and lowercase letters, numbers, and symbols, and avoid easily guessed combinations such as birthdays or family names. People should not write down passwords on papers left near the computer and should use different passwords for each account. For better security, a computer user may want to consider switching to a new password every few months.

Antivirus and Malware Protection

One way that hackers gain access to secure information is through malware, which includes computer viruses, spyware, worms, and other programs. These pieces of code are installed on computers to steal information, limit usability, record user actions, or destroy data. Using strong antivirus software is one of the best ways of improving information security. Antivirus programs scan the system to check for any known malicious software, and most will warn the user if he or she is on a webpage that contains a potential virus. Most programs will also perform a scan of the entire system on command, identifying and destroying any harmful objects.

Most operating systems include a basic antivirus program that will help protect the computer to some degree. The most secure programs are typically those available for a monthly subscription or one-time fee, and which can be downloaded online or purchased in a store. Antivirus software can also be downloaded for free online, although these programs may offer fewer features and less protection than paid versions.

Even the best antivirus programs usually need to be updated regularly to keep up with the new malware, and most software will alert the user when a new update is available for downloading. Users must be aware of the name and contact method of each anti-virus program they own, however, as some viruses will pose as security programs in order to get an unsuspecting user to download and install more malware. Running a full computer scan on a weekly basis is a good way to weed out potentially malicious programs.

Firewalls

A firewall helps maintain computer information security by preventing unauthorized access to a network. There are several ways to do this, including by limiting the types of data allowed in and out of the network, re-routing network information through a proxy server to hide the real address of the computer, or by monitoring the characteristics of the data to determine if it's trustworthy. In essence, firewalls filter the information that passes through them, only allowing authorized content in. Specific websites, protocols (like File Transfer Protocol or FTP), and even words can be blocked from coming in, as can outside access to computers within the firewall.

Most computer operating systems include a pre-installed firewall program, but independent programs can also be purchased for additional security options. Together with an antivirus package, firewalls significantly increase information security by reducing the chance that a hacker will gain access to private data. Without a firewall, secure data is more vulnerable to attack.

Codes and Cyphers

Encoding data is one of the oldest ways of securing written information. Governments and military organizations often use encryption systems to ensure that secret messages will be unreadable if they are intercepted by the wrong person.

Encryption methods can include simple substitution codes, like switching each letter for a corresponding number, or more complex systems that require complicated algorithms for decryption. As long as the code method is kept secret, encryption can be a good basic method of information security.

On computers systems, there are a number of ways to encrypt data to make it more secure. With a symmetric key system, only the sender and the receiver have the code that allows the data to be read. Public or asymmetric key encryption involves using two keys — one that is publicly available so that anyone can encrypt data with it, and one that is private, so only the person with that key can read the data that has been encoded. Secure socket layers use digital certificates, which confirm that the connected computers are who they say they are, and both symmetric and asymmetric keys to encrypt the information being passed between computers.

Legal Liability

Businesses and industries can also maintain information security by using privacy laws. Workers at a company that handles secure data may be required to sign non-disclosure agreements (NDAs), which forbid them from revealing or discussing any classified topics. If an employee attempts to give or sell secrets to a competitor or other unapproved source, the company can use the NDA as grounds for legal proceedings. The use of liability laws can help companies preserve their trademarks, internal processes, and research with some degree of reliability.

Training and Common Sense

One of the greatest dangers to computer data security is human error or ignorance. Those responsible for using or running a computer network must be carefully trained in order to avoid accidentally opening the system to hackers. In the workplace, creating a training program that includes information on existing security measures as well as permitted and prohibited computer usage can reduce breaches in internal security. Family members on a home network should be taught about running virus scans, identifying potential Internet threats, and protecting personal information online.

In business and personal behavior, the importance of maintaining information security through caution and common sense cannot be understated. A person who gives out personal information, such as a home address or telephone number, without considering the consequences may quickly find himself the victim of scams, spam, and identity theft. Likewise, a business that doesn't establish a strong chain of command for keeping data secure, or provides inadequate security training for workers, creates an unstable security system. By taking the time to ensure that data is handed out carefully and to reputable sources, the risk of a security breach can be significantly reduced.

3. Answer the questions:

1. What is critical for good information security?
2. What is information security?
3. What does the term "information security" describe?
4. What is one of the most basic methods of improving information security?
5. Who has easy access to the information?
6. Why should people not write down passwords on papers left near the computer?
7. Can antivirus software be downloaded for free online?
8. How do firewalls increase information security?

Text 13. Machine translation today and tomorrow

1. **Learn the vocabulary of the text:**
    1. machine translation (MT)
    2. the pioneer research area
    3. computational linguistics
    4. the automatic translation of all kinds of documents
    5. apparent
    6. human revision of MT output
    7. the crude (unedited) MT output
    8. the production of human-quality translations
    9. a cost-effective option
    10. to produce rough translations
    11. to reduce costs
    12. to improve MT output
    13. reduce (or even eliminating) lexical ambiguity
    14. to simplify complex sentence structures
    15. enhance the comprehensibility of the original texts
    16. documentation workflow
    17. to make effective use of MT systems
    18. to be assisted by computer-based translation support tools
    19. to store and search databases
    20. translator workstations
    21. translation tools
    22. linguistically sophisticated texts
    23. unrivalled
    24. to be of publishable quality
    25. memoranda
    26. highly specialized technical subjects

2. **Read and translate the text:**

The field of machine translation (MT) was the pioneer research area in computational linguistics during the 1950s and

1960s. When it began, the assumed goal was the automatic translation of all kinds of documents at a quality equaling that of the best human translators. It became apparent very soon that this goal was impossible in the foreseeable future. Human revision of MT output was essential if the results were to be published in any form. At the same time, however, it was found that for many purposes the crude (unedited) MT output could be useful to those who wanted to get a general idea of the content of a text in an unknown language as quickly as possible. For many years, however, this latter use of MT (i.e. as a tool of assimilation, for information gathering and monitoring) was largely ignored. It was assumed that MT should be devoted only to the production of human-quality translations (for dissemination). Many large organizations have large volumes of technical and administrative documentation that have to be translated into many languages. For many years, MT with human assistance has been a cost-effective option for multinational corporations and other multilingual bodies (e.g. the European Union). MT systems produce rough translations which are then revised (post-edited) by translators. But post-editing to an acceptable quality can be expensive, and many organizations reduce costs and improve MT output by the use of 'controlled' 55 languages, i.e. by reducing (or even eliminating) lexical ambiguity and simplifying complex sentence structures – which may itself enhance the comprehensibility of the original texts. In this way, translation processes are closely linked to technical writing and integrated in the whole documentation workflow, making possible further savings in time and costs. At the same time as organizations have made effective use of MT systems, human translators have been greatly assisted by computer-based translation support tools, e.g. for terminology management, for creating in-house dictionaries and glossaries, for indexing and concordances, for post-editing facilities, and above all (since the end of the 1980s) for storing and searching databases of previously translated texts ('translation memories’). Most commonly these tools are combined in translator workstations – which often incorporate full MT systems as well. Indeed, the converse is now true: MT systems designed for large organizations are including translation memories and other translation tools. As far as systems for dissemination (publishable translations) are concerned the old distinctions between human-assisted MT and computer-aided translation are being blurred, and in the near future may be irrelevant. It is widely agreed that where translation has to be of publishable quality, both human translation and MT have their roles. Machine translation is demonstrably cost-effective for large scale and/or rapid translation of technical documentation and software localization materials. In these and many other situations, the costs of MT plus essential human preparation and revision or the costs of using computerized translation tools (workstations, translation memories, etc.) are significantly less than those of traditional human translation with no computer aids. By contrast, the human translator is (and will remain) unrivalled for non-repetitive linguistically sophisticated texts (e.g. in literature and law), and even for one-off texts in highly specialized technical subjects. However, translation does not have to be always of publishable quality. Speed and accessibility may be more important. From the beginnings of MT, unrevised translations from MT systems have been found useful for low-circulation technical reports, administrative memoranda, intelligence activities, personal correspondence, indeed whenever a document is to be read by just one or two people interested only in the essential message and unconcerned about stylistic quality or even exact terminology. The range of options has expanded significantly since the early 1990s, with the increasing use and rapid development of personal computers and the Internet.

Task 1. Find synonyms for the following adjectives:

Equal, useful, general, quick, rough, expensive, complex, significant, powerful, real.

Task 2. Translate the following word combinations:

the pioneer research area, human-quality translations, human assistance, cost-effective option, rough translations, complex sentence structures, documentation workflow, computer-based translation support tools, in-house dictionaries and glossaries, translator workstations, translation memories and other translation tools, non-repetitive linguistically sophisticated texts, low-circulation technical reports, rapid development.

Task 3. Make up special questions to the given sentences:

1. The assumed goal was the automatic translation of all kinds of documents at a quality equaling that of the best human translators. (What?)
2. Human revision of MT output was essential if the results were to be published in any form. (Why?)
3. The crude (unedited) MT output could be useful to those who wanted to get a general idea of the content of a text in an unknown language as quickly as possible. (What? Who?)
4. Many large organizations have large volumes of technical and administrative documentation that have to be translated into many languages. (What?)
5. MT systems produce rough translations which are then revised (post-edited) by translators. (Who?)
6. Many organizations reduce costs and improve MT output by the use of 'controlled' 55 languages. (How?)
7. MT systems designed for large organizations are including translation memories and other translation tools. (What?)
8. The human translator is (and will remain) unrivalled for non-repetitive linguistically sophisticated texts. (Why?)
9. Speed and accessibility may be more important. (Why?)
10. The range of options has expanded significantly since the early 1990s, with the increasing use and rapid development of personal computers and the Internet. (When?)

Критерии оценивания качества выполненного задания

отметка	Критерии оценивания монологического высказывания
5	Студент логично строит монологическое высказывание в связи с прочитанным текстом, умеет использовать факты из текста, аргументирует свое отношение к поставленной проблеме. Используемые лексические единицы и грамматические структуры соответствуют поставленной коммуникативной задаче. Ошибки практически отсутствуют. Объем высказывания не менее 12 фраз.
4	Студент логично строит монологическое высказывание в связи с прочитанным текстом, умеет использовать факты из текста, но не аргументирует свое отношение к поставленной проблеме. Используемые лексические единицы и грамматические структуры соответствуют поставленной коммуникативной задаче, но при этом допускаются незначительные грамматические ошибки или ограниченный словарный запас. Объем высказывания менее 12 фраз.
3	Студент строит монологическое высказывание в связи с прочитанным текстом, умеет использовать факты из текста, но высказывание не содержит аргументации, нелогично, содержит повторы. Используется ограниченный словарный запас, допускаются ошибки в использовании лексики, затрудняющие понимание текста. В ответе

	имеются многочисленные грамматические ошибки. Объем высказывание до 10 фраз.
2	Студент не понял содержание текста и не может сделать сообщение в связи с прочитанным, выразить и аргументировать свое отношение к проблеме, затронутой в тексте.

Для оценки качества выполненного упражнения используется 100 бальная шкала. Критерии оценивания:

60% правильных ответов и ниже – оценка 2,
61-70% правильных ответов - оценка 3,
71-85% правильных ответов – оценка 4
85 -100% правильных ответов – оценка 5

Методические указания для обучающихся по освоению дисциплины «Профессиональный иностранный язык»

Работа с лексическим материалом

Для эффективного усвоения лексического материала и расширения словарного запаса студентам предлагаются:

- многократное чтение отрывка текста вслух, содержащего лексику, которую нужно усвоить, а также чтение ранее проработанных материалов с целью повторения слов; составление несложных предложений с использованием новых слов (устно и письменно);
- постановка вопросов по содержанию прочитанного текста с использованием в них тренируемых слов, ответы на эти вопросы (устно и письменно);
- составление на русском языке несложных предложений, включающих закрепляемые слова, устный или письменный перевод этих предложений на английский язык в утвердительной, отрицательной или вопросительной форме (при условии, если это возможно по содержанию);
- использование словообразовательных и семантических связей заучиваемых слов (однокоренных слов, синонимов, антонимов);
- анализ и фиксирование словообразовательных моделей (префиксы, суффиксы, сокращение, словосложение и др.

