МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральное государственное автономное образовательное
учреждение высшего образования «Национальный исследовательский
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English for Mathematicians and Information Technologies Learners

Учебно-методическое пособие

Рекомендовано методической комиссией Института филологии и журналистики ННГУ для студентов, изучающих английский язык и обучающихся по направлениям подготовки 02.03.01 «Математика и компьютерные науки», 02.03.02 «Фундаментальная информатика и информационные технологии», 09.03.04 «Программная инженерия»

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П 91 **Пушкина Е.Н. English for Mathematicians and Information Technologies Learners = Английский для студентов, изучающих математику и информационные технологии :** учебно-методическое пособие [Электронный ресурс] / Е.Н.Пушкина. – Нижний Новгород, ННГУ, 2019. – 88 с.

Настоящая работа состоит из трёх разделов, включающих 26 текстов с заданиями к каждому из них. В текстах затрагиваются такие темы, как история математики, становление и развитие компьютерной науки, открытия выдающихся учёных разных эпох. Цель пособия – формирование и развитие навыков работы с профессионально-ориентированными текстами, совершенствование навыков устной речи на основе чтения и пополнение словарного состава за счёт специальной лексики. Задания к текстам направлены на контроль понимания прочитанного, усвоение новой лексики, совершенствование фонетических, грамматических навыков и навыков учебного перевода.

Учебно-методическое пособие предназначено для студентов математической специализации второго года обучения, прошедших начальный период обучения английскому языку по программе бакалавриата.

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Методическая записка

Период обучения, на который ориентировано данное пособие, занимает промежуточное положение между начальным (1 курс) и продвинутым и завершающим этапами обучения (магистратура, аспирантура). На первом курсе закладываются основы вузовского курса обучения английскому языку. На продвинутом и завершающем этапах обучения проводится работа со специальными текстами, с языком избранной специальности. Настоящее пособие может рассматриваться как подготовительный материал к последующим этапам обучения, или как введение в язык специальности.

В текстах пособия рассматриваются такие вопросы, как история становления математики как науки, с древних времён и до момента появления первых компьютеров, задачи, стоящие перед компьютерной наукой в настоящее время, научные достижения и открытия выдающихся учёных разных эпох. В краткой форме в нём рассказывается о том, что должен знать каждый математик – о роли математики в жизни общества, о событиях, составляющих основу её истории, о связи различных периодов её развития, преемственности достижений, при которой учёные прошлого своими трудами подготавливали почву для плодотворной работы учёных последующих поколений, о том, как одни и те же идеи возникали в умах разных учёных, и какой пример беззаветного служения науке показали потомкам гениальные учёные разных стран и времён.

В определённой мере, в пособии реализуется принцип обучения специальности через обучение иностранному языку. Профессионально-ориентированные тексты дают возможность понять, как много математических терминов имеют сходное звучание в английском и русском языках, и, подчас, зная значение английского слова, мы можем догадаться о значении нового для нас термина в русском языке. Можно с уверенностью сказать, что изучение английского языка способствует освоению профилирующих дисциплин и одновременно расширяет кругозор русскоговорящего студента, носителя родного для него русского языка.

Уровень сложности текстов рассчитан на базовые знания и умения, приобретённые на начальном этапе обучения. В упражнениях используются уже известные по другим пособиям формулировки заданий для работы над содержанием текста, его словарным составом, над произносительной и грамматической стороной речи, устной речью и учебным переводом. Желательно пользоваться справочными материалами по фонетике и грамматике предшествующего периода обучения и, главное, помнить, что залогом успешного продвижения вперёд является систематическая и тщательная работа над языком, добросовестное выполнение всех предложенных заданий.

Part I. Mathematics through the Ages

Text 1. Counting in the Early Ages

Counting is the oldest of all processes. It goes back to the very dawn of human history. At all times and practically in all places, people had to think of supplies of food, clothing and shelter. There was often not enough food or other things. So, even the most primitive people were always forced to think of how many they were, how much food and clothing they possessed, and how long all those things would last. These questions could be answered only by counting and measuring.

How did people count in the dim and distant past, especially when they spoke different languages? Suppose you wanted to buy a chicken from some poor savage tribe. You might point toward some chickens and then hold up one finger. Or, instead of this, you might put one pebble or one stick on the ground. At the same time, you might make a sound in your throat, something like *ung*, and the savages would understand that you wanted to buy one chicken.

But suppose you wanted to buy two chickens or three bananas, what would you do? It would not be hard to make a sign for the number *two*. You could show two fingers or point to two shoes, to two pebbles, or to two sticks.

For *three* you could use three fingers or three pebbles, or three sticks. You see that even though you and the savages could not talk to one another, you could easily make the numbers *one*, *two*, and *three* known. It is a curious fact that much of the story of the world begins right here.

Have you ever tried to imagine what the world would be like if no one had ever learned how to count or how to write numerals? We are so in the habit of using numbers that we rarely think of how important they are to us.

For example, when we open our eyes in the morning, we are likely, first of all, to look at the clock, to see whether it is time to get up. But if people had never learned to count, there would be no clocks. We would know nothing of hours or minutes, or seconds. We could tell time only by the position of the sun or the moon in the sky; we could not know the exact time under the best conditions, and in stormy weather, we could only guess whether it was morning or noon, or night.

The clothes we wear, the houses we live in, and the food we eat, all would be different if people had not learned how to use numbers. We dress in the morning without stopping to think that the materials of which our clothing is made have been woven on machines adjusted to a fraction of an inch. The number and height and width of the stair steps on which we walk were carefully calculated before the house was built. In preparing breakfast, we measure so many cups of cereal to so many cups of water; we count the minutes it takes to boil the eggs, or make the coffee.

When we leave the house, we take money for bus fare unless we walk and for lunch unless we take it with us; but if people could not count, there would be no money. All day long, we either use numbers ourselves or use things that other people have made by using numbers.

It has taken people thousands of years to learn how to use numbers, or the written figures, which we call *numerals.* For a long time after men began to be civilized, such simple numbers as *two* and *three* were all they needed. For larger numbers, they used words in their various languages which correspond to expressions, such as *lots* of people, a *heap* of apples, a *school* of fish, and *a flock* of sheep. For example, a study of thirty Australian languages showed no number above *four*, and in many of these languages there were number names for only *one* and *two,* the larger numbers being expressed simply as *much* and *many.*

You must have heard about the numerals, or number figures, called *digits.* The Latin word *digiti* means *fingers.* Because we have five fingers on each hand, people began, after many centuries, to count by fives. Later, they started counting by tens, using the fingers of both hands. Because we have ten toes as well as ten fingers, people counted fingers and toes together and used a number scale of twenty. In the English language, the sentence "The days of a man's life are three score years and ten" the word *score* means twenty (so, the life span of humans was considered to be seventy).

Number names were among the first words used when people began to speak. The numbers from one to ten sound alike in many languages. The name *digits* was first applied to the eight numerals from 2 to 9. Nowadays, however, the first ten numerals, beginning with 0, are usually called the digits.

It took people thousands of years to learn to write numbers, and it took them a long time to begin using signs for the numbers; for example, to use the numeral 2 instead of the word *two.*

When people began to trade and live in prosperous cities, they felt a need for large numbers. So, they made up a set of numerals by which they could express numbers of different values, up to hundreds of thousands.

People invented number symbols. To express the number *one,* they used a numeral like our 1. This numeral, probably, came from the lifted finger, which is the easiest way of showing that we mean *one.*

The numerals we use nowadays are known as Arabic. But they have never been used by the Arabs. They came to us through a book on arithmetic which was written in India about twelve hundred years ago and translated into Arabic soon afterward. By chance, this book was carried by merchants to Europe, and there it was translated from Arabic into Latin. This was hundreds of years before books were first printed in Europe, and this arithmetic book was known only in manuscript form.

When people began to use large numbers, they invented special devices to make computation easier. The Romans used a counting table, or abacus, in which units, fives, tens and so on were represented by beads which could be moved in grooves. They called these beads *calculi,* which is the plural of *calculus,* or pebble. We see here the origin of our word *calculate.* In the Chinese abacus, the calculi slid along on rods. In Chinese, this kind of abacus is called a *suan* – pan; in Japanese it is known as the *soroban* and in the Russian language as the *s'choty.* The operations that could be rapidly done on the abacus were addition and subtraction. Division was rarely used in ancient times. On the abacus, it was often done by subtraction; that is, to find how many times 37 is contained in 74, we see that 74 – 37 = 37, and 37 – 37 = 0, so that 37 is contained twice in 74.

Our present method, often called *long division,* began to be used in the 15th century. It first appeared in print in Calandri's arithmetic, published in Florence, Italy, in 1491, a year before Columbus discovered America.

The first machines that could perform all the operations with numbers appeared in modern times and were called *calculators.* The simplest types of calculators could give results in addition and subtraction only. Others could list numbers, add, subtract, multiply and divide. Many types of these calculators were operated by electricity, and some were so small that they could be easily carried about by the hand.

The twentieth century was marked by two great developments. One of these was the capture of atomic energy. The other is a computer. It may be rightly called the Second Industrial Revolution.

What is a computer? A computer is a machine that can take in, record, and store information, perform reasonable operations and put out answers. Such a machine must have a program, and specialists are needed to write programs and operate these machines.

Phonetics

1. Read the following words according to the transcription.

Arabic [ˊærəbik] – арабский
Arabs [ˊærəbz] – арабы
arithmetic [əˊriθmətik] – арифметика
arithmetic = arithmetical, *adj*. [ˌæriθˊmetik] – арифметический
calculate [ˊkælkjuleit] – вычислять
abacus [ˊæbəkəs] – счёты
calculator [ˊkælkjuleitə] – вычислитель, калькулятор
Chinese [ʧɑiˊni:z] – китайский
Columbus [kəˊlʌmbəs] – Колумб
Calandri [kɑ:ˊlɑ:ndri] – Каландри
record [riˊkɔ:d] – записывать
reasonable [ˊri:znəbl] – разумный
manuscript [ˊmænjuskript] – рукопись

2. Transcribe the following words:
Clothes, civilized, woven, thousands, program, specialist, century, development

Vocabulary

3. Give the English for the four basic operations of arithmetic: *сложение, вычитание, умножение, деление.*

4. Supply the corresponding nouns for the following verbs. See the model.
Model*: to invent – invention*

to add; to subtract; to multiply; to explain; to calculate; to operate; to compute; to translate; to inform; to expect.

5. Give derivatives for the following words.
Model: *rare, rarely, rarity*

to measure; to perform; to suppose; to use; difference; symbolic; computer; to imagine; to vary; to develop; to publish; to prosper; expressive; high; wide; to prepare.

6. Match the following.

1. distant past	a) определять время
2. to tell time	b) далёкое прошлое
3. to perform operations	c) точное время
4. exact time	d) выполнять операции
5. rarely	e) изобретать
6. to invent	f) редко
7. digit	g) хранить информацию
8. to store information	h) однозначное число
9. to record	i) приспособление
10. device	j) записывать
11. ancient times	k) процветать
12. to prosper	l) древние времена
13. abacus	m) счётная доска
14. to print	n) счёты
15. counting table	o) печатать

7. Supply antonyms for the following words.
Subtract, before, hard, unknown, begin, unlikely, unimportant, alike, intentionally, small, ancient times, first, long, simple, easy, past, rapidly, often.

8. Find synonyms in the text.
To make *calculation* easier
to *do* operations
to *show* one finger
the *etymology* of the word *calculate*
to be *quickly* done
to be *seldom* used
no number *larger* than *four*
to be marked by two great *achievements*
first *printed* in Italy.

Grammar
9. Fill in each blank with an appropriate preposition: ***of, to, in, at, through, with, on***. **One preposition can be used several times.**

… our modern world, mathematics is related … a very large number … important human activities. Make a trip … any modern city, look …the big houses, plants, laboratories, museums, libraries, hospitals and shops, … the system … transportation and communication. You can see that there is practically nothing … our modern life which is not based … mathematical calculations. … co-operation … science, mathematics made possible our big buildings, railroads, automobiles, airplanes, spaceships, subways and bridges, artificial human organs, surgical operations and means of communication that in the past seemed fantastic and could never be dreamt … .

Text Comprehension

10. Answer the following questions:

1. What is the text about?
2. What signs did people use instead of numerals?
3. What is the role of numerals in our life?
4. What numbers sound alike in many languages?
5. What number names is the word *digit* applied to?
6. How long has it taken people to learn to use numbers?
7. What is a numeral?
8. How did the first arithmetic book appear in Europe?
9. What numbers were the most important for people in the remote past?
10. What devices did they invent to make computation easier?
11. What operations were done on the abacus?
12. When did long division appear?
13. What were the first counting machines called?
14. Could they perform all basic operations of arithmetic?
15. What development was the next step in counting?

Text 2. 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 19^{th} 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.

Phonetics

1. Read the following words according to the transcription.

Processes [ˊprousəsiz] – процессы
algebra [ˊælʤibrə] – алгебра
geometry [ʤɪˊɔmitri] – геометрия
cognition [kəgˊniʃən] – познание
deduce [diˊdju:s] –выводить (*заключение, следствие, формулу*)
encompass [inˊkʌmpəs] – заключать
symbolic [simˊbɔlik] – символический
deduction [diˊdʌkʃən] – вычитание
inference [ˊinfərəns] – вывод, заключение
postulate [‘pɔstjulit] – постулат
axiom [ˊæksiəm] – аксиома
theorem [ˊθiərəm] – теорема

Vocabulary

2. 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) изучать
16. quantity	p) основы

Text Comprehension

3. 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 19^{th} 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 …

4. Copy out:

a) key words from each paragraph of the text;
b) sentences that convey the main idea of every paragraph.

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?

6. Read the text below and say if you share the views of the author.

Mathematics and Art

Mathematics and its creations belong to art rather than science. It is convenient to keep the old classification of mathematics as one of the sciences, but it is more appropriate to call it an art or a game. Unlike the sciences, but like the art of music or a game of chess, mathematics is foremost a free creation of the human mind. Mathematics is the sister, as well as the servant of the arts and is touched with the same genius.

In the age when specialization means isolation, a layman may be surprised to hear that mathematics and art are intimately related. Yet, they are closely identified from ancient times. To begin with, the visual arts are *spatial* by definition. It is, therefore, not surprising that geometry is evident in classic architecture or that the ruler and compass are as familiar to the artist as to the artisan.

Artists search for ideal proportions and mathematical principles of composition. Many trends and traditions in this search are mixed.

Mathematics and art are mutually indebted in the area of *perspective* and *symmetry* which express relations only now fully explained by the mathematical *theory of groups*, a development of the last centuries.

From the science of number and space, mathematics becomes the science of all *relations*, of *structure* in the broadest sense. A mathematician, like a painter or a poet, is a maker of *patterns*. The mathematician's patterns, like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way. Beauty and elegance is the true test for both. The revolutions in art and mathematics only deepen the relations between them. It is a common observation that the emotional drive for creation and the satisfaction from success are the same, whether one constructs an object of art or a mathematical theory.

7. Make a summary of the text *Mathematics and Art* **focusing on the following questions.**

1. What do mathematics and art have in common?
2. How were mathematics and art related in ancient times?
3. What do artists search for in their creative activities?
4. Do mathematics and art both deal with perspective and symmetry?
5. What mathematical theory explains the relations expressed by these two notions?
6. Does art, like science, also deal with relations and structure?
7. Do patterns exist both in mathematics and art?
8. Do the laws of creation equally apply to the creative processes in mathematics and art?

Grammar

8. Fill in each blank with an appropriate preposition*: in, to, among, of, for, into, at.* One preposition may be used several times.