Работа с грамматическими формами и конструкциями

Для эффективного усвоения грамматической формы или конструкции студентам рекомендуется внимательное чтение утвердительных, вопросительных и отрицательных предложений; изучение и анализ примеров и выполнение упражнений на конкретную грамматическую модель, т. е. упражнений, которые иллюстрирует данное правило. Первые упражнения по работе над определенной грамматической моделью содержат, в основном, примеры на употребление данной конструкции. Их можно использовать в качестве образцов при выполнении остальных упражнений. Каждая грамматическая форма или конструкция является неотъемлемой частью коммуникативного высказывания. Поэтому необходимо обращать внимание на употребление грамматической формы или конструкции в определенном контексте, находить примеры их использования в аутентичных источниках и максимально часто применять изучаемую модель при построении собственного устного или письменного высказывания. Обязательной частью работы и над лексикой, и над грамматикой является работа над ошибками, которую надо выполнять сразу после проверки задания.

Работа над устным высказыванием

Успешная устная речь предполагает логичное и последовательное изложение основного содержания текста; умение делать доклады, сообщения, вести беседу и дискуссию, включая деловую с использованием формул речевого этикета (для выражения собственного мнения, согласия/несогласия с собеседником, вступления в разговор и т. д.), понимать на слух собеседника не только на уровне общего смысла и деталей, но и подтекста. При построении устного высказывания необходимо: систематически продумывать и проговаривать свои выступления; при подготовке ответа в группе/ парной работе сформулировать ответ на мысленный вопрос ваших слушателей/собеседников; помнить: то, о чем выступающий говорит должно быть ему интересно, только в этом случае можно заинтересовать своих слушателей, а интерес слушателей является залогом успеха выступления; поэтому при подготовке выступления нужно тщательно отбирать материал, выстраивать его в определенной последовательности, продумывать примеры, наглядный материал и приемы общения с аудиторией; записать свое выступление и прослушать себя.

Работа над письменным высказыванием

Успешное письменное высказывание должно логично и последовательно развивать мысль автора. При построении высказывания в письменной форме рекомендуется:
четко определять содержание (какой тезис соответствует теме, какие положения доказывают этот тезис, раскрывая тему, какие выводы надо сделать из всего написанного);
· соблюдать структуру, принятую для данного типа письменного высказывания (эссе, письмо, резюме и др.);
· правильно выбирать грамматические структуры и лексические единицы, в том числе связующие слова, которые обеспечивают логичный и плавный переход от одной части к другой, а также внутри частей; использовать разные варианты построения предложения, прием перефразирования; избегать плагиата. Важно планировать работу так, чтобы была возможность проверить свое письменное высказывание через определенное время после написания, что позволит увидеть недочеты и ошибки, незамеченные во время работы.

Supplement

Addition.

A + b=c is read: a plus b equals c; a and b is equal to c; a added to b makes c; a plus b is c. a, b are called **“addends” or “summands”** (слагаемые); c is **the “sum”.**

Subtraction.

4-3=1 is read: three from four is one; four minus three is one; four minus three is equal to one; four minus three makes one; the difference between four and three is one; three from four leave(s) one.
4 is called **“a minuend”** (уменьшаемое); 3 is **“a subtrahend”** (вычитаемое); 1 is **“a difference”** (разность).

Multiplication.

$2 \cdot 3=6$; $2 \cdot 3=6$ is read: two multiplied by three is six; twice three is six; three times two is six; two times three make(s) six.
$5 \cdot 3=15$ five threes is (are) fifteen 2, 5 are **“multiplicands”** (множимое); 3 is “a **multiplier”** / **“factor”** (множитель); 6 is **“a product”.**

Division.

35:5=7 is read: thirty five divided by five is 7; five into thirty five goes seven times; 35 divided by 5 equals 7. 35 is **“a dividend”** (делимое); 5 is **“a divisor”** (делитель); 7 is **“a quotient**” (частное).

Involution or Raise to power.

3^2, 5^3 are read: three to the second power or 3 squared; five cubed or 5 to the third power (to power three). x^2 – x is called the **“base of the power”;** 2 is called **“an exponent or index of the power”.**

Evolution. Извлечение из корня.

$\sqrt{9}=3$ is read: the square root of nine is three. $\sqrt[3]{27} = 3$ is read: the cube root of twenty seven is three. √ is called “the radical sign” or “the sign of the root”.
to extract the root of … – извлекать корень из…

Arithmetical and Geometrical Progressions

An arithmetical progression is a sequence such as 3, 5, 7, 9 …, in which each member differs from the one in front of it by the same amount.
A geometrical progression is a sequence such as 3, 6, 12, 24 …, in which each member differs from the one in the same ratio. "The number of families holidaying abroad grew now in geometrical progression".
Mathematicians more often use now the expressions **arithmetic sequence and geometric sequence.**

Ratio

a:b is read: the ratio of a to b; **10:5** is read: the ratio of ten to five;
4:2 = 2: the ratio of four to two is two. **20/5= 16/24**: the ratio of twenty to five equals the ratio of sixteen to four; twenty is to five as sixteen is to four.

Proportion

In proportion we have two equal ratios. The equality is expressed by the sign **::** which may be substituted by the international sign of equality =.
a:b::c:d or a:b = c:d – is read: a is to b as c is to d; 2:3:: 4:6 or 2:3 = 4:6 – is read: two is to three as four is to six.
The extreme terms of proportion are called **"extremes**", the mean terms are called **"means".** The proportion can vary directly (изменяться прямо пропорционально) and it can vary inversely (изменяться обратно пропорционально):
x (y: x varies directly as y; x is directly proportional to y; x = k/y: x varies inversely as y; x is inversely proportional to y.

Saying numbers

1. Saying 0 in English:

We say **oh** after a decimal point (5.03) - five point oh three
in telephone numbers 67 0138 - six seven oh one three eight
in bus numbers No. 701 get the seven oh one
in hotel room numbers - I'm in room 206 - two oh six
in years 1905- nineteen oh five
We say **nought** before the decimal point 0.02- nought point oh two
We say **zero** for the number 0 the number zero
for temperature -5˚C five degrees below zero
We say **nil** in football scores 5 - 0 Argentina won five nil
We say **love** in tennis 15 – 0 The score is fifteen love
Say the following: 1) The exact figure is 0.002. 2) Can you get back to me on 01244 24907? I'll be there all morning. 3) Can you put that on my bill? I'm in room 804. 4) Do we have to hold the conference in Reykjavik? It's 30 degrees below 0! 5) What's the score? 2 – 0 to Juventus.

2. Per cent

The stress is on the **cent** of per cent: ten per cent
We say:
0.5% a half of one per cent
Say the following: 1) What's 30% of 260? 2) 0.75% won't make any difference.

3. The number 1,999 is said one thousand nine hundred and ninety nine
The year 1999 is said nineteen ninety nine
The year 2000 is said the year two thousand
The year 2001 is said two thousand and one
The year 2015 is said two thousand and fifteen or twenty fifteen
1,000,000 is said a million or ten to the power six
1,000,000,000 is said a billion or ten to the power nine

Say the following: 1) It's got 1001 different uses. 2) Profits will have doubled by the year 2000. 3) You are one in 1,000,000! 4) No, that's 2,000,000,000 not 2,000,000!

4. Squares, cubes and roots

10^2 is ten squared

10^3 is ten cubed

$\sqrt{10}$ is the square root of ten.

5. We usually give **telephone and fax numbers** as individual digits:

01273 736344 oh one two seven three seven three six three four four

344 can also be said as three double four

44 26 77 double four two six double seven

777 can be said as seven double seven or seven seven seven

6. Notice the way of speaking about **exchange rates** :

How many francs are there to the dollar? How many francs per dollar did you get? The current rate is 205 pesetas to the pound.

7. Fractions

Fractions are mostly like ordinal numbers (fifth, sixth, twenty third etc.)

1/3 - a third 1/5 - a fifth 1/6 - a sixth

Notice, however, the following:

1/2 - a half 1/4 - a quarter 3/4 - three quarters 3½ - three and a half

8. Calculating

10 + 4 = 14 ten **plus** four is fourteen

ten **and** four equals fourteen

10 – 4 = 6 ten **minus** four is six

ten **take away** four equals six

10 X 4 = 40 ten **times** four is (equals) forty

ten **multiplied by** four is forty

10 ÷ 4 = 2½ ten **divided by** four is two and a half

9. When a number is used before a noun – like am adjective – it is always singular. We say:

a fifty-minute lesson not a fifty-minute**s** lesson a sixteen-week semester, a fifteen-minute walk, a twenty-pound reduction, a one and a half litre bottle.

Check yourself

How many of the following can you say aloud in under 1 minute?

1) 234, 567 2) 1,234, 567, 890 3) 1.234 4) 0.00234% 5) 19,999 6) In 1999 7) I think the phone number is 01227-764000. 8) He was born in 1905 and died in 1987. 9) 30 X 25 = 750 10) 30 ÷ 25 = 1.20 11) Let’s meet in 2023. 12) I can give you 367,086,566 apples. 13) The score is 6-0 to Zenit. 14) I’ll rent room 407. 15) My salary is $ 200 a month. 16) If he was born in 1964 and decided to start working at this problem in 1998, then 34 years had passed before he began doing it. 17) Did you say 0.225 or 0.229? 18) It’s white Lamborghini Diabolo, registration number MI 234662, and it looks as if it’s doing 225 kilometers an hour! 19) Have you got a pen? Their fax number is 00 33 567 32 49. 20) 2/5 21) 2¾

Mathematical symbols and signs

N – the set of natural numbers,

Z – the set of whole numbers (integers),

R – the set of real numbers,

Ø – an empty set,

$\{ u_n \}$ – a sequence with a general term u_n,

$[a , b]$ – a numerical segment,

(a , b) – a numerical interval,

==> – it follows,

<=> – equivalent

+ addition, plus, positive – знак сложения или положи тельной величины

— subtraction, minus, negative – знак вычитания или отрицательной величины

± plus or minus – плюс минус

x или · multiplication sign, multiplied by – знак умножения, умноженный на …

÷ или / division, divided by – знак деления, деленный на ...
a/b a divided by b – а деленное на b
: dividied by, ratio sign – делённое; знак отношения
:: equals; as – знак пропорции
< less than – менее
≮ not less than – не менее
> greater than – более
≯ not greater than – не более
≈ approximately equal – приблизительно равно
∽ similar to – подобный
= equals – равно
≠ not equal to – не равно
= approaches – достигает значения
~ difference – разность
∞ infinity – бесконечность
∴ therefore – следовательно
∵ since, because – так как
√ square root – квадратный корень
$\sqrt[3]{}$ cube root – кубичный корень
$\sqrt[n]{}$ n^{th} root – корень п-й степенн
≤ equal to or less than – меньше или равно
≥ equal to or greater than – больше или равно
a^n the n^{th} power of a – а в n-й степени
a_1 a sub 1 – а первое
a_n a sub n – а n-е
∟ angle – угол
⊥ perpendicular to – перпендикулярно к
|| parallel to – параллельно
log или log10 common logarithm, or Briggsian logarithm десятичный логарифм
loge или 1n natural logarithm, or hyperbolic logarithm, or Naperian logarithm –натуральный логарифм
e base (2.718) of natual systems of logarithms – основание натуральных логарифмов
sin (sine) – синус (sin)

cos (cosine) – косинус (cos)
tan (tangent) – тангенс (tg)
ctn или cot (cotangent) – котангенс
sec (secan)t – секанс
csc (cosecant) – косеканс (cosec)
vers (versine), versed sine – синус-верзус
covers (coversine), coversed sine – косинус-верзус
$\sin^{-1}$ antisine – арксинус (arcsin)
$\cos^{-1}$ anticosine – арккосинус (arccos)
sinh hyperbolic sine – синус гиперболический (sh)
cosh hyperbolic cosine – косинус гиперболический (ch)
tanh hyperbolic tangent – тангенс гиперболический (th)
f(x) или (x) function of x – функция от x
f' f primed – производная
Δx increment of x – приращение x
$\sum$ summation of – знак суммирования
○ или ⨀ circ1e;
circumference – круг; окружность
(),[],{} parentheses, brackets, and braces – круглые, квадратные и фигурные скобки
AB length of 1ine from A to B – длина отрезка AB
μ micron = 0,001 mm – микрон (10^{3-} мм)
mμ millimicron = 0,001μ – миллимикрон (10^{7-} см)
º degree – градус
´ minute – минута
´´ second – секунда
1. № (номер), если знак предшествует числу; 2. англ. фунт, если знак поставлен после числа
℄ centre line – центральная линия, линия центров
5' 1. пять футов; 2. угол в 5 мин
9" 1. девять дюймов; 2. угол в 9 сек
.5 (англичане и американцы иногда не пишут нуль целых)
1.5 (англичане и американцы отделяют знаки десятичных дробей не запятой, а точкой, ставя ее вверху, в середине или внизу строки)