1. Mathematics ranks … the highest cultural developments … man.
2. Mathematical reasoning is … the highest level known …man.
3. Mathematical style aims … brevity and perfection.
4. Arithmetic, geometry, and astronomy were to the classical Greece music … the soul and art … the mind.
5. Most mathematicians claim that there is great beauty … their science.
6. …1933, George Birkhoff, one … the most distinguished mathematicians … his generation, attempted to apply mathematics … art.
7. Joseph Fourier showed that all sounds, vocal and instrumental, simple and complex, are completely describable … mathematical terms.
8. Each musical sound, however complex, is merely a combination … simple sounds.
9. Thus, thanks … Fourier, the nature … musical sounds is now clear … us.
10. The role of mathematics … music stretches even …the composition itself.
11. Masters, such as Bach, constructed and advocated vast mathematical theories … the composition … music.
12. … such theories, cold reason rather than feeling and emotions produce the creative pattern.
13. Through Fourier's theorem, music leads itself perfectly … mathematical description.

14. Hence, the most abstract … the arts can be transcribed … the most abstract … the sciences.

Text 3. Four 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 a 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.

Phonetics

1. Read the following words according to the transcription.

Addition [əˊdiʃən] – сложение
subtraction [səbˊtrækʃən] – вычитание
multiplication [ˏmʌltipliˊkeiʃən] – умножение
division [diˊviʒən] – деление
addend [əˊdend] – слагаемое суммы
summand [ˊsʌ mənd] – слагаемое суммы (любой член суммы)
minuend [ˊminjuend] – уменьшаемое
subtrahend [ˊsʌbtrəhend] – вычитаемое
inverse [inˊvə:s] – обратный
multiplier [ˊmʌltiplɑiə] – множитель

multiplicand [ˌmʌltipliˈkænd] – множимое
dividend [ˈdividənd] – делимое
divisor [diˈvɑizə] – делитель
equation [ɪˈkweiʃən] – уравнение
quotient [ˈkwəuʃənt] – частное

Text Comprehension

2. Answer the following questions.

1. What are the four basic operations of arithmetic?
2. What mathematical symbols are used in these operations?
3. What are inverse operations?
4. What is the remainder?
5. How can division be checked?

Vocabulary

3. Give examples of equations representing the four basic operations of arithmetic and name their constituents.

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

Table A	Table 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

5. 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. $4200 : 2 = 2100$

6. 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.

Grammar

7. Turn from *Active* into *Passive.*

Model:

1. Scientists *introduce* new concepts by rigorous definitions.
New concepts *are introduced* by rigorous definitions.
2. Mathematicians *cannot define* some notions in a precise and explicit way.
Some notions *cannot be defined* in a precise and explicit way.

1. People often use this common phrase in such cases.
2. Even laymen must know the foundations, the scope and the role of mathematics.
3. In each country, people translate mathematical symbols into peculiar spoken words.
4. All specialists apply basic symbols of mathematics.
5. You can easily verify the solution of this equation.
6. Mathematicians apply abstract laws to study the external world of reality.
7. A mathematical formula can represent interconnections and interrelations of physical objects.
8. Scientists can avoid ambiguity by means of symbolism and mathematical definitions.
9. Mathematics offers an abundance of unsolved problems.
10. Proving theorems and solving problems form a very important part of studying mathematics.
11. At the seminar, they discussed the recently published article.
12. They used a mechanical calculator in their work.
13. One can easily see the difference between these machines.
14. They are checking the information.

15. The researchers have applied new methods of research.
16. They will have carried out the experiment by the end of the week.

Text 4. Algebra

The earliest records of advanced, organized mathematics date back to the ancient Mesopotamian country of Babylonia and to the Egypt of the 3rd millennium BC. Ancient mathematics was dominated by arithmetic, with an emphasis on measurement and calculation in geometry and with no trace of later mathematical concepts such as axioms or proofs.

It was in ancient Egypt and Babylon that the history of algebra began. Egyptian and Babylonian mathematicians learned to solve linear and quadratic equations as well as indeterminate equations whereby several unknowns are involved.

The Alexandrian mathematicians Hero of Alexandria and Diophantus continued the traditions of Egypt and Babylon, but Diophantus' book *Arithmetica* is on a much higher level and gives many surprising solutions to difficult indeterminate equations.

In the 9th century, the Arab mathematician Al-Khwarizmi wrote one of the first Arabic algebras, and at the end of the same century, the Egyptian mathematician Abu Kamil stated and proved the basic laws and identities of algebra.

By medieval times, Islamic mathematicians had worked out the basic algebra of polynomials; the astronomer and poet Omar Khayyam showed how to express roots of cubic equations.

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 3 of *La geometria* (1637) written by the French philosopher and mathematician Rene Descartes looks much like a modern algebra text. Descartes' 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.

Phonetics

1. Read the following words according to the transcription.

Ancient [ˈeinʃənt] – древний
Mesopotamian [ˌmesəpəˈteimjən] – месопотамский
Babylonian [bæbiˈləunjən] –вавилонский
Egypt [ˈi:gipt] – Египет
Egyptian [ɪˈʤipʃən] – египетский
Alexandria [æligˈzɑ:ndriə] – Александрия
Diophantus [dɑiˈɔfəntəs] – Диофант
Al-Khwarizmi [ˈæl kəˈrizmi] – Аль Каризми
Abu Kamil [ɑ:ˈbu: kəˈmil] – Абу Камиль
Islamic [izˈlæmik] –мусульманский
Omar Khayyam [ɔuˈmɑ: keiˈæm] – Омар Хайям

Persian [ˊpə:ʃən] – персидский
polynomial [pɔliˊnɔumjəl] – многочлен
astronomer [əsˊtrɔnəmə] – астроном
algebraic [ælʤiˊbreiik] – алгебраический
philosopher [fiˊlɔsəfə] – философ
Rene Descartes [rəˊnə deiˊkɑ:t] – Рене Декарт

Text Comprehension

2. True or false?

1. In the 3rd millennium BC, mathematics was dominated by arithmetic.
2. The history of algebra began in Europe.
3. The book Arithmetica was written by Diophantus.
4. One of the first Arabic algebras was written by the Arab mathematician Al-Khwarizmi.
5. The basic algebra of polynomials was worked out by Rene Descartes.
6. Omar Khayyam introduced symbols for the unknown and for algebraic powers and operations.
7. Analytic geometry was discovered by Islamic mathematicians.

3. Answer the following questions.

1. What was characteristic of ancient Mathematics?
2. Where did the history of algebra begin?
3. What equations did Egyptian and Babylonian mathematicians learn to solve?
4. Who continued the traditions of Egypt and Babylon?
5. Who was algebra developed by in the 9th century?
6. What mathematicians advanced algebra in medieval times?
7. What was an important development in algebra in the 16th century?
8. What was the result of this development?
9. What was Rene Descartes' most significant contribution to mathematics?

Vocabulary

4. Match the words on the left with their Russian equivalents on the right.

1. contribution	a) решение
2. development	b) вклад
3. solution	c) достижение
4. records	d) степень
5. quadratic	e) кубический
6. to work out	f) разрабатывать
7. polynomial	g) открытие
8. unknown	h) неизвестное
9. discovery	i) многочлен
10. ancient	j) корень
11.indeterminate	k) древний
12.identity	l) неопределённый

13.root	m) тождество
14.power	n) письменные материалы
15.cubic	o) квадратный

Grammar

5. Put the adjective or adverb in brackets in the necessary degree of comparison.

1. The scholar's (significant) contribution to mathematics was his discovery of analytic geometry.
2. Diophantus' book was on (high) level than the works of Egyptian and Babylonian mathematics.
3. (early) records of organized mathematics date back to ancient times.
4. (simple) types of calculators could give results in addition and subtraction only.
5. (often used) numbers were *two* and *three.*
6. For numbers (large) than two and three, different word-combinations were used.
7. Even (primitive) people were forced to count and measure.
8. In the 19th century, mathematics was regarded (much) as the science of relations.
9. Mathematics is said to be (close) to art than to science.
10. Mathematics becomes the science of *relations* and *structure* in (broad) sense.

Text 5. Geometry

Geometry (Greek; geo = earth, metria = measure) arose as the field of knowledge dealing with spatial relationships.

For the ancient Greek mathematicians, geometry was the crown jewel of their sciences, reaching a completeness and perfection of methodology that no other branch of their knowledge had attained. They expanded the range of geometry to many new kinds of figures, curves, surfaces, and solids; they changed its methodology from trial-and-error to logical deduction; they recognized that geometry studies "external forms", or abstractions, of which physical objects are only approximations; and they developed the idea of an "axiomatic theory" which, for more than 2000 years, was regarded to be the ideal paradigm for all scientific theories.

The Muslim mathematicians made considerable contributions to geometry, trigonometry and mathematical astronomy and were responsible for the development of algebraic geometry.

The 17th century was marked by the creation of analytic geometry, or geometry with coordinates and equations, associated with the names of Rene Descartes and Pierre de Fermat.

In the 18th century, differential geometry appeared, which was linked with the names of L. Euler and G. Monge.

In the 19th century, Carl Frederich Gauss, Janos Bolyai and Nikolai Ivanovich Lobachevsky, each working alone, created non-Euclidean geometry. Euclid's fifth postulate states that through a point outside a given line, it is possible to draw only one line parallel to that line, that is, one that will never meet the given line, no matter how far the lines are extended in either direction. But Gauss, Bolyai and Lobachevsky demonstrated the possibility of constructing a system of geometry in which Euclid's postulate of the unique parallel was replaced by a postulate stating that through any point not on a given straight line an infinite number of parallels to the given line could be drawn.

Their works influenced later researchers, including Riemann and Einstein.

Phonetics

1. Read the following words according to the transcription.

Methodology [ˌmeθəˈdɔləʤi] – методология
trial-and-error [ˈtrɑiəl ənd ˈerə] – метод проб и ошибок
approximation [əˌproksiˈmeiʃən] – приближение
axiomatic [ˌæksiəuˈmætik] – аксиоматичный
external [ɪksˈtə:nəl] – внешний
paradigm [ˈpærədɑim] – парадигма
trigonometry [ˌtrigəˈnɔmitri] – тригонометрия
Muslim [ˈmʌzlim] – мусульманский
Pierre de Fermat [piˈer də ferˈmɑ:] – Пьер де Ферма
Euler [ˈɔilə] – Эйлер
Monge [ˈmɔŋʒ] – Монж
Carl Frederich Gauss [ˈkɑ:l ˈfredrik ˈgaus] – Карл Фридрих Гаусс
Janos Bolyai [ˈjænəs bɔˈlɑi] – Ян Боляй
Euclid [ˈju:klid] – Эвклид
Euclidean [ju:ˈkli:djən] – Эвклидовый
infinite [ˈinfinit] – бесконечный
Riemann [ˈri:mən] – Риман
Einstein [ˈɑinstɑin] – Эйнштейн

Text Comprehension

2. Answer the following questions.

1. What is the origin of the term *geometry?*
2. What does geometry deal with?
3. What was the contribution of Greek mathematicians to the science of geometry?
4. Who contributed to the development of algebraic geometry?
5. Who was analytic geometry created by?
6. Whose names was differential geometry associated with?
7. Whose names was the creation on non-Euclidean geometry linked with?
8. Whose works were later influenced by non-Euclidean geometry?

3. Complete the sentences below with the words and phrases from the box.

a) measurement and calculation b) the works of later researchers c) Euler and Monge	d) analytic geometry e) trigonometry and mathematical astronomy f) non-Euclidean geometry

1. The Muslim mathematicians made considerable contributions to …
2. In geometry, emphasis was made on …
3. The 17th century was marked by the creation of …
4. Differential geometry was linked with the names of …
5. The 19th century was marked by the creation of …
6. Non-Euclidean geometry influenced …

4. Put the terms below in the correct order to show the process of the development of geometry as a science:

A. analytic geometry
B. geometry
C. differential geometry
D. non-Euclidean geometry
E. algebraic geometry

Grammar

5. Find the sentences with the *ing-forms* in the text and translate them into Russian.

6. Transform the following sentences into Participle I constructions.

Model:
The sign that *stands* for an angle …
The sign *standing* for an angle …

1. The line which *passes* through these two points is a diameter.
2. If you *express* these statements in mathematical terms, you obtain the following equations.
3. A decimal fraction is a fraction which *has* a denominator of 10, 100, 1000 or some simple multiple of 10.
4. The mathematical language, which *codifies* the present day science so clearly, has a long history of development.
5. When we *amalgamate* several relationships, we express the resulting relation in terms of a formula.
6. If we *try* to do without mathematics, we lose a powerful tool for reshaping information.
7. Calculus, which *is* the main branch of modern mathematics, operates with the rules of logical arguments.
8. When we *use* mathematical language, we avoid vagueness and unwanted extra meanings of our statements.
9. When scientists *apply* mathematics, they codify their science more clearly and objectively.
10. The person who *looks* at a mathematical formula and *complains* of its abstractness, dryness and uselessness fails to grasp its true value.

11. The book is useful reading for students who *seek* an introductory overview to mathematics, its utility and beauty.
12. Math is a living plant which *flourishes* and *fades* with the rise and fall of civilizations, respectively.

Text 6. The Development of Mathematics in the 17th Century

The scientific revolution of the 17th century spurred advances in mathematics as well. The founders of modern science – Nicolaus Copernicus, Johannes Kepler, Galileo, and Isaac Newton – studied the natural world as mathematicians, and they looked for its mathematical laws. Over time, mathematics grew more and more abstract as mathematicians sought to establish the foundations of their fields in logic.

The 17th century opened with the discovery of *logarithms* by the Scottish mathematician John Napier and the Swiss mathematician Justus Byrgius. Logarithms enabled mathematicians to extract the roots of numbers and simplified many calculations by basing them on addition and subtraction rather than on multiplication and division. Napier, who was interested in simplification, studied the systems of the Indian and Islamic worlds and spent years producing the tables of logarithms that he published in 1614. Kepler's enthusiasm for the tables ensured their rapid spread.

The 17th century saw the greatest advances in mathematics since the time of ancient Greece. The major invention of the century was *calculus.* Although two great thinkers - Sir Isaac Newton of England and Gottfried Wilhelm Leibniz of Germany – have received credit for the invention, they built on the work of others. As Newton noted, "If I have seen further, it is by standing on the shoulders of giants." Major advances were also made in numerical calculation and geometry.

Gottfried Leibniz was born (1st July, 1646) and lived most of his life in Germany. His greatest achievement was the invention of *integral and differential calculus*, the system of notation which is still in use today. In England, Isaac Newton claimed the distinction and accused Leibniz of plagiarism, that is stealing somebody else's ideas but stating that they are original. Modern-day historians, however, regard Leibniz as having arrived at his conclusions independently of Newton. They point out that there are important differences in the writings of both men.

Differential calculus came out of problems of finding tangents to curves, and an account of the method is published in Isaac Barrow's "*Lectiones geometricae*" (1670). Newton had discovered the method (1665-66) and suggested that Barrow include it in his book.

Leibniz had also discovered the method by 1676, publishing it in 1684. Newton did not publish his results until 1687. A bitter dispute arose over the priority for the discovery. In fact, it is now known that the two made their discoveries independently and that Newton had made it ten years before Leibniz, although Leibniz published first. The modern notation of *dy/dx* and the elongated *s* for integration are due to Leibniz.

The most important development in geometry during the 17th century was the discovery of *analytic geometry* by Rene Descartes and Pierre de Fermat, working independently in France. Analytic geometry makes it possible to study geometric figures using algebraic equations.

By using algebra, Descartes managed to overcome the limitations of Euclidean geometry. That resulted in the reversal of the historical roles of geometry and algebra. The French mathematician Joseph Louis Lagrange observed in the 18th century, "As long as algebra and geometry proceeded along separate paths, their advance was slow and their applications limited. But when these sciences joined company, they drew from each other fresh vitality and thenceforward marched on at a rapid pace toward perfection."