7,568 = 7568; 1,000,000= 10^6 (англичане и американцы в многозначных числах отделяют каждые три цифры запятой)
$.0^5103$ = 00000103 = 0,00000103 (англичане и американцы иногда записывают, таким образом, для краткости малые дроби, впрочем, в большинстве случаев они пользуются общепринятой записью 103 x 10^{5-})
2/0, 3/0 и т. д. означают номера размеров проводов 00, 000 и т. д, согласно британскому стандартному калибру проводов (SWG)

Reading of mathematical expressions

1. x > y «x is greater than y»
2. x < y «x is less than y»
3. x = 0 «x is equal to zero»
4. x ≤ y «x is equal or less than y»
5. x < y < z «y is greater than x but less than z»
6. xv «x times or x multiplied by y»
7. a + b «a plus b»
8. 7 + 5 = 12 «seven plus five equals twelve; seven plus five is equal to twelve; seven and five is (are) twelve; seven added to five makes twelve»
9. a – b «a minus b»
10. 7 – 5 = 2 «seven minus five equals two; five from seven leaves two; difference between five and seven is two; seven minus five is equal to two»
11. a x b «a multiplied by b»
12. 5 x 2 = 10 «five multiplied by two is equal to ten; five multiplied by two equals ten; five times two is ten»
13. a : b «a divided by b»
14. a/b «a over b, or a divided by b»
15. 10 : 2 =5 «ten divided by two is equal to five; ten divided by two equals five»
16. a = b «a equals b, or a is equal to b»
17. b ≠ 0 «b is not equal to 0»

18. т : ab «т divided by a multiplied by b»
19. $\sqrt{ax}$ «The square root of ax»
20. ½ «one second»
21. ¼ «one quarter»
22. -7/5 «minus seven fifth»
23. a^4 «a fourth, a fourth power or a exponent 4»
24. a^n «a n^{th}, a n^{th} power, or a exponent n»
25. e^{π} «e to the power π »
26. $\sqrt[n]{b}$ «the nth root of b»
27. $\sqrt[3]{8}$ «the cube root of eight is two»
28. $\log_{10} 3$ «logarithm of three to the base of ten»
29. 2 : 50 = 4 : x «two is to fifty as four is to x»
30. 4! «factorial 4»
31. $(a + b)^2 = a^2 + 2ab + b^2$ «the square of the sum of two numbers is equal to the square of the first number, plus twice the product of the first and second, plus the square of the second»
32. $(a-b)^2 = a^2 - 2ab + b^2$ «the square of the difference of two numbers is equal to the square of the first number minus twice the product of the first and second, plus the square of the second»
33. Δx «increment of x»
34. $\Delta x \to 0$ «delta x tends to zero»
35. $\sum$ «summation of ...»
36. dx «differential of x»
37. dy/dx «derivative of y with respect to x»
38. d^2y/dx^2 «second derivative of y with respect to x»
39. d^ny/dx^n «nth derivative of y with respect to x»
40. dy/dx «partial derivative of y with respect to x»
41. d^ny/dx^n «nth partial derivative of y with respect to x»
42. $\int$ «integral of ...»
43. $\int_b^a$ «integral between the limits a and b»
44. $\sqrt[5]{d^n}$ «the fifth root of d to the nth power»
45. $\sqrt{a+b}/ a - b$ «the square root of a plus b over a minus b»

46. $a^3 = \log_c d$ «a cubed is equal to the logarithm of d to the base c»

Higher mathematics

Basic terminology

1. Series - ряд

2 + 4 + 6 + 8 - arithmetical series - арифметический ряд

2 + 4 + 8+ 16 – geometric series - геометрический ряд

2, 4, 6, 8, 16 ... elements - элементы

2. infinitesimal calculus - исчисление бесконечно малых вели чин

dy/dx - derivative - производная

dy, dx - тне differentials - дифференциалы

d - differential sign - знак дифференциала

$\int axdx = a \int xdx = ax^2/2 + c$ - integral - интеграл

x - THE VARIABLE - переменная (величина)

dx - тне differential - дифференциал

$\int$ - the integral sign – знак интеграла

Mathematical terminology

A

accuracy n - точность
addition n – сложение, прибавление
adjacent a – смежный, соседний
algebra n - алгебра
alter v – изменять, переделывать, изменяться
altitude n - высота
amount n – сумма, количество, объем
angle n - угол
apply v – прилагать, применять, употреблять
appropriate v – присваивать, предназначать, a подходящий, соответствующий
approximately adv – приблизительно
area n – площадь, зона
arrange v – приводить в порядок
arrangement n- устройство
associate v – соединять, связывать, соединяться
average a - средний
axis n – ось

B

balance n – равновесие, v уравновешивать
base n - основание
binary a – бинарный, двойной
brackets n – скобки

C

calculation n - вычисление
calculus n - исчисление
capability n - способность
capable a - способный
cell n – элемент ячейки
chord n - хорда
cipher n –шифр v шифровать
circle n - круг
circumference n - окружность

coefficient n - коэффициент
combine with v - соединяться
comparatively adv – сравнительно, относительно
complete a – полный, завершенный; v завершать
component n – компонент, составная часть
compose v - составлять
composition n - состав
cone n - конус
conclude v – делать вывод
condition n – состояние, условие
conical a – конический, конусообразный
consequently adv – следовательно, поэтому
constitute v - составлять
contiguous a - смежный
contract v – сокращать уменьшать(ся)
conversely adv – обратно. наоборот
count v -считать
cube n -куб
curve n – кривая
D
decimal a - десятичный
decode v - расшифровывать
decomposition n - разложение
decrease n – уменьшение, убывание, v – убывать, уменьшаться
deduce v – выводить (заключение), проследить
definite a - определенный
degree n - градус
denominator n - знаменатель
destination n - назначение
determine n – определять, устанавливать, побуждать, заставлять
diameter n - диаметр
difference n - разность
different a – различный, отличный(от других)

differentiate v - различать
digit n – цифра, разряд
direction n - направление
discontinuous a - прерывистый
discover v – открывать, обнаруживать
divide v – производить деление
division n - деление
domain n – область, сфера
dominant a – преобладающий, господствующий
due a – должный, обусловленный
E
enlarge м – увеличивать(ся), расширять(ся)
equal a –равный, v – равняться, уравнивать
equation n - уравнение
equivalent n – эквивалент, a равносильный
even a - четный
exaggerate v - преувеличивать
exceed v – превышать, превосходить
exception n - исключение
excess n – избыток, излишек
expand v - расширяться
extent n – протяжение, объем, предел
extremely adv – крайне
F
familiar a - близкий
figure n - цифра
fit v - соответствовать
foundation n – основание, фундамент, основа, базис
fraction n - дробь
frequency n -частота
function n – функция
G
geometry n - геометрия
give v – вызывать, давать

H
height n - высота
horizontal n – горизонталь
I
identical a - одинаковый; подобный; идентичный
identity v - опознавать, идентифицировать
imbalance n - неустойчивость
imply - означать; подразумевать
increase n - увеличение; v - увеличивать, увеличиваться
indicate v - указывать, показывать
infinity п - бесконечность
instability n - неустойчивость, непостоянство
instance n - пример, отдельный случай
intensity n - напряженность, интенсивность
interaction n - взаимодействие
intermediate a - промежуточный
introduce v - вводить
invariably adv - неизменно, всегда
inversely adv - 1) обратно 2) обратно пропорционально
involve v - включать
irregular a - беспорядочный
irrespective adv – независимо
L
length n - длина
level n - уровень
limit n – граница, предел, v - ограничивать
line n – линия, черта
literal a – буквенный
M
majority n - большинство
make up v – составлять; образовывать
mathematics n – математика
maximum n – максимум; наибольшее значение
mean n – среднее число, середина
measure n - мера v - измерять

measurement n - измерение
medium n – среда a - средний
middle 1) a – средний 2) n - середина
minimum n – минимум, наименьшее значение
minute a - маленький
multiplication n – мат. умножение
multiply v – мат. умножать
mutual a – взаимный, общий
N
natural a – естественно; натурально
negative n – отрицание a – отрицательный v - отрицать
negligible a - незначительный
notation n – система обозначений
number n - число
numeration n – исчисление, нумерация
numerator n – мат. числитель дроби
numerical a – числовой
O
obvious a - очевидный
occur v – иметь место; случаться
odd a - нечетный
opposite a - противоположный
order n - порядок
ordinary a - обычный
otherwise adv – 1) иначе 2) в противном случае
outcome n - результат
owing to prep – вследствие; благодаря

P
pattern n - образец
peak n – высшая точка, пик
percentage n – процент, процентное соотношение
permanent a – вечный, бесконечный
phenomenon n – явление, феномен
positive a – положительный

possible a - возможный
power n - степень
precisely adv - точно
prism n - призма
probability n - вероятность
probably adv - возможно
proceed v – 1) продолжать 2) происходить 3) переходить (к)
produce v – предъявлять, предоставлять; производить
product n - произведение
property n - свойство
proportion n - пропорция
protect v – защищать, охранять
protractor n - транспортир
purely adv - исключительно
purpose n - цель

Q
quantity n - количество
quarter n – четверть
R
random a – случайный, at random беспорядочно
range n - 1)ряд; линия 2) диапазон 3) перен. область распространения
rate n – норма v - оценивать
reaction n - реакция
reason n – причина, довод, основание
reduce v – уменьшать, сокращать
reflect v - отражать
reflection n – отражение, отображение
relatively adv - относительно
reorganization n – реорганизация, преобразование
resemble v – быть похожим
residual n – остаток, разность; a - остаточный

result n – результат; v – проистекать; приводить к чему-либо
right-angled a - прямоугольный
ruler n – линейка
S
scan v – внимательно рассматривать
score n - счет
separate a – отдельный, особый; v – отделять, разделять
set-square n - угольник
several a - несколько
shape n - форма
share n – часть, доля
signal n – сигнал; знак
signify v - обозначать
similar a – похожий, подобный
significance n – 1) значение, смысл 2) важность
size n - размер
strengthen v – усиливать (ся)
structure n – структура; устройство; строение
subject n - предмет
subtend v – мат. Стягивать (о дуге); противолежать (о стороне треуголькика)
subtraction n - вычитание
sufficiently adv - достаточно
supremacy n - превосходство
systematically adv - систематически
tangent n – 1) касательная 2) тангенс
temporary a - временный
tend v – направляться; стремиться; иметь склонность к
tensile a - растяжимый
thence adv – отсюда; из этого следует
theorem n - теорема
theoretical a - теоретический
theory n - теория
therefore adv – поэтому, следовательно

thus adv – таким образом; итак
tiny a - крошечный
total a – полный; общий
transfer n – передача, перенос v – переносить; перемещать; передавать
transmit v - передавать
treble a – тройной; v - утраивать
triangle n - треугольник
trigonometry n - тригонометрия
twice adv - дважды
undoubtedly adv - несомненно
uneven a – неровный, нечетный
uniformly adv - равномерно
unit n - единица
value n – значение, величина
variant n – разновидность; a – отличный от других
variation n – изменение, отклонение
vary v – изменять(ся), менять(ся)
vertex n - вершина
virtually adv - фактически
differentiation - дифференцирование, отыскание производной
integration – интегрирование, вычисление интеграла
measure – мера; показатель; критерий; масштаб; делитель
infinite series - бесконечный ряд
calculus - 1) исчисление 2) математический анализ (учебная дисциплина, раздел высшей математики)
mathematical object – математический объект
topological space - топологическое пространство;
metrical space – метрическое пространство
method of exhaustion – метод последовательных элиминаций
regular polygon – правильный многоугольник
limit - 1) предел; граница 2) pl. интервал значений

Zeno's paradox of the dichotomy – парадокс дихотомии Зенона или апория «Дихотомия» (последовательное деление целого на две части).
Zeno of Elea – Зено́н Эле́йский (490 до н. э. - 430 до н. э.), древнегреческий философ, ученик Парменида. Родился в Элее, Лукания. Знаменит своими апори́ями, которыми он пытался доказать противоречивость концепций движения, пространства и множества. Научные дискуссии, вызванные этими парадоксальными рассуждениями, существенно углубили понимание таких фундаментальных понятий, как роль дискретного и непрерывного в природе, адекватность физического движения и его математической модели и др.
Liu Hui – Лю Хуэй известен своими комментариями на «Математику в девяти книгах», которая представляет собой сборник решений математических задач из повседневной жизни. Лю Хуэй опубликовал «Цзю чжан суаньшу» в 263 году со своими комментариями, это старейшая сохранившаяся публикация книги. Самые известные труды Лю Хуэя:
Расчёт числа π методом вписанных правильных многоугольников.
Решение систем линейных уравнений методом, названным впоследствии именем Гаусса.
Расчёт объёма призмы, пирамиды, тетраэдра, цилиндра, конуса и усечённого конуса;
метод неделимых.
Cavalieri's principle – Принцип Кавальери, наиболее полное выражение и теоретическое обоснование метод неделимых получил в работе итальянского математика Бонавентуры Кавальери в ***современном виде:***
Для плоскости: Площади двух фигур с равными по длине хордами всех их общих секущих, параллельных прямой, по одну сторону от которой они лежат, равны.