Descartes' publications provided the basis for Newton's mathematical work later in the century. Pierre de Fermat, however, regarded his own work on what became known as analytic geometry as a reformulation of Appollonius's treatise on conic sections. That treatise had provided the basic work on the geometry of curves from ancient times until Descartes.

Phonetics

1. Read the following words according to the transcription.

Nicolaus Copernicus [ˈnikələs kɔuˈpə:nikəs] – Николай Коперник
Johannes Kepler [jəˈhænis ˈkeplə] – Иоганн Кеплер
Galilei [gæliˈlei] – Галилей
Isaak Newton[ˈɑizək ˈnju:tən]- Исаак Ньютон
logarithms [ˈlɔgəriθms] – логарифмы
John Napier [ˈʤon ˈneipiə] – Джон Напир
Justus Byrgius [ˈʤastəs ˈbə:ʤəs] – Юстас Бирджес
Gottfried Wilhelm Leibniz [ˈgɔtfrid wɪlhelmˈlɑipnits] – Готфрид Вильгельм Лейбниц
integral [ˈintegrəl]- интеграл
Rene Descartes [rəˈnə deiˈkɑ:t] – Рене Декарт
Pierre de Fermat [piˈer də ferˈmɑ:] – Пьер де Ферма
Joseph Louis Lagrange [ʒəˈzef ˈlui ləˈgreinʒ] –Жозеф Луи Лагранж
treatise [ˈtri:tis] – трактат
conic [ˈkɔnik] - коническое сечение
Appollonius [əpəˈləunjes] – Аполлон

Vocabulary

2. Find the English equivalents in the text to the following Russian words and phrases.

1. первенство
2. сделать открытие
3. извлекать корни
4. упростить
5. плагиат
6. опубликовать
7. интегральные и дифференциальные исчисления

8. система обозначений
9. претендовать (*на что-л.)*
10. совершенство

Text Comprehension

3. Answer the following questions.

1. What scholars are considered to be the founders of modern science?
2. Why did mathematics grow more and more abstract?
3. Who were logarithms discovered by?
4. What did logarithms enable mathematicians to do?
5. What was the major invention of the 17th century?
6. What is the essence of analytic geometry?
7. Why did a dispute arise between Leibniz and Newton?
8. What enabled Descartes to overcome the limitations of Euclidean geometry?
9. Whose publications provided the basis for Newton's mathematical work later in the century?

4. Complete the sentences below with the words and phrases from the box.

a) Rene Descartes and Pierre de Fermat b) the discovery of calculus c) Kepler d) geometry and algebra	e) Newton and Leibniz f) the scientific revolution of the 17th century g) the tables of logarithms

1. The Scottish mathematician Napier spent years producing …
2. The rapid spread of the tables of logarithms was ensured by …
3. The development of analytic geometry was beneficial for both …
4. The invention of calculus is connected with the names of …
5. A bitter dispute arose over the priority for…
6. Advances in mathematics were facilitated by …
7. Analytic geometry was discovered by …

Grammar

5. Transform the following sentences using Participle II constructions.

Model:

1. *The reasons which are given* for the study of mathematics …
The reasons given for the study of mathematics …
2. *When they are expressed* in terms of symbols, these relations produce a formula.
Expressed in terms of symbols, these relations produce a formula. *Когда эти отношения выражены символами, они …*

1. *The procedure which was suggested* at the meeting of the team had a number of advantages.

2. *When they are used* as scientific terms, these concepts have different meanings.
3. *The formal language which is spoken* in this country is Russian.
4. *The tasks which were set* for the students to fulfill were rather difficult.
5. *If it is expressed* in mathematical terms, this theorem gives a general method of calculating the area.
6. *The sense which is implied* in this assertion is not quite clear.
7. *If it is designed* and *devised* in a proper way, the symbol language becomes universal.
8. *When math is used* in any science, it brings precision, rigour and objectivity about.
9. *The theory which was discussed* at the seminar aroused great interest.
10. *The code which has been designed* by the programmer is rather inconvenient.
11. *The statement which was made* by the researcher did not satisfy certain conditions.
12. *The rules that are learnt* by the students are very important for their future professional activities.

Text 7. 18th – 19th Century Mathematics

During the 18th century, calculus became the cornerstone of mathematical analysis on the European continent. Mathematicians applied the discovery to a variety of problems in physics, astronomy, and engineering. In the course of doing so, they also created new areas of mathematics.

In France, Joseph Louis Lagrange made substantial contributions in all fields of pure mathematics, including differential equations, the calculus of variations, probability theory, and the theory of equations. In addition, Lagrange put his mathematical skills to work in the solution of practical problems in mechanics and astronomy.

The greatest mathematician of the 18th century, Leonard Euler of Switzerland, wrote works that covered the entire fields of pure and applied mathematics. He wrote major works on mechanics that preceded Lagrange's work. He won a number of prizes for his work on the orbits of comets and planets, the field known as celestial mechanics. But Euler is best known for his works in pure mathematics. In one of his works, *Introduction to the Analysis of Infinites,* published in 1748, he approached calculus in terms of functions rather than the geometry of curves. Other works by Euler contributed to number theory and differential geometry (the application of differential calculus to the study of the properties of curves and curved spaces).

Mathematicians succeeded in firming the foundations of analysis and discovered the existence of additional geometries and algebras and more than one kind of infinity.

The 19th century began with the German mathematician Carl Frederich Gauss. He ranks as one of the greatest mathematicians of the world. His book *Inquiries into Arithmetic* published in 1801 marks the beginning of modern era in number theory.

Gauss called mathematics *the queen of sciences* and number theory *the queen of mathematics.*

Almost from the introduction of calculus, efforts had been made to supply a rigorous foundation for it. Every mathematician made some effort to produce a logical justification for calculus and failed. Although calculus clearly worked in solving problems, mathematicians lacked rigorous proof that explained why it worked. Finally, in 1821, the French mathematician Augustin Louis Cauchy established a rigorous foundation for calculus with his theory of limits, a purely arithmetic theory. Later, mathematicians found Cauchy's formulation still too vague because it did not provide a logical definition of *real number.* The necessary precision for calculus and mathematical analysis was attained in the 1850s by the German mathematician Karl T. W. Weierstrass and his followers.

Another important advance in analysis came from the French mathematician Jean Baptiste Fourier, who studied infinite series in which the terms are trigonometric functions. Known today as Fourier series, they are still powerful tools in pure and applied mathematics.

The investigation of Fourier series led another German mathematician, Georg Cantor, to the study of infinite sets and to the arithmetic of infinite numbers.

Georg Cantor began his mathematical investigations in number theory and went on to create set theory. In the course of his early studies of Fourier series, he developed a theory of irrational numbers. Cantor and another German mathematician, Julius W. R. Dedekind, defined the irrational numbers and established their properties. These explanations hastened the abandonment of many 19^{th} century mathematical principles.

When Cantor introduced his theory of sets, it was attacked as a disease from which mathematics would soon recover. However, it now forms part of the foundations of mathematics. The application of set theory greatly advanced mathematics in the 20^{th} century.