Для пространства: Объёмы двух тел над плоскостью, с равными по площади сечениями всех общих секущих их плоскостей, параллельных данной плоскости, равны.
Принцип Кавальери явился одним из первых шагов на пути к интегральному исчислению. В частности, используя обозначения бесконечно малых, он доказал теорему, эквивалентную современной формуле: .
Taylor series–ряды Те́йлора, разложение функции в бесконечную сумму степенных функций.
infinite series expansions – разложение бесконечных рядов
power series - степенной ряд
Rolle's theorem – Теорема Ро́лля (теорема о нуле производной): если вещественная функция, непрерывная на отрезке [a; b] и дифференцируемая на интервале (a; b), принимает на концах этого интервала одинаковые значения, то на этом интервале найдётся хотя бы одна точка, в которой производная функции равна нулю.
infinitesimal [ɪnfɪnɪ'tesɪm(ə)l] - бесконечно малая величина
infinitesimal calculus - анализ бесконечно малых величин
sine [saɪn], cosine ['kəusaɪn], tangent ['tænʤ(ə)nt], arctangent – синус, косинус, тангенс, арктангенс
derivative – производная, производная функция
Newton and Leibniz; Descartes and Fermat – Ньютон и Лейбниц; Декарт и Ферма
calculus of variations - вариационное исчисление
Fourier analysis - гармонический анализ, Фурье-анализ
generating function - порождающая функция, производящая функция
Cauchy sequence - фундаментальная последовательность (Коши)
theory of complex analysis – теория комплексного анализа
Siméon Denis Poisson – Симео́н Дени́ Пуассо́н (21 июня 1781 - 25 апреля 1840), знаменитый французский математик, механик и физик. Число научных трудов Пуассона превосходит 300. Они относятся к разным

областям чистой математики, математической физики, теоретической и небесной механики.
Joseph Liouville – Жозеф Лиувилль (24 марта 1809 – 8 сентября 1882), французский математик. Систематически исследовал разрешимость ряда задач, дал строгое определение понятию элементарной функции и квадратуры. В частности, исследовал возможность интегрирования заданной функции, алгебраической или трансцендентной, в элементарных функциях, и разрешимость в квадратурах линейного уравнения 2-го порядка.
Jean Baptiste Joseph Fourier – Жан Батист Жозеф Фурье (21 марта 1768 – 16 мая 1830), французский математик и физик. Доказал теорему о числе действительных корней алгебраического уравнения, лежащих между данными пределами (Теорема Фурье 1796). Исследовал, независимо от Ж. Мурайле, вопрос об условиях применимости разработанного Исааком Ньютоном метода численного решения уравнений (1818). Нашёл формулу представления функции с помощью интеграла, играющую важную роль в современной математике. Доказал, что всякую произвольно начерченную линию, составленную из отрезков дуг разных кривых, можно представить единым аналитическим выражением. Его имя внесено в список величайших учёных Франции, помещённый на первом этаже Эйфелевой башни.
harmonic analysis - гармонический анализ
(ε, δ) - definition of limit - "epsilon-delta definition of limit"
theory of integration – теория интегрирования
discontinuities - нарушение последовательности; прерывность;
continuum of real numbers – континуум действительных чисел
Julius Wilhelm Richard Dedekind - Ю́лиус Вильге́льм Ри́хард Дедеки́нд (6 октября 1831 - 12февраля 1916) -

немецкий математик, известный работами по общей алгебре и основаниям вещественных чисел.

Dedekind cuts - Дедекиндово сечение

a complete set – полное множество

Simon Stevin - Си́мон Сте́вин (1548 - 1620), фламандский математик, механик и инженер.

decimal expansions - представление [многоразрядного числа или дроби] в десятичной форме примеры: преобразование простой дроби (common fraction) в десятичную, особенно если в результате получается 0,(n), как в случае 1/3 = 0,333333...

Riemann integration – Интегра́л Ри́мана (одно из важнейших понятий математического анализа. Введён Бернхардом Риманом в1854 году, и является одной из первых формализаций понятия интеграла.

arithmetization of analysis – арифметизация анализа

Karl Theodor Wilhelm Weierstrass – Карл Те́одор Вильге́льм Ве́йерштрасс (31 октября 1815 - 19 февраля 1897) - немецкий математик, «отец современного анализа»

limit – лимит, предел

discontinuities of real functions – разрыв непревывности вещественных функций

nowhere continuous function – всюду разрывная функция

nowhere differentiable functions (Weierstrass functions) - функция Вейерштрасса – пример непрерывной функции, нигде не имеющей производной

space-filling curve – заполняющая пространство кривая (is a curve whose range contains the entire 2-dimensional unit square (or more generally an n-dimensional hypercube) 11

Мари́ Энмо́н Ками́ль Жорда́н (5января 1838 – 22января 1922) – французский математик, известный благодаря своим фундаментальным работам в теории групп и «Курсу анализа».

theory of measure – теория мер (в математическом анализе мера Жордана используется для построения интеграла Римана)
Georg Ferdinand Ludwig Philipp Cantor – Гео́рг Ка́нтор (3 марта 1845, Санкт-Петербург – 6 января 1918, Галле (Заале)) – немецкий математик. Он наиболее известен как создатель теории множеств, ставшей краеугольным камнем в математике. Кантор ввёл понятие взаимно-однозначного соответствиямежду элементами множеств, дал определения бесконечного и вполне-упорядоченного множеств и доказал, что действительных чисел «больше», чем натуральных. Теорема Кантора, фактически, утверждает существование «бесконечности бесконечностей». Он определил понятия кардинальных и порядковых чисел и их арифметику. Его работа представляет большой философский интерес, о чём и сам Кантор прекрасно знал.
naive set theory - наи́вная тео́рия мно́жеств (раздел математики, в котором изучаются общие свойства множеств)
René-Louis Baire – Рене́-Луи́ Бэр, французский математик. Является одним из создателей современной теории вещественных функций и дескриптивной теории множеств. Одной из важнейших работ математика стала теорема Бэра. Бэр также разработал классификацию разрывных функций.
Henri Léon Lebesgue - Анри Леон Лебе́г (28 июня 1875, Бове, департамент Уаза – 26 июля 1941, Париж) – французский математик, член Парижской АН (1922), профессор Парижского университета (с 1910). Наиболее известен как автор теории интегрирования. Интеграл Лебега нашёл широкое применение в теории вероятностей.
David Hilbert – Дави́д Ги́льберт (23 января 1862 – 14 февраля 1943), немецкий математик-универсал, внёс значительный вклад в развитие многих областей математики. В 1910—1920-е годы (после смерти Анри Пуанкаре) был признанным мировым лидером

математиков. Гильберт разработал широкий спектр фундаментальных идей во многих областях математики, в том числе теорию инвариантов и аксиоматику евклидовой геометрии. Он сформулировал теорию гильбертовых пространств, одной из основ современного функционального анализа.

Stefan Banach – Сте́фан Ба́нах (30 марта 1892, Краков – 31 августа 1945, Львов) – польский математик, профессор Львовского университета (1924), декан физико-математического факультета этого университета (1939). Член Польской АН и член-корреспондент АН УССР. Один из создателей современного функционального анализа и львовской математической школы.

normed vector space – нормированное векторное пространство

metric space – метрическое пространство

metric – метрика, т.е. функция, определяющая расстояние между двумя точками пространства или двумя элементами множества

distance – 1) расстояние; дистанция 2) интервал; промежуток

real line – вещественная прямая (ось)

complex plane – комплексная плоскость бесконечная двумерная плоскость, служащая для представления комплексных чисел (complex number); образована перпендикулярными действительной (real axis) и мнимой (imaginary axis) осями, на которых откладываются соответственно действительная и мнимая части комплексного числа

Euclidean space – евклидово пространство пространство, в котором местоположение каждой точки задано и расстояния между точками вычисляются как корень квадратный из суммы квадратов разностей координат по каждому измерению. В математике рассматриваются и неевклидовы пространства (non-Euclidean space), где это правило не выполняется.

vector spaces – векторное пространство; **integer** – целое число

complex plane – комплексная плоскость, плоскость комплексной переменной complex plane = complex number plane

ordered pair – упорядоченная пара

Cavalieri's principle (method of indivisibles) – Принцип Кавальери (Метод неделимых) наиболее полное выражение и теоретическое обоснование метод

неделимых получил в работе итальянского математика Бонавентуры Кавальери «Геометрия неделимых непрерывных, выведенная из некоего нового подсчёта»:

 Фигуры относятся друг к другу, как все их линии, взятые по любой регуле [базе параллельных], а тела — как все их плоскости, взятые по любой регуле.

 Если два тела имеют одинаковую высоту, и если сечения тел, равноудалённые и параллельные плоскости, на которой те покоятся, всегда останутся в заданном отношении, то и объёмы тел останутся в этом отношении.

В современном виде **для плоскости:** Площади двух фигур с равными по длине хордами всех их общих секущих, параллельных прямой, по одну сторону от которой они лежат, равны. **Для пространства**: Объёмы двух тел над плоскостью, с равными по площади сечениями всех общих секущих их плоскостей, параллельных данной плоскости, равны.

function – фунция; **iff -** тогда и-только тогда

triangle inequality – аксиома треугольника, неравенство треугольника

totally ordered – вполне упорядоченный;

countable – исчисляемый

real number – действительное (вещественное) число любое положительное, отрицательное число или нуль; разделяются на рациональные и иррациональные.

function – функция: **exponential function** – экспоненциальная функция; **inverse function** – обратная функция; **linear function** – линейная функция; **trigonometric function** – тригонометрическая функция

sequence - последовательность, ряд

convergence – сближение, конвергенция, схождение в одной точке **Ant: divergence**

sequence of real numbers – последовательность действительных чисел

calculus – 1) исчисление – формальная математическая система, задаваемая множеством базовых символов, множеством синтаксических правил для порождения из базовых элементов произвольных, множеством аксиом (заведомо истинных элементов данного исчисления) и множеством правил вывода (семантических правил), с помощью которых из одних элементов системы порождаются др.; 2) математический анализ (учебная дисциплина, раздел высшей математики)

continuity – непрерывность; преемственность; неразрывность; целостность;

smoothness – гладкость (напр. функции)

real-valued functions – действительная функция

functions of complex numbers – функции комплексных чисел

algebraic geometry – алгебраическая геометрия

number theory – теория чисел, математическая дисциплина, изучающая свойства чисел.