Phonetics

1. Read the following words according to the transcription.

European [ˏjuərə΄pi:ən]- европейский
Joseph Louis Lagrange [ʒə΄zef ΄lui lə΄greinʒ] –Жозеф Луи Лагранж
Leonard Euler [΄lenənd ΄ɔilər] – Леонард Эйлер
Switzerland [΄switsələnd] – Швейцария
celestial [si΄lestjəl] – небесный
differential [ˏdifə΄renʃəl] – дифференциальный
succeed [sək΄si:d] – преуспевать
Carl Frederich Gauss [΄kɑ:l ΄fredrik ΄gaus] – Карл Фридрих аусс
Georg Cantor [΄ʤi:əg ΄kæntə] – Георг Кантор
Augustin Louis Cauchy [ɔ:΄gʌstin ΄lui ΄kəuʃi] – Августин Луи Коши
Karl Weierstrass [΄kɑ:l ΄wierʃtrɑ:s] – Карл Вейерштрасс
Jean Baptiste Fourier [΄ʒɑ:n bəp΄tist ΄fu:riə] – Жан Баптист Фурье
Julius Dedekind [΄ju:ljəs ΄dedəkind] – Юлиус Дедекинд

although [ɔ:lˊðou] – несмотря на то, что
trigonometric [ˌtrigənəˊmetrik] – тригонометрический
hasten [ˊheisn] – ускорять
abandonment [əˊbændənmənt] – отказ

Vocabulary

2. Translate the following words and word-combinations from the text into Russian.

1. cornerstone
2. substantial
3. major works
4. to rank as
5. to lack smth.
6. vague
7. precision
8. to attain
9. abandonment
10. to advance

Text Comprehension

3. Complete the sentences below with the words and phrases from the box.

a) preceded Lagrange's work b) number theory and differential geometry c) Karl T. W. Weierstrass d) celestial mechanics e) Cantor and Dedekind	f) Carl Frederich Gauss g) mechanics and astronomy h) Fourier series i) physics, astronomy, and engineering j) foundations of mathematics

1. Euler's major works on mechanics…
2. Mathematicians applied the discovery of calculus to…
3. Lagrange managed to solve some practical problems in …
4. Euler's works contributed to…
5. Euler won a number of prizes for his work on…
6. Mathematics was called *the queen of sciences* by…
7. A precise foundation for calculus was supplied by…
8. Cantor's study of infinite sets became possible due to the study of…
9. The properties of irrational numbers were established by…
10. Cantor's set theory became part of the…

4. Answer the following questions.

1. What did the discovery of calculus lead to?
2. What was Lagrange's contribution to pure and applied mathematics?
3. What did Euler's works contribute to?

4. What is the essence of differential geometry?
5. What event marked the beginning of modern era in number theory?
6. When was a rigorous foundation for calculus finally supplied?
7. What is the theoretical and practical value of Fourier series?
8. What was Georg Cantor's contribution to mathematical studies?
9. Who were irrational numbers investigated and defined by?
10. What was the first reaction to Cantor's set theory?
11. Was the attitude to the discovery later changed?

Grammar

5. Change each sentence using either an *adverbial clause of time* (*after*…) or *Perfect Participle Active* (*having* …).

Model:

After we had combined these two groups, we produced a new set.
Having combined these two groups, we produced a new set.
После того как мы объединили эти две группы, мы получили новое множество. Объединив эти две группы, мы получили новое множество.

1. *After we had considered* the phenomena separately, we managed to establish a proper correspondence between them.
2. *Having read* the text closely, we understood the problem correctly.
3. *After we had assigned* numerals to these points, we established two one-to-one correspondences between a set of numbers and a set of points.
4. *Having obtained* different results, we arranged a discussion.
5. *After we had carried out* the experiment, we understood that the machine had certain advantages.
6. *Having analysed* the situation properly, we found a solution to the problem.
7. *After we had intensified* the whole process, we managed to meet the deadline.
8. *After we had tested* the new computer, we came to the conclusion that it was more powerful than the old model.
9. *Having replaced* the variable with the proper numeral, we received a true sentence.
10. *After we had checked* the result, we could see that it agreed with the expected one.
11. *Having solved* the equation, they obtained the necessary data.

Text 8. 20th Century Mathematics

During the 20th century, mathematics became more solidly grounded in logic and advanced the development of symbolic logic. Philosophy was not the only field to progress with the help of mathematics. Physics, too, benefited from the contributions of mathematicians to relativity theory and quantum theory. Indeed, mathematics achieved broader applications than ever before, as new fields developed within mathematics (*computational mathematics, game theory, and chaos theory*), and other branches of knowledge, including economics and physics, achieved firmer grounding through the application of mathematics. Even the most abstract mathematics seemed to find application, and the boundaries between pure mathematics and applied mathematics grew ever fuzzier.

Mathematicians searched for unifying principles and general statements that applied to large categories of numbers and objects. In algebra, the study of structure continued with a focus on structural units called rings, fields, and groups, and at mid-century, it extended to the relationships between these categories. Algebra became an important part of other areas of mathematics, including analysis, number theory, and topology, as the search for unifying theories moved ahead. Topology – the study of the properties of objects that remain constant during transformation, or stretching, became a fertile research field, bringing together geometry, algebra and analysis.

Until the 20th century, the centres of mathematics research in the West were all located in Europe. Although the University of Göttingen in Germany, the University of Cambridge in England, the French Academy of Sciences and the University of Paris, and the University of Moscow in Russia retained their importance, the United States rose in prominence and reputation for mathematical research, especially the departments of mathematics at Princeton University and the University of Chicago.

In some ways, pure mathematics became more abstract in the 20th century, as it joined forces with the field of symbolic logic in philosophy. The scholars who bridged the fields of mathematics and philosophy early in the century were Alfred North Whiteland and Bertrand Russel, who worked together at Cambridge University. They published their major work, *Principles of Mathematics*, in three volumes from 1910 to 1913. In it, they demonstrated the principles of mathematical knowledge and attempted to show that all of mathematics could be deduced from a few premises and definitions by the rules of formal logic. In the late 19th century, the German mathematician Gottlob Frege had provided the system of notation for mathematical logic and paved the way for the work of Russel and Whitehead. Mathematical logic influenced the direction of 20th century mathematics, including the work of Hilbert.

Speaking at the Second International Congress of Mathematicians in Paris in 1900, the German mathematician David Hilbert made a survey of 23 mathematical problems that he felt would guide research in mathematics in the coming century. Since that time, many of the problems have been solved. When the news breaks that another *Hilbert problem* has been solved, mathematicians worldwide impatiently await further details.

Hilbert contributed to most areas of mathematics, starting with his classic *Foundations of Geometry*, published in 1899. Hilbert's work created the field of functional analysis (*the analysis of functions as a group*), a field that occupied many mathematicians during the 20th century. He also contributed to mathematical physics. From 1915 on, he fought to have Emmy Noether, a noted German mathematician, hired at Göttingen. When the university refused to hire her because of objections to the presence of a woman in the faculty senate, Hilbert countered that the senate was not the changing room for a swimming pool. Noether later made major contributions to ring theory in algebra and wrote a standard text on abstract algebra.

Several revolutionary theories, including relativity and quantum theory, challenged existing assumptions in physics in the early 20th century. The work of a number of mathematicians contributed to these theories.

The Russian mathematician Hermann Minkowski contributed to relativity the notion of the space-time continuum, with time as a fourth dimension. Hermann Weyl, a student of Hilbert's, investigated the geometry of relativity and applied group theory to quantum mechanics. Weyl's investigations helped advance the field of topology. Early in the century, Hilbert quipped, "Physics is getting too difficult for physicists."

Mathematics formed an alliance with economics in the 20th century as the tools of mathematical analysis, algebra, probability, and statistics illuminated economic theories. A specialty called *econometrics* links enormous numbers of equations to form mathematical models for use as forecasting tools.

Game theory began in mathematics, but had immediate applications in economics and military strategy. This branch of mathematics deals with situations in which some sort of decision must be made to maximize a profit – that is, to win. Its theoretical foundations were supplied by von Neumann in a series of papers written during the 1930s and 1940s. Von Neumann and the economist Oscar Morgenstern published the results of their investigations in *The Theory of Games and Economic Behaviour* (1944). John Nash, the Princeton mathematician profiled in the motion picture *A Beautiful Mind,* shared the 1994 Nobel Prize in economics for his work in game theory.

Phonetics

1. **Read the following words according to the transcription.**

Quantum [ˈkwɔntəm] – квантовый
chaos [ˈkeiəs] – хаос, неупорядоченность
topology [tɔˈpɔləʤi] – топология
fertile [ˈfə:tɑil] – *зд.* благодатный
Princeton [ˈprinstən] – Принстон
Chicago [ʃiˈkɑ:gɔu] – Чикаго
Cambridge [ˈkeimbriʤ] – Кэмбридж
Bertrand Russel [ˈbə:trənd ˈrʌsəl] – Бертранд Рассел
premise [ˈpremis] – предпосылка
Hermann Weyl [ˈhə:mən ˈweil] – Герман Вэйль
Emmy Noether [ˈemi ˈnə:tə] –Эмми Нётер
econometrics [ˌikənəˈmetriks] – эконометрика
maximize [ˈmæksimɑiz] – предельно увеличить
Von Neumann [fɔn ˈnɔimən] – фон Нойман
series [ˈsiəri:z] – ряд
supply [səˈplɑi] – *зд.* разработать
profiled [ˈprəufɑild] – изображённый (в фильме)

the Nobel Prize [ðə nəu′bel ′prɑiz] – нобелевская премия

Vocabulary

2. Match the synonyms.

1. to work out	a) concept
2. to await	b) to take on
3. to apply	c) to use
4. notion	d) to anticipate
5. to hire	e) distinguished
6. to attempt	f) to try
7. noted	g) to develop
8. to break the news	h) scientist
9. to challenge	i) main
10. to research	j) to begin
11. scholar	k) prognosis
12. forecast*, n*	l) to solve problems connected with
13. to start	m) to investigate
14. major	n) to announce
15. to deal with	o) to put to doubt

Text Comprehension

3. True or false?

1. In the 20th century, mathematics achieved broader applications than ever before.
2. Abstract mathematics failed to find application.
3. Mathematicians searched for unifying principles and theories.
4. Alongside with Europe, the United States became one of the centers of mathematical research.
5. Mathematical logic influenced the work of the outstanding German mathematician David Hilbert.
6. The University of Göttingen refused to take Emmy Noether on the faculty staff on academic ground.
7. Mathematics helped reconsider relativity and quantum theories.
8. David Hilbert made a survey of 26 problems that played the key role in mathematical research in the 20th century.
9. Game theory was originally applied in the sphere of entertainment.

4. Answer the following questions.

1. The development of what science did mathematics advance in the 20th century?
2. What two famous theories in physics did mathematics contribute to?
3. What new fields developed within mathematics?

4. Was there a great difference between pure and applied mathematics in the 20^{th} century?
5. What role did algebra play in other areas of mathematics?
6. Why did topology become a fertile research field for mathematicians?
7. What universities became centers of mathematical research in the US?
8. What branch of mathematical science influenced the direction of 20^{th} century mathematics?
9. What notion did the Russian mathematician Hermann Minkowski contribute to the theory of relativity?
10. How did mathematics advance economics in the 20^{th} century?
11. What does game theory deal with?
12. Who were the theoretical foundations of game theory supplied by?

Grammar

5. Change the sentences according to the model using the Complex Subject pattern.

Model:

It is believed that *he* is an efficient specialist.

He is believed to be an efficient specialist. Считается, что он опытный специалист.

1. *It is expected* that *they* will detect the error.
2. *It is believed* that *he* is very accurate in making calculations.
3. *It is known* that *they* have foreseen all the possible mistakes.
4. *It is likely* that *he* has given them explicit instructions.
5. *It is unlikely* that *they* have supplied the laboratory with such complex equipment.
6. *It appears* that *they* are unable to account for this absurd situation.
7. *It seemed* that *he* was an experienced researcher.
8. *It happened* so that *the error* was quickly detected.
9. *It appears* that *the law* holds for all the equations.
10. *It is unlikely* that *most fundamental processes of arithmetic and algebra* should change a great deal.
11. *It was expected* that *the students* knew the law.
12. *It is known* that *these laws* are applied to all kinds of exponents.
13. *It is expected* that *the students* remember these proportions.
14. *It appeared* that *the procedure* was appropriate.
15. *It seems* that *the computation* is correct.
16. *It appears* that *these statements* are mathematically correct.
17. *It is expected* that *the scientists* will establish an appropriate pattern.
18. *It is believed* that *the result* is of great importance.
19. *It is expected* that *he* will speak on number relations.
20. *It is unlikely* that *he* will speak on the coordinate system.

Text 9. Mathematics – the Language of Science

One of the foremost reasons given for the study of mathematics is that mathematics is the language of science. This does not mean that mathematics is useful only to those who specialize in science. It implies that even a layman must know something about the foundations, the scope and the basic role played by mathematics in our scientific age.

The language of mathematics consists mostly of signs and symbols, and, in a sense, is an unspoken language. There can be no more universal or simpler language. It is the same throughout the civilized world, though the people of each country translate it into their own particular language. For instance, the symbol 5 means the same to a person in England, Spain, Italy or any other country, but in each country it may be called by a different spoken word. Some of the best known symbols of mathematics are the numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 and the signs of addition (+), subtraction (-), multiplication (×), division (:), equality (=) and the letters of the alphabets: Greek, Latin, Gothic and Hebrew (rather rarely).

Symbolic language is one of the basic characteristics of modern mathematics for it determines its true aspect. With the aid of symbolism, mathematicians can make transitions in reasoning almost mechanically by the eye and leave their minds free to grasp the fundamental ideas of the subject matter. Just as music uses symbolism for the representation and communication of sounds, so mathematics expresses quantitative relations and spatial forms symbolically. Unlike the common language, which is the product of custom, as well as social and political movements, the language of mathematics is carefully, purposefully and often ingeniously designed. By virtue of its compactness, it permits a mathematician to work with ideas which, when expressed in terms of common language, are unmanageable. This compactness makes for efficiency of thought.

Mathematics is a special kind of language. The language so perfect and abstract that, possibly, it may be understood by intelligent creatures throughout the universe, no matter how different their organs of sense and perception may be. The grammar of the language – its proper usage – is determined by the rules of logic. Its vocabulary consists of symbols, such as numerals for numbers, letters for unknown numbers, equations for relationships between numbers and many other symbols, including the ones used in higher mathematics.

All of these symbols are tremendously helpful to the scientist because they serve to cut-short his thinking.

Albert Einstein wrote: “What distinguishes the language of science from language as we ordinarily understand the word? How is it that scientific language is international? The supernational character of scientific concepts and scientific language is due to the fact that they are set up by the best brains of all countries and all times.”

Phonetics

1. Read the following words according to the transcription.

Hebrew [ˈhi:bru:] – древнееврейский

Gothic [ˈgɔθik] – готский

spatial [´speiʃəl] – пространственный
ingeniously [in´ʤjniəsli] – гениально
tremendously [tri´mendəsli] – *зд.* очень
compactness [kəm´pæktnis] – сжатость, лаконичность
universe [´ju:nivə:s] –вселенная
Einstein [´ɑinstɑin] – Эйнштейн

Vocabulary

2. Match the following.

1. foremost	a) древнееврейский язык
2. Gothic	b) главный
3. Hebrew	c) готский язык
4. aid	d) переход
5. transition	e) в отличие от
6. reasoning	f) благодаря
7. spatial	g) гениально
8. unlike	h) лаконично
9. common	i) пространственный
10. by virtue of	j) обычный
11. ingeniously	k) ускорять мышление
12. compactness	l) непрофессионал
13. efficiency	m) восприятие
14. to cut-short thinking	n) точность
15. perception	o) мышление
16. layman	p) помощь

Text Comprehension

3. Answer the following questions.

1. What does the language of mathematics consist of?
2. Why is mathematics called a universal language?
3. What are the best known mathematical symbols?
4. How can mathematics be likened to music?
5. What is the most characteristic feature of the language of mathematics?
6. What are the grammar and the vocabulary of mathematics as the language of science?
7. How do mathematical symbols help the scientists in their research work?
8. How did Einstein explain the international, or supernational, character of the language of science?

Grammar

4. Say the same in a different way using conditional sentences. See the model.

Model:

If it were not for the works of the preceding scholars, the scientists of the following generations would not have made their discoveries.
But for the works of the preceding scholars, the scientists of the following generations would not have made their discoveries.
Если бы не труды учёных прошлых времён, современные учёные не смогли бы сделать свои открытия.