applied mathematics – прикладная математика научная дисциплина, изучающая применение математических методов в других отраслях знаний, в свою очередь делится на ряд направлений

physics, hydrodynamics, thermodynamics – физика, гидродинамика, термодинамика
mechanical engineering and electrical engineering – машиностроение и электротехника
quantum field theory – квантовая теория поля (КТП) 18
analytic function – аналитическая функция
real and imaginary parts of any analytic function – дествительная и мнимая часть любой аналитической функции
Laplace's equation - уравнение Лапласа
Functional analysis - функциональный анализ
vector spaces - векторное пространство
inner product - скалярное произведение, внутреннее произведение (векторов)
norm - норма вектора (функционал, заданный на векторном пространстве и обобщающий понятие длины вектора или абсолютного значения числа)
topology – топология
linear operators - лине́йный опера́тор (обобщение линейной числовой функции (точнее, функции) на случай более общего множества аргументов и значений
linear map (linear mapping, linear transformation , linear function) - лине́йное отображе́ние
space of functions – функциональное пространство
Fourier transform - Преобразование Фурье ($\mathscr{F}$) — операция, сопоставляющая функции вещественной переменной другую функцию вещественной переменной.
continuous - непрерывный, континуальный, неразрывный
unitary - унитарный; единичный; однократный
differential and integral equations – дифференциальные и интегральные уравнения
mathematical equation – математическое уравнение
variable – переменная, переменная величина
derivatives of various orders – производные различного порядка

engineering – инженерное дело, **economics** – экономика, **biology** – биология

Newton's laws (of motion) - законы (движения) Ньютона

equation of motion – уравнение движения, динамическое уравнение

set – множество, **subset** - подмножество

Lebesgue measure - лебегова мера

Euclidean space - евклидово пространство пространство, в котором местоположение каждой точки задано и расстояния между точками вычисляются как корень квадратный из суммы квадратов разностей координат по каждому измерению. В математике рассматриваются и неевклидовы пространства (non-Euclidean space), где это правило не выполняется.

length - длина; расстояние; отрезок; долгота; **area** – площадь; **volume** – объем

Euclidean geometry – евклидова геометрия

interval – интервал; промежуток времени; отрезок; расстояние

and (positive infinity and negative infinity) – (положительная бесконечность) и (отрицательная бесконечность)

empty set – пустое множество (множество, не содержащее ни одного элемента)

counting measure - считающая мера (мера, сосредоточенная на множестве целых чисел и равная для каждого из них единице)

-algebra (sigma-algebra) – σ-алгебра (си́гма-а́лгебра), т.е. алгебра множеств, замкнутая относительно операции счётного объединения. Сигма-алгебра играет важнейшую роль в теории меры и интегралов Лебега, а также в теории вероятностей.

countable – исчисляемый

union - объедине́ние мно́жеств (су́мма или соедине́ние) в теории множеств - множество, содержащее в себе все элементы исходных множеств. Объединение двух множеств и обычно обозначается , но иногда можно встретить запись в виде суммы .

intersections - пересече́ние мно́жеств в теории множеств - это множество, которому принадлежат те и только те элементы, которые одновременно принадлежат всем данным множествам.

complements - разность двух множеств – это теоретико-множественная операция, результатом которой является множество, в которое входят все элементы первого множества, не входящие во второе множество. **Non-measurable sets** – неисчисляемые множества

axiom of choice - аксиомой выбора называется следующее высказывание теории множеств: для всякого семейства X непустых множеств существует функция f, которая каждому множеству семейства сопоставляет один из элементов этого множества. Функция f называется функцией выбора для заданного семейства.

Numerical analysis - численный анализ – научное направление, изучающее алгоритмы решения задач непрерывной математики (в отличие от дискретной математики (discrete mathematics))

algorithm - алгоритм (программа решения математических либо других задач, предписывающая, какие действия и в какой последовательности необходимо предпринять для получения требуемого результата)

approximation – приближение; аппроксимация; приблизительное соответствие

symbolic manipulations (computer algebra, symbolic computation or algebraic computation) - символьные вычисления - это преобразования и работа с математическими равенствами и формулами как с последовательностью символов, компьютерная алгебра (в отличие от численных методов) занимается разработкой и реализацией аналитических методов решения математических задач на компьютере и предполагает, что

исходные данные, как и результаты решения, сформулированы в аналитическом (символьном) виде.
discrete mathematics - дискретная математика охватывает такие направления, как комбинаторный анализ, теория графов, теория управляющих систем, теория функциональных систем, криптография, теория кодирования, вероятностные задачи дискретной математики, алгоритмы и анализ их сложности, комбинаторные и вычислительные задачи теории чисел и алгебры
ordinary differential equations - обыкнове́нные дифференциа́льные уравне́ния (ОДУ) — это дифференциальные уравнения для функции от одной переменной.
celestial mechanics - механика небесных тел
numerical linear algebra – линейная алгебра
stochastic differential equation – стохастическое дифференциальное уравнение (СДУ) – дифференциальное уравнение, в котором один член или более имеют стохастическую природу, то есть представляют собой стохастический процесс (т.е. случайный процесс).
Markov chain – це́пь Ма́ркова, т.е. последовательность случайных событий с конечным или счётным числом исходов, характеризующаяся тем свойством, что, говоря нестрого, при фиксированном настоящем будущее независимо от прошлого.
Calculus of variations – вариационное исчисление
extremized function - экстремизованная функция
calculus – 1) исчисление; дифференциальное исчисление; интегральное исчисление; 2) математический анализ (учебная дисциплина, раздел высшей математики)
Harmonic analysis - гармонический анализ
Fourier series - ряд Фурье
Mathematical terminology

infinitely large or infinitely small elements – бесконечно большие и бесконечно малые элементы (части)
magnitude – величина; абсолютное значение; модуль
ordered group – упорядоченная группа; **ordered field** – упорядоченное поле
local field – локальное поле
infinitesimal – бесконечно малая величина
linearly ordered group – линейно упорядоченная группа
Archimedean group – архимедова группа
***p*-adic numbers –** р-адические числа
absolute value – абсолютная величина, абсолютное значение
ultrametric property – ультраметрическое свойство
axiomatic theory – аксиоматическая теория
least upper bound property – свойство точной верхней границы
bounded above – ограниченный сверху
proof by contradiction – доказательство от противного
assume for a contradiction – предположим обратное
constructive analysis – конструктивный анализ
monoid – моноид (полугруппа с нейтральным элементом). Моноидом называется множество М, на котором задана бинарная ассоциативная операция, обычно именуемая умножением, и в котором существует такой элемент е, что ex=x=xe для любого x∈M. Элемент е называется единицей и часто обозначается 1. В любом моноиде имеется ровно одна единица.
cofinal – кофинальный, коконцевой;
dense – плотный
series – ряд; прогрессия; последовательность
term – член, элемент
terms of a sequence – члены (элементы) последовательности
infinite sequence – бесконечная последовательность
summation – суммирование
Zeno's dichotomy – дихтомия Зенона

formula (**pl. formulae, formulas**) – формула (мн. формулы)
algorithm - алгоритм
formal sum – формальная сумма
converge – 1) сходиться; стремиться к (общему) пределу, 2) сводить (в одну точку)
diverge – 1) расходиться, 2) отклоняться (от линии, направления)
functions thereof – их функций
index set – индексное множество
recurring decimal – периодическая десятичная дробь
Geometric analysis – геометрический анализ
partial differential equation – дифференциальное уравнение в частных производных (частные случаи также известны как уравнения математической физики, УМФ) – дифференциальное уравнение, содержащее неизвестные функции нескольких переменных и их частные производные.
Clifford analysis – анализ Клиффорда
***p*-adic analysis** – p-адический анализ
Non-standard analysis - нестандартный анализ
hyperreal numbers - гипервещественное число
rigorous treatment – точная трактовка
infinitesimals - бесконечно малая величина
Stochastic calculus – стохастическое исчисление
Set-valued analysis – анализ многозна́чных фу́нкций
multivalued function (multifunction, many-valued function, set-valued function, set-valued map, point-to-set map, multi-valued map, multimap) – многозначная функция – обобщение понятия функции, допускающее наличие нескольких значений функции для одного аргумента
Convex analysis – выпуклый анализ
Einstein field equation - уравне́ния Эйнште́йна – уравнение гравитационного поля в общей теории относительности, связывающие между собой метрику искривлённого

пространства-времени со свойствами заполняющей его материи.
real number - действительное (вещественное) число
rational number/irrational number – рациональное число/иррациональное число
integer - целое число
fraction – дробь; дробное число
square root of – квадратный корень
π (transcendental number) – трансцендентное число
number line (real line) – числовая прямая, [вещественная] цифровая ось
decimal representation – десятичное представление (запись числа в десятичной системе счисления)
complex plane – комплексная плоскость, бесконечная двумерная плоскость, служащая для представления комплексных чисел (complex number); образована перпендикулярными действительной (real axis) и мнимой (imaginary axis) осями,
на которых откладываются соответственно действительная и мнимая части комплексного числа
totally ordered field – вполне упорядоченное поле
Isomorphism – изоморфизм (свойство объектов некоторой совокупности иметь однотипную внутреннюю структуру)
equivalence classes – классы эквивалентности
Cauchy sequences – последовательность Коши
Dedekind cuts – дедекиндово сечение
uncountable – неисчисляемый, несчётный (о множестве)
infinite set – бесконечное множество (ant: finite set)
one-to-one function – взаимно однозначная функция
cardinality of the set – мощность (множества), количество элементов множества
continuum – континуум, абсолютно непрерывный объект; сплошная среда
continuum hypothesis – континуум-гипотеза

Zermelo–Fraenkel set theory – теория множеств Цермело-Френкеля с аксиомой выбора (обозначается ZFC), самая распространенная аксиоматическая теория множеств

consistent – непротиворечивый, совместимый, состоятельный (напр. об оценке)

simple fraction – простая дробь

Vedic "Sulba Sutras" – ведийские шу́льба-су́тры – это афоризмы (высказывания) являются единственным источником по индийской математике эпохи Вед, их содержание касается геометрических проектов и задач, относящихся к прямолинейным фигурам, их комбинациям и трансформациям, квадратуре круга, а также алгебраических и арифметических решений данных задач

Pythagoras [piˈthagərəs], [pʌɪˈθagərəs] - Пифагор

negative / positive number – отрицательное / положительное число

integral – целое число

fractional number – дробное число

magnitude – величина; абсолютная величина, значение, модуль

quadratic equations – квадратное уравнение, уравнение второй степени уравнение вида $ax^2 + bx + c=0$, где a не равно нулю

coefficient – коэффициент; множитель

equation – уравнение; равенство

cube root – кубический корень, корень третьей степени

fourth root – корень четвёртой степени

decimal notation – десятичная система исчисления

Descartes [ˈdeɪˌkɑrt] – Рене́ Дека́рт (1596 - 1650), французский философ, математик, механик, физик и физиолог, создатель аналитической геометрии и современной алгебраической символики, автор метода радикального сомнения в философии, механицизма в физике.

quintic - 1) уравнение пятой степени; полином 5-ой степени 2) в пятой степени;
uncountably infinite – несчётно-бесконечный
countably infinite – счётно бесконечный
diagonal argument – диагональное доказательство Кантора
addition – сложение
multiplication – умножение
ordered field – упорядоченное поле
total order (linear order, total order, simple order, non-strict ordering) - линейно упорядоченное множество или цепь
non-empty subset – непустое подмножество
upper bound – верхний предел, верхняя граница
least upper bound – точная (наименьшая) верхняя грань (граница), или супре́мум
converge - 1) сходиться; стремиться к (общему) пределу 2) сводить (в-одну точку)
construction of the real numbers-конструктивные способы определения вещественного числа
limit – лимит, предел
exponential function – экспоненциальная функция, показательная функция
lattice-complete – полная решётка, частично упорядоченное множество, в котором всякое непустое подмножество A имеет точную верхнюю и нижнюю грань, называемые обычно объединением и пересечением элементов подмножества A.
fractional component – дробная составляющая
set of integers – множество целых чисел
natural numbers – натуральные числа
additive inverse – аддитивная инверсия, инверсия относительно сложения
boldface – полужирный шрифт, полужирный (о шрифте)
blackboard bold – способ написания жирным шрифтом
countably infinite – счётно бесконечный
algebraic number theory – алгебраическая теория чисел

algebraic integers – целое алгебраическое число
number line – [вещественная] цифровая ось
unital ring – унитальное кольцо (кольцо́ (ассоциативное кольцо) – в общей алгебре – алгебраическая структура, в которой определены операция обратимого сложения и операция умножения, по свойствам похожие на соответствующие операции над числами. Простейшими примерами колец являются числа (целые, вещественные, комплексные), функции, определенные на заданном множестве.
ring homomorphism – гомоморфизм колец
universal property – универсальное свойство
initial object – инициальный объект (в теории категорий начальный объект категории C – это её объект I, такой что для любого объекта X в C существует единственный морфизм $I \rightarrow X$.)
exponentiation [ˌɛkspənɛnʃɪˈeɪʃ(ə)n] – возведение в степень
abstract algebra – абстрактная алгебра
abelian group – абелева группа; коммутативная группа
cyclic group – циклическая группа
isomorphic – изоморфный, имеющий идентичную форму; в математике говорят, что между двумя структурами существует изоморфизм, если для каждого компонента одной структуры есть соответствующий компонент в другой структуре, и наоборот
commutative monoid – коммутативный [абелев] моноид
commutative ring – коммутативное кольцо
equality of expressions – равенство выражений
integral domain – область целостности
field of fractions – поле частных, поле отношений
number field – числовое поле; поле чисел
subring – подкольцо (подмножество кольца)
absolute value – абсолютное значение, абсолютная величина, модуль (числа)

remainder – 1) остаток (от деления); 2) разность; 3) остаточный член (ряда)
greatest common divisors – наибольший общий делитель
principal ideal domain – область главных идеалов
fundamental theorem of arithmetic – основная теорема арифметики
totally ordered set – вполне упорядоченное множество
ordered ring – упорядоченное кольцо
Noetherian valuation ring – кольцо нормирования Нетер; 40
Noether – Эмми Нетер (1882-1935), немецкий математик. С 1933 в США. Труды Нетер по алгебре способствовали созданию нового направления, названного общей алгеброй. Сформулировала (1918) фундаментальную теорему теоретической физики.
discrete valuation ring – кольцо дискретного нормирования
disjoint union – несвязное объединение
singleton set – одноэлементное множество
equivalence classes – классы эквивалентности
ordered pair of natural numbers – упорядоченная пара натуральных чисел
equivalence relation – отношение эквивалентности
to be embedded into – быть вложенным в
embedding (or imbedding) – вложение в математике – это специального вида отображение одного экземпляра некоторой математической структуры во второй экземпляр такого же типа. А именно, вложение некоторого объекта X в Y задаётся инъективным отображением, сохраняющим некоторую структуру. Что означает «сохранение структуры», зависит от типа математической структуры, объектами которой являются X и Y. В терминах теории категорий отображение, «сохраняющее структуру», называют морфизмом.
familiar representation – привычное представление
primitive data type – исходный тип данных

computer languages (programming languages) – языки программирования
cardinality – кардинальное число, мощность множества
aleph-null – алеф-нуль (кардинальное число, характеризующее мощность счетного множества)
bijection – биекция, взаимно-однозначное отображение
injective – инъективный а) реализующий вложение, реализующий инъективное отображение; б) увеличивающий число аргументов (о функции)
surjective – сюръективный
natural numbers – натуральные числа (the positive integers (whole numbers) 1, 2, 3, etc., and sometimes zero as well)
number line – a line on which numbers are marked at intervals, used to illustrate simple numerical operations
exponentiation - the operation of raising one quantity to the power of another
equivalence relation - a relation between elements of a set that is reflexive, symmetric, and transitive. It thus defines exclusive classes whose members bear the relation to each other and not to those in other classes (e.g., "having the same value of a measured property")
completeness property – свойство полноты
geometric series – геометрический ряд, бесконечная геометрическая прогрессия
constant – константа, постоянная (величина)
if and only if – тогда и только тогда, когда
arithmetico-geometric sequence – арифметико-геометрическая прогрессия
harmonic series – гармонический ряд (ряд, обратные величины членов которого составляют арифметическую прогрессию)
alternating series – знакопеременный ряд
unary operation – унарная операция
linear – линейныйж; **linear operator** – линейный оператор

finite difference – конечная разность, математический термин, широко применяющийся в методах вычисления при интерполировании.
integration – интегрирование
differentiation – дифференцирование, отыскание производной
conditional convergence – условная сходимость
function - функция
relation - отношение
set - множество
inputs – входные (вводные) данные
permissible – допустимый
outputs – выходные данные
input variable – входная величина, входная переменная
argument of the function – аргумент функции
objects of investigation – объект исследования
graph of the function – график функции
inverse - обратная величина; обратный, противоположный
solution – решение
differential equation – дифференциальное уравнение
ordered pair – упорядоченная пара
tuple –1) кортеж, многокомпонентный объект данных; 2) декартово произведение, N-ка, "энка"; 3) запись
Cartesian coordinates – декартовы [прямоугольные] координаты
domain - область определения
codomain – область значений (функции), кообласть
range – слово может обозначать и область значений и выходные данные
unambiguous word – однозначное слово
avoid ambiguity – избегать неоднозначности (неясности, двусмысленности)
image of the function, image domain – область отображения
function space – функциональное пространство
real analysis – анализ действительных чисел

complex analysis – комплексный анализ
functional analysis – функциональный анализ
triangle – треугольник
rectangle – прямоугольник
hexagon – шестиугольник; шестигранник
square – квадрат
linked – связанный
mapped – отображенный; отображаемый
value – значение, величина
integer – целое число
polygon – многоугольник; многогранник; полигон
vertice – вершина
four shapes times five colors – 4 фигуры умноженные на 5 цветов
notation – обозначение; форма записи
signum function - знаковая функция
velocity - скорость
prefix notation – префиксная нотация (бесскобочная запись), одна из возможных бесскобочных форм записи арифметических выражений, функций и их операндов, в которой оператор (имя функции) предшествует всем её операндам, т. е. ставится слева от операндов. В этой нотации алгебраическое выражение (A+B) * C будет выглядеть как * + ABC.
dot notation - точечная запись (нотация)
continuous function - непрерывная функция
discontinuous function – дискретная, прерывная функция
continuous inverse function – непрерывная обратная функция
homeomorphism – гомеоморфизм, топологическое отображение
height – высота, вершина, верх
epsilon-delta definition – эпсилон-дельта определение
Bernard Bolzano – Бернард Больца́но (1781-1848), чешский математик, философ, автор первой строгой теории

вещественных чисел и один из основоположников теории множеств.
Augustin-Louis Cauchy - Огюсте́н Луи́ Коши́ (1789-1857), великий французский математик и механик, член Парижской академии наук, Лондонского королевского общества, Петербургской академии наук. Разработал фундамент математического анализа, внёс огромный вклад в анализ, алгебру, математическую физику. Его имя внесено в список величайших учёных Франции, помещённый на первом этаже Эйфелевой башни.
uniform continuity - равномерная непревывность
curve - кривая; изгибать; изгиб; график; дуга; закругление; искривление
equivalent - эквивалент, эквивалентный
open interval - открытый интервал; **closed interval -** замкнутый интервал
limit point - предельная точка
vacuously true – бессодержательно истинный; **vacuous set** – пустое множество
neighborhood – окрестность (точки)
metric topology - метрическая топология
infinitesimal - бесконечно малая (величина)
Non-standard analysis - нестандартный анализ
hyperreal number - гипервещественное число
Augustin-Louis Cauchy's definition of continuity – определение непрерывности по Коши
cubic function - кубическая функция
polynomial functions – полиномиальная функция, полином
rational function – рациональная функция
asymptote - асимптота
sinc function [ˈsɪŋk] *sinus cardinalis* (cardinal sine function) - «кардина́льный си́нус», математическая функция
signum (sign function) - сигнум (функция), знаковая функция

intermediate value theorem - теорема о промежуточном значении

existence theorem – теорема существования

property of completeness – свойство полноты (напр. системы функций)

closed interval – замкнутый интервал

extreme value theorem – теорема об экстремальном значении, экстремумах функции

differentiable function – дифференцируемая функция, гладкая функция

Weierstrass's function – Функция Вейерштрасса, непрерывная функция, нигде не имеющая производной

derivative - производная функция

open subset – открытое подмножество

differentiability – дифференцируемость (свойство функции, означающее возможность вычисления производной по какому-л. аргументу в какой-л. точке; в случае с функцией полезности означает, что поверхности безразличных множеств не имеют изломов)

integrable – интегрируемый, суммируемый; **absolutely integrable -**абсолютно интегрируемый

Riemann integral – интегра́л Ри́мана, определённый интеграл

pointwise limit – точечный предел

uniform convergence theorem – равномерная сходимость последовательности функций (отображений) – свойство последовательности , где — произвольное множество, - метрическое пространство, сходится к функции (отображению) ,

означающее, что для любого существует такой номер , что для всех номеров и всех точек выполняется неравенство. Обычно обозначается. Это условие равносильно тому, что

exponential function – экспоненциальная функция, показательная функция

logarithm – логарифм; **common logarithm –** десятичный логарифм, **natural logarithm –** натуральный логарифм; **square root function –** функция квадратный корень
trigonometric function – тригонометрическая функция
differential – дифференциал, дифференциальный
derivative – производная
variable – переменная
Leibniz notation – система обозначений Лейбница
differential form – дифференциальная форма
linear approximation – линейная аппроксимация, линейное приближение
Gottfried Wilhelm Leibniz (1646 – 1716) – немецкий философ, логик, математик, механик, физик, юрист, историк, дипломат, изобретатель и языковед. Основатель и первый президент Берлинской Академии наук, иностранный член Французской Академии наук.
Важнейшие научные достижения: Лейбниц, независимо от Ньютона, создал математический анализ - дифференциальное и интегральное исчисления, основанные на бесконечно малых;
Лейбниц создал комбинаторику как науку; только он во всей истории математики одинаково свободно работал как с непрерывным, так и с дискретным; он заложил основы математической логики; описал двоичную систему счисления с цифрами 0 и 1, на которой основана современная компьютерная техника; в механике ввёл понятие «живой силы» (прообраз современного понятия кинетической энергии) и сформулировал закон сохранения энергии; в психологии выдвинул понятие бессознательно «малых перцепций» и развил учение о бессознательной психической жизни.
appeal to – ссылаться
formula – 1) (mathematical formula; мн.ч - formulae) - [математическая] формула в математике - формализованная запись некоторой функциональной зависимости string

formula 2) уравнение Syn: equation 3) аналитическое выражение 4) формулировка

algorithm – 1) алгоритм математическая функция или конечный чёткий набор описаний логической последовательности действий (правил, инструкций), 2) метод, правило

to compute the value of *f*(*x*) – вычислить значение функции *f(x)*

piecewise definability – кусочная определимость

induction - математическая индукция – метод математического доказательства, используется чтобы доказать истинность некоторого утверждения для всех натуральных чисел. Для этого сначала проверяется истинность утверждения с номером 1 – база (базис) индукции, а затем доказывается, что, если верно утверждение с номером n, то верно и следующее утверждение с номером n + 1 –
шаг индукции, или индукционный переход. Доказательство по индукции наглядно может быть представлено в виде так называемого принципа домино. Пусть какое угодно число косточек домино выставлено в ряд таким образом, что каждая косточка, падая, обязательно опрокидывает следующую за ней косточку (в этом заключается индукционный переход). Тогда, если мы толкнём первую косточку (это база индукции), то все косточки в ряду упадут.

recursion –реку́рсия в определении, описании, изображении какого-либо объекта или процесса внутри самого этого объекта или процесса, то есть ситуация, когда объект является частью самого себя. В математике рекурсия имеет отношение к методу определения функций и числовых рядов: рекурсивно заданная функция определяет своё значение через обращение к себе самой с другими аргументами.

algebraic or analytic closure - алгебраическое или аналитическое замыкание
limit - предел
analytic continuation – аналитическое продолжение
infinite series – бесконечные ряды
integral and differential equations – интегральные и дифференциальные уравнения
lambda calculus – лямбда-исчисление - математическая система для определения функций, вычисления значений выражений (lambda expression) и доказательства равенства выражений
flexible syntax – гибкий (адаптивный) синтаксис
function of several variables – функция с несколькими переменными
Axiom of Choice – аксиома выбора
postfix notation – постфиксная нотация, постфиксная запись известна также под названием "обратная польская запись"; метод бесскобочной записи математических выражений, при котором операция записывается после операндов, например, (2+3) * (4+5) в постфиксной нотации будет выглядеть как 2 3 + 4 5 + *. Такая запись используется в языке Forth
computable function – вычислимая функция функция вычислима, если можно найти алгоритм, позволяющий вычислить её выходное значение для любого действительного входного; известно, что существует много функций, для которых это сделать не удаётся
Euclidean algorithm – евклидов алгоритм
greatest common divisor – наибольший общий делитель
number theory – number theory теория чисел математическая дисциплина, изучающая свойства чисел. Применяется, в частности, в криптографии
computability theory – теория вычислимости, также известная как теория рекурсивных функций, - это раздел современной математики, лежащий на стыке

математической логики, теории алгоритмов и информатики, возникший в результате изучения понятий вычислимости и невычислимости. Изначально теория была посвящена вычислимым и невычислимым функциям и сравнению различных моделей вычислений. Сейчас поле исследования теории вычислимости расширилось — появляются новые определения понятия вычислимости и идёт слияние с математической логикой, где вместо вычислимости и невычислимости идёт речь о доказуемости и недоказуемости (выводимости и невыводимости) утверждений в рамках каких-либо теорий.

cardinality – мощность множества, число элементов множества, кардинальное число

countable – исчисляемый, счётный (о множестве)

busy beaver function – невычислимая функция (A busy beaver function quantifies the upper limits on a given measure and is a noncomputable function.)

halting problem – проблема останова в теории вычислений - проблема определения, остановится ли (завершится ли) данная программа при вычислении данного набора входных данных. Эта проблема относится к числу алгоритмически неразрешимых задач.

undecidable problem – неразрешимая задача

inverse image or preimage – образ в инверсии или прообраз

singleton set – одноэлементное множество

in a similar vein – в том же духе, подобным образом

in a critical vein – в критическом духе

Linear function – линейная функция (функция вида y = kx + b; основное свойство такой функции заключается в том, что ее приращение пропорционально приращению аргумента)

Trigonometric functions - тригонометрическая функция

Discontinuous function – разрывная функция

Quadratic function – квадратическая функция

Fermat's Last Theorem – Последняя теорема Ферма (или Вели́кая теоре́ма Ферма́)

number theory – теория чисел (математическая дисциплина, изучающая свойства чисел; применяется, в частности, в криптографии
positive integer – положительное целое число
conjecture – гипотеза, догадка, предположение
conjectured – гипотетический
Pierre de Fermat – Пьер де Ферма́ (1601 – 1665) – французский математик, один из создателей аналитической геометрии, математического анализа, теории вероятностей и теории чисел. По профессии юрист, с 1631 года — советник парламента в Тулузе. Блестящий полиглот. Наиболее известен формулировкой Великой теоремы Ферма.
successful proof – успешное доказательство
Andrew Wiles–Сэр Эндрю Джон Уайлс (родился 11 апреля 1953, Кембридж, Великобритания рыцарь-командор Ордена Британской Империи с 2000) – английский и американский математик, профессор математики Принстонского университета, заведующий его кафедрой математики, член научного совета Института математики Клэя
algebraic number theory – алгебраическая теория чисел
modularity theorem – теорема о модулярности
Guinness Book of World Records – Кни́га реко́рдов Ги́ннесса, ежегодный сборник мировых рекордов, достижений человека, животных и природных величин. Впервые опубликована в 1955 году по заказу ирландской пивоваренной компании «Гиннесс».
unsolved problem – нерешенный вопрос
Pythagorean theorem – теорема Пифагора
right triangle – прямоугольный треугольник
hypotenuse [haɪˈpɒtɪˌnjuːz] – гипотенуза
equation – уравнение
Pythagorean triple – Пифагорова тройка, в математике **пифагоровой тройкой** называется упорядоченный

конечный набор из трёх натуральных чисел удовлетворяющих следующему однородному квадратному уравнению: при этом числа, образующие пифагорову тройку, называются **пифагоровыми числами**.

exponent – показатель степени, показатель, экспонента

prime number – простое число

Sophie Germain – Софи́ Жерме́н (1776–1831) – французский математик, философ и механик. Внесла весомый вклад в дифференциальную геометрию, теорию чисел и механику. Самостоятельно училась в библиотеке отца-ювелира и с детства увлекалась математическими сочинениями, особенно известной историей математика Монтюкла, хотя родители препятствовали её занятиям как не подходящим для женщины.

regular prime – регулярное простое число

elliptic curve – эллиптическая кривая

modular form – модулярная форма

Frey curve – кривая Фрея, т.е. эллиптическая кривая, ассоциируемая с решением уравнения Ферма

Ribet's Theorem – теорема Рибета, ранее называлась эпсилон-гипотеза (epsilon conjecture or ε-conjecture)

succeed in proving – преуспеть в доказательстве (чего-то), доказать

peer review – экспертная оценка, проводить экспертную оценку; независимая (внешняя) экспертиза (оценка)

Richard Taylor – Ричард Лоуренс Тейлор (1962) – английский математик, занимающийся проблемами теории чисел.

surveying – общий анализ; выполнение общего анализа

Diophantine equation [ˌdaɪəʊ'fæntaɪn] – диофантово уравнение

Euclidean algorithm – евклидов алгоритм

relatively prime – взамно простой

grand conjecture – великая догадка (предположение)

elementary function – элементарная функция

infinite descent – бесконечный спуск
proof by infinite descent – метод бесконечного спуска, это метод доказательства от противного, основанный на том, что множество натуральных чисел вполне упорядочено.
pairwise coprime – попарно взаимно простые числа
odd prime number – нечетное простое число
proof by induction – доказательство посредством индуктивного метода
Galois theory – т**еóрия Галуá,** раздел алгебры, позволяющий переформулировать определенные вопросы теории полей на языке теории групп, делая их в некотором смысле более простыми
Euler system – эйлерова система
coprimes – взаимно простые числа
side – грань треугольника
altitude to the hypotenuse – высота, проведенная к гипотенузе
gravitational field – гравитационное поле
gradient field – градиентное поле
conservative field – консервативное поле, потенциальное (безвихревое) поле
gradient descent – градиентный (наибыстрейший) спуск, алгоритм градиентного спуска инкрементный алгоритм оптимизации, или поиска оптимального решения, где приближение к
antiderivative – неопределённый интеграл, первообразная функция
indefinite integral – неопределенный интеграл
derivative – производная, производная величина
fundamental theorem of calculus - основная теорема матанализа
closed interval – замкнутый интервал
infinite sum of rectangles – бесконечная сумма прямоугольников
infinitesimal width – бесконечно малая ширина

curvilinear – криволинейный
curve – кривая, график
surface integral – интеграл по поверхности
differential form – дифференциальная форма
differential geometry – дифференциальная геометрия
physical law – физическая закономерность
electrodynamics – электродинамика
Lebesgue integral - интеграл Лебéга, это обобщение интеграла Римана на более широкий класс функций
precision engineering – точное машиностроение
differentiating – дифференцирование
limit of weighted sums – предел взвешенных сумм
Riemann sum – сумма Римана
Darboux sums – суммы Дарбу
Darboux integral – интеграл Дарбу
vector space – векторное пространство
pointwise addition – поточечное сложение
linear functional – линейный функционал
linear combination – линейная комбинация (функций или векторов)
real-valued Lebesgue-integrable (Riemann-integrable) function – действительная функция, интегрируемая по Лебегу (Риману)
measure space – пространство с мерой
closed and bounded interval – ограниченный и замкнутый интервал
Cauchy–Schwarz inequality – неравенство Коши-Шварца
Hilbert space – гильбертово пространство
inner product – скалярное произведение
square-integrable functions – квадратично интегрируемые функции
conventions - условные обозначения
end-points of the interval – конечные точки интервала
limits of integration – пределы интегрирования
oriented manifolds – ориентированное множество

measure theory – теория меры
continuous function – непрерывная функция
Vector calculus – векторное исчисление
differentiation and integration of vector field – дифференцирование и интегрирование векторного поля
primarily – главным образом; первоначально
3-dimensional - трёхмерное (пространство)
electromagnetic field – электромагнитное поле
path integral – градиентный (наибыстрейший) спуск, алгоритм градиентного
Euclidean space – евклидово пространство, т.е. пространство, в котором местоположение каждой точки задано и расстояния между точками вычисляются как корень квадратный из суммы квадратов разностей координат по каждому измерению. В математике рассматриваются и неевклидовы пространства (non-Euclidean space), где это правило не выполняется
multivariable calculus – многовариантное исчисление
partial differentiation – определение частной производной
multiple integration – многократное интегрирование
differential geometry – дифференциальная геометрия
partial differential equation – частный дифференциал
electromagnetic field – электромагнитное поле, ЭМП
gravitational field – гравитационное поле
fluid flow – поток текучей среды, течение жидкости, течение жидкости или газа
quaternion – кватернион, четырёхчлен – гиперкомплексное число с тремя мнимыми единицами i, j, k, то есть: q = w+x*i+y*j+z*k, где w, x. y, и z - действительные числа. Кватернион используется для представления вращения объектов в трёхмерном пространстве - в САПР, в машинной графике, компьютерных играх и т. п.
geometric algebra – Алгебра Клиффорда - специального вида ассоциативная алгебра с единицей Cl(E,Q(,)) над некоторым коммутативным кольцом K (E - векторное

пространство, в дальнейшем обобщении - свободный K-модуль) с некоторой операцией [«умножения»], совпадающей с заданной на E билинейной формой Q.
exterior product – внешнее произведение
scalar field – скалярное поле
mathematical number (in linear algebra = real numbers = scalars) - скалярная величина
physical quantity – физическая величина
spin-zero quantum fields – бесспиновое квантовое поле
scalar field theory – теория скалярного поля
vector field – векторное поле
magnetic or gravitational force – магнитная и гравитационная сила
vector and pseudovector – вектор и псевдовектор
scalar multiplication – скалярное умножение
vector addition – векторное сложение, сложение векторов
dot product – скалярное произведение (векторов)
cross product – векторное произведение
triple product – смешанное произведе́ние (тройное скалярное произведение) **(a, b, c**) векторов **a, b, c** – скалярное произведение вектора **a** на векторное произведение векторов **b** и **c**: **(a,b,c) = a . (b x c).**
scalar triple product – смешанное произведение (векторов)
vector triple product – двойное векторное произведение
differential operator – дифференциальный оператор
del operator – оператор используемый в векторном анализе; набла, символ ∇, символ δ
gradient – 1) градиент (a) дифференциальный оператор, b) градиент скалярного или векторного поля, c) скорость изменения какой-либо величины с расстоянием, d) кривая локальному минимуму функции идёт шагами, пропорциональными обратной величине градиента этой функции в текущей точке.

Applied Mathematics Vocabulary

variable - the quantity or quality that may change in value
ratio - the number of times one value contains or is contained within the other
binomial - combination of two outcomes
coefficient - a numerical constant quantity before and multiplying the variable in an algebraic expression
ordered pairs - two numbers written in the form (x,y)
y-coordinate - written second in an ordered pair
proportion - a part, share, or number considered in comparative relation to a whole
intercept - the equation of any straight line, called a linear equation, can be written as: $y = mx + b$, where m is the slope of the line and b is the y-intercept. The y-intercept of this line is the value of y at the point where the line crosses the y axis.
vertex - the turning point
terms - a single number or variable
perfect square - a number that has a whole number square root
equation - a statement that the value of two mathematical expressions are equal
factors - numbers that you can multiply together to get another number
function slope - slope of a linear function
like terms - numbers whose variables are the same
trinomial - three terms that are connected by plus or minus notations
symmetry - exactly alike when you turn or flip a shape
algebraic expression - mathematical phrase that can contain ordinary numbers, variables, and operators
polynomial - consisting of several terms
linear equation - the point of the graph of each line in a system
x-coordinate - written first in a ordered pair
formula - equation you will use to solve a math problem

real numbers - numbers that can be positive, negative, large or small, whole numbers or decimal

Main branches of Mathematical Analysis

real number – действительное (вещественное) число: любое положительное, отрицательное число или нуль; разделяются на рациональные и иррациональные.
function – функция: **exponential function** – экспоненциальная функция; **inverse function** – обратная функция; **linear function** – линейная функция; **trigonometric function** – тригонометрическая функция
sequence - последовательность, ряд
convergence – сближение, конвергенция, схождение в одной точке Ant: **divergence**
sequence of real numbers – последовательность действительных чисел
calculus – 1) исчисление – формальная математическая система, задаваемая множеством базовых символов, множеством синтаксических правил для порождения из базовых элементов произвольных, множеством аксиом (заведомо истинных элементов данного исчисления) и множеством правил вывода (семантических правил), с помощью которых из одних элементов системы порождаются др.; 2) математический анализ (учебная дисциплина, раздел высшей математики)
continuity – непрерывность; преемственность; неразрывность; целостность;
smoothness – гладкость (напр. функции)
real-valued functions – действительная функция
functions of complex numbers – функции комплексных чисел
algebraic geometry – алгебраическая геометрия
number theory – теория чисел, математическая дисциплина, изучающая свойства чисел.

applied mathematics – прикладная математика, научная дисциплина, изучающая применение математических методов в других отраслях знаний, в свою очередь делится на ряд направлений **physics, hydrodynamics, thermodynamics** – физика, гидродинамика, термодинамика
mechanical engineering and electrical engineering – машиностроение и электротехника
quantum field theory – квантовая теория поля (КТП)
analytic function – аналитическая функция
real and imaginary parts of any analytic function – действительная и мнимая часть любой аналитической функции
Laplace's equation - уравнение Лапласа
functional analysis - функциональный анализ
vector spaces - векторное пространство
inner product - скалярное произведение, внутреннее произведение (векторов)
norm - норма вектора (функционал, заданный на векторном пространстве и обобщающий понятие длины вектора или абсолютного значения числа)
topology – топология
linear operators - линейный оператор (обобщение линейной числовой функции (точнее, функции) на случай более общего множества аргументов и значений
linear map (linear mapping, linear transformation, linear function) - линейное отображение
space of functions – функциональное пространство
Fourier transform - преобразование Фурье — операция, сопоставляющая функции вещественной переменной другую функцию вещественной переменной.
continuous - непрерывный, континуальный, неразрывный
unitary - унитарный; единичный; однократный
differential and integral equations – дифференциальные и интегральные уравнения
mathematical equation – математическое уравнение

variable – переменная, переменная величина
derivatives of various orders – производные различного порядка
engineering – инженерное дело
economics – экономика
biology – биология
Newton's laws (of motion) - законы (движения) Ньютона
equation of motion – уравнение движения, динамическое уравнение
set – множество
subset - подмножество
Lebesgue measure - лебегова мера
Euclidean space - евклидово пространство; пространство, в котором местоположение каждой точки задано и расстояния между точками вычисляются как корень квадратный из суммы квадратов разностей координат по каждому измерению. В математике рассматриваются и неевклидовы пространства (**non-Euclidean space**), где это правило не выполняется.
length - длина; расстояние; отрезок; долгота;
area – площадь;
volume – объем
Euclidean geometry – евклидова геометрия
interval – интервал; промежуток времени; отрезок; расстояние
positive infinity and negative infinity – (положительная бесконечность) и (отрицательная бесконечность)
empty set – пустое множество (множество, не содержащее ни одного элемента)
counting measure - считающая мера (мера, сосредоточенная на множестве целых чисел и равная для каждого из них единице)
-algebra (sigma-algebra) - -алгебра (сигма-алгебра), т.е. алгебра множеств, замкнутая относительно операции счётного объединения. Сигма-алгебра играет важнейшую

роль в теории меры и интегралов Лебега, а также в теории вероятностей.

countable – исчисляемый

union - объединение множеств (сумма или соединение) в теории множеств - множество, содержащее в себе все элементы исходных множеств.

intersections - пересечение множеств в теории множеств - это множество, которому принадлежат те и только те элементы, которые одновременно принадлежат всем данным множествам.

complements - разность двух множеств – это теоретико-множественная операция, результатом которой является множество, в которое входят все элементы первого множества, не входящие во второе множество.

non-measurable sets – неисчисляемые множества

axiom of choice - аксиомой выбора называется следующее высказывание теории множеств: для всякого семейства X непустых множеств существует функция f, которая каждому множеству семейства сопоставляет один из элементов этого множества. Функция f называется функцией выбора для заданного семейства.

numerical analysis - численный анализ – научное направление, изучающее алгоритмы решения задач непрерывной математики (в отличие от дискретной математики (discrete mathematics))

algorithm - алгоритм (программа решения математических либо других задач,

предписывающая, какие действия и в какой последовательности необходимо предпринять для получения требуемого результата)

approximation – приближение; аппроксимация; приблизительное соответствие

symbolic manipulations (computer algebra, symbolic computation or algebraic computation) - символьные вычисления -это преобразования и работа с математическими равенствами и формулами как с последовательностью символов, компьютерная алгебра (в отличие от численных методов) занимается разработкой и реализацией аналитических методов решения математических задач на компьютере и предполагает, что исходные данные, как и результаты решения, сформулированы в аналитическом (символьном) виде.

discrete mathematics - дискретная математика охватывает такие направления, как комбинаторный анализ, теория графов, теория управляющих систем, теория функциональных систем, криптография, теория кодирования, вероятностные задачи дискретной математики, алгоритмы и анализ их сложности, комбинаторные и вычислительные задачи теории чисел и алгебры

ordinary differential equations - обыкновенные дифференциальные уравнения (ОДУ) — это дифференциальные уравнения для функции от одной переменной.

celestial mechanics - механика небесных тел

numerical linear algebra – линейная алгебра

stochastic differential equation – стохастическое дифференциальное уравнение (СДУ) – дифференциальное уравнение, в котором один член или более имеют стохастическую природу, то есть представляют собой стохастический процесс (т.е. случайный процесс).

Markov chain – цепь Маркова, т.е. последовательность случайных событий с конечным или счётным числом исходов, характеризующаяся тем свойством, что, говоря нестрого, при фиксированном настоящем будущее независимо от прошлого.

calculus of variations – вариационное исчисление

extremized function - экстремизованная функция

calculus – 1) исчисление; дифференциальное исчисление; интегральное исчисление; 2) математический анализ (учебная дисциплина, раздел высшей математики)
harmonic analysis - гармонический анализ
Fourier series - ряд Фурье
geometric analysis – геометрический анализ
partial differential equation – дифференциальное уравнение в частных производных (частные случаи также известны как уравнения математической физики, УМФ) – дифференциальное уравнение, содержащее неизвестные функции нескольких переменных и их частные производные.
Clifford analysis – анализ Клиффорда
non-standard analysis - нестандартный анализ
hyperreal numbers - гипервещественное число
rigorous treatment – точная трактовка
infinitesimals - бесконечно малая величина
stochastic calculus – стохастическое исчисление
set-valued analysis – анализ многозначных функций
multivalued function (multifunction, many-valued function, set-valued function, **set-valued map, point-to-set map, multi-valued map, multimap**) – многозначная функция – обобщение понятия функции, допускающее наличие нескольких значений функции для одного аргумента
convex analysis – выпуклый анализ
Einstein field equation - уравнения Эйнштейна – уравнение гравитационного поля в общей теории относительности, связывающие между собой метрику искривлённого пространства времени со свойствами заполняющей его материи.

Fractions
to do sums / to solve problems – решать примеры, задачи.
common denominator – общий знаменатель.
The task is to reduce to the common denominator. – Задача – привести к общему знаменателю.
difference – разность.
The difference of 15 and 10 is 5. – Разность пятнадцати и десяти – пять.
equation /ɪˈkweɪʒ(ə)n/ – уравнение. Solve the equation. – Решите уравнение.
improper fraction – неправильная дробь.
"Improper fractions" are not an easy topic for him. – «Неправильные дроби» – непростая тема для него.
mixed fraction – смешанная дробь.
He knows exactly what a mixed fraction is. – Он точно знает, что такое смешанная дробь.
numerator /ˈnjuːməˌreɪtə(r)/ – числитель.
Numerator is the number above the line in a common fraction showing how many of the parts indicated by the denominator are taken. – Числитель – это число над линией простой дроби, показывающее сколько частей, указанных знаменателем, взято.
quotient /ˈkwəʊʃ(ə)nt/ – частное (при делении).
Quotient is a result obtained by dividing one quantity by another. – Частное – это значение, полученное путем деления некого числа на другое.
remainder – остаток.
Remainder is the number that is left over in a division in which one quantity does not exactly divide another – Остаток – это число, которое осталось в результате деления, когда одно число не делится на другое без остатка.
cube root of – корень кубический из.
Find the cube root of 15. – Найдите кубический корень из 15.
inequality /ˌɪnɪˈkwɒləti/ – неравенство.

Inequality is the relation between two expressions that are not equal. – Неравенство – это соотношение между двумя выражениями, которые не являются одинаковыми.
equality /ɪˈkwɒləti/ – равенство.
Equality is the condition of being equal in number or amount. – Равенство – это идентичность числа или величины.
mathematical sign – математический знак.
Minus is an example of a mathematical sign. – Минус – это пример математического знака.
multiplication table – таблица умножения.
Schoolchildren learn the multiplication table all over the world. – Школьники по всему миру учат таблицу умножения.
parentheses /pəˈrenθəsɪs/ или round brackets – круглые/овальные скобки.
Parentheses are widely used in mathematics. – Круглые скобки широко используются в математике.
right angle – прямой угол.

References

1. Арбекова Т.И., Власова Н.Н., Макарова Г.А. Я хочу и буду знать английский. Учеб. пособие. – М.: ИнКА, 1993. – 502 с.
2. Бондарева В.В. Английская грамматика в забавных рассказах. – СПб.: КАРО, 2006. – 224 с.
3. Гречина О.В., Миронова Е.П. Пособие по английскому языку для математических факультетов педагогических вузов. Учеб. пособие. – М.: Высшая школа, 1974. – 111 с.
4. Шаншиева С.А. Английский для математиков. – М.: Издательство Московского университета, 1976. – 414 с.
5. Glencoe Mathematics: Applications and Concepts, Course 2. – USA: The McGraw-Hill Companies, Inc, 2006. – 1242 p.
6. http://ru.scribd.com/doc/15489402/
7. http://myhandbook.info/class_number.html
8. http://www.whatismathematics.com
9. http://www.kidsmathgamesonline.com/facts/html
10. http://plus.maths.org/content/life-and-numbers-fibonacci
11. http://www.wikihow.com/Train-Your-Brain
12. http://www.funtrivia.com/en/subtopics/Fractions
13. http://scienceray.com/mathematics/the-history-of
14. http://www.sciencedaily.com/articles/m/mathematical_
15. http://cstl.syr.edu/fipse/decUnit/roundec/roundec.htm
16. http://wiki.answers.com/Q/What_is_origin_of_the_
17. http://www.cut-the-knot.org/blue/Modulo.shtml
18. http://cstl.syr.edu/fipse/decUnit/opdec/opdec.htm
19. http://www.encyclopedia.com/topic/number_theory
20. http://en.wikipedia.org/wiki/Intelligence_quotient
21. http://www.cut-the-knot.org/arithmetic/Less-EqualGreater.shtml
22. http://www.sciencedaily.com/releases/2013/03/

23. http://www.basic-mathematics.com/definition-of-apolynomial.html
24. http://www.expert-chess-strategies.com/who-invented-chess.html
25. http://www.purplemath.com/Units/factnumb.htm
26. http://www.guardian.co.uk/culture/2010/apr/11/the-10-bestmathematicians
27. .http://en.wikibooks.org/wiki/Algebra/Equalities_and_Inequalities
28. http://www.allaboutcircuits.com/vol_4/chpt_7/1.html
29. http://www.wtamu.edu/academic/anns/mps/math/mathlab/col_al gebra/col_alg_tut49_systwo.htm
30. http://news.discovery.com/human/psychology/brain-electricitymath.htm
31. http://www.purplemath.com/Units/radicals.htm
32. http://www.ehow.com/list_6188947_math-brain
33. http://www.shodor.org/unchem/math/logs/index.htm
34. http://www.themathpage.com/aprecalc/logarithms.htm#definitio
35. http://www.encyclopedia.com/topic/Logarithms.aspx
36. http://www.mathworld.ru/taxonomy/term/12?page=2
37. .http://rapidtables.com/math/symbols/Basic_Math_Symbols.htm