1. *If it were not for* a trifling error, the experiment might have been a success.
2. *But for* Babylonian and Mesopotamian mathematicians, Alexandrian scholars would not have achieved such remarkable results.
3. *If it were not for* the unreliable equipment, there would be fewer mistakes in print.
4. *But for* the absurdity of the solution, we might not have noticed the error.
5. *If it were not for* the discovery of logarithms, the scholars of the 18th century would not have been able to make such great and successful advances.
6. *But for* Kepler's enthusiasm, the tables of logarithms would not have so rapidly spread.
7. *But for* mathematics, the present day achievements in science and technology would have been impossible.
8. *If it were not for* the greatest discoveries of world-famous scholars, our life would not be so comfortable as it is now.
9. *But for* the computer, many sciences would not have advanced so far.

5. Identify the non-finite forms of the verb in the following text: *the gerund, the participle* or *the infinitive.*

The Value of Solving Problems in Mathematics

There is much *thinking* and *reasoning* in mathematics. The students master the subject matter not only by *reading* and *learning*, but by *proving* theorems and *solving* problems. The problems, therefore, are an important part of *teaching*, because they make the students *discuss* and *reason* and *polish up* their own knowledge.

To understand how experimental knowledge is matched with theory and how new results are obtained, the students need *to do* their own *reasoning* and *thinking*. Of course, it is easier for both teacher and student if the text states all the results and outlines all the *reasoning*; but it is hard *to remember* such teaching for long, and harder still *to get* a good *understanding* of science from it.

Solving problems, you do your own *thinking*, and for this reason, problems form a very important part of *teaching*.

Some questions *raised* by the problems obviously do not have a single, unique or completely correct answer. More than that, the answers to them may be sometimes *misleading*, *demanding* more *reasoning* and further *proving*. Yet, *thinking* your way through them and *making* your own choice and *discussing* other choices are part of a good education in science and a good method of *teaching*.

Part II. Mathematics and Computer Science

Text 1. Mathematics and Computers

It is well known that the development of computers and computer science was due to the effort of mathematicians, physicists, and engineers. But the early, theoretical work came from mathematicians.

The English mathematician Alan Turing, working at Cambridge University, introduced the idea of a machine that could perform mathematical operations and solve equations. The Turing machine, as it became known, was a precursor of the modern computer. Through his work, Turing brought together the elements that form the basis of computer science: symbolic logic, numerical analysis, electrical engineering, and a mechanical vision of human thought process.

Computer theory is associated with the name of the outstanding scientist von Neumann, who established the basic principles on which computers operate.

The first large-scale digital computers were pioneered in the 1940s. In 1945, von Neumann completed the EDVAC (Electronic Discrete Variable Automatic Computer) at the Institute of Advanced Study in Princeton. In 1946, the engineers John Eckert and John Mauchly built ENAC (Electronic Numerical Integrator and calculator), which operated at the University of Pennsylvania.

Complex computers have attracted the attention of researchers in the field of artificial intelligence. They are trying to develop computer systems that can imitate human thought processes.

The mathematician Norbert Wiener, who worked at the Massachusetts Institute of Technology (MIT), also became interested in automatic computing and developed the field known as cybernetics. Cybernetics grew out of Wiener's work on increasing the accuracy of bombsights during World War II. From this, came a broader investigation of how information can be translated into improved performance. Cybernetics is now applied to communication and control systems in living organisms.

Computers have exercised an enormous influence on mathematics and its applications. They have given great impetus to such branches of mathematics as numerical analysis and finite mathematics. Computer science has suggested new areas for mathematical investigation, such as the study of algorithms. Computers have also become powerful tools in diverse fields, such as number theory, differential equations, and abstract algebra. In addition, the computer has made possible the solution of several long-standing problems in mathematics which were proposed in the previous centuries.

Phonetics

1. Read the following words according to the transcription.

Alan Turing [ˊælən ˊtju:əriŋ] – Алан Тюринг
Norbert Wiener [ˊnɔ:bət ˊwi:nə] – Норберт Винер
Von Neumann [fɔn ˊnɔimən] –фон Нойман
cybernetics [ˏsɑibəˊnetiks] – кибернетика

pioneer, *v* [ˌpɑiəˈniːə] – впервые использовать
technology [tekˈnɔlɔʤi] – технология
impetus [ˈimpetəs] – толчок
diverse [dɑiˈvəːs] – различные

Text Comprehension

2. Answer the following questions.

1. What is the role of mathematicians in the development of computers and computer science?
2. Who was the idea of a computer introduced by?
3. Who is computer theory associated with?
4. When were the first large-scale digital computers pioneered?
5. Who was the first electronic numerical integrator and calculator built by?
6. Whose name is *Cybernetics* associated with?
7. What influence have computers exercised on mathematics and its applications?

3. Read the text below and do the tasks following it.

a) Choose the title to the text that suits best:

1. Computer applications
2. The age of modern computer technologies
3. The role of the computer in work and studies

Computers have become a part of our everyday life. We use them to do different mathematical and logical operations, to receive, store and transfer any kind of information, to work on the Internet, write e-mail letters, speak over the Skype, etc. We daily deal with different computer systems, such as calculators, car electronics, mobile phones, timers in microwave ovens or washing machines, programmers inside the TV sets and so on. The impact of the computer on our society is felt in every area – government, business, science, medicine, sport, industry, agriculture, entertainment and leisure activities.

The computer is a high-speed calculating machine which speeds up your financial calculations. It is an electronic notebook which manages to collect tremendous quantities of data, such as databases of any school or university, studying programs, personal information, etc. It is a unique typewriter that allows every user to type and print any kind of written document, pictures or even photos. It is the greatest electronic entertainment system, so you can relax listening to your favoutite music or watching your favourite film, or playing computer games. And finally, the computer is a personal communicator that enables us to communicate with other people all over the world without leaving your house.

b) Give your answers to the following questions.

1. What are the main spheres of computer usage?
2. What areas of human activity are affected by the computer?
3. Why is the computer so important in our life?
4. How do you use the computer in your every day life?
5. What recommendations could you give to those who use the computer in a big way?

Grammar

4. Put the adjectives in brackets into the correct form (comparative or superlative degree) to make an accurate description of computer sizes.

Words and word combinations

mainfraim computer – мэйнфрейм, «большой компьютер», суперкомпьютер
minicomputer – миникомпьютер
microcomputer – микрокомпьютер
portable – портативный
desktop – настольный компьютер
laptop – лэптоп (*lap* – колени сидящего человека)
notebook computer - ноутбук (компьютер типа «ноутбук»)
subnotebook – ультрапортативный ноутбук
handheld – ручной
palmtop computer - карманный персональный компьютер

There are different types of computer. The ... (large)[1] … and ... (powerful)[2] … are *mainframe* computers. *Minicomputers* are ... (small)[3] ... than mainframes, but are still very powerful. *Microcomputers* are small enough to sit on a desk. They are the ... (common)[4] … type of computer. They are usually ... (powerful)[5] … than minicomputers. Portable computers are ... (small)[6] … than *desktops.* The ... (large)[7] … portable is a *laptop.* ... (Small)[8] … portables, about the size of a piece of writing paper, are called *notebook* computers. *Subnotebooks* are ... (small)[9] … than notebooks. You can hold ... (small)[10] … computers in one hand. They are called handheld computers, or *palmtop* computers.

5. Put questions to the following sentences.

1. Chemists have found that 100,000 chemical reactions take place in the brain every second.
2. We still don’t know how languages are learnt.
3. We are only now really starting to learn the truth about how the human brain works.
4. As long as the brain is given plenty of exercise, it keeps its power.
5. It has been found that an old person who has always been mentally active has a quicker mind than a young person who has done only physical work.

6. The study of the physiology of memory is in its infancy, and researchers must thus still rely on analogy, on terms like *storage* and *retrieval*, to explain how we remember.
7. But even a rudimentary understanding of the physiology of memory is better than none at all.

6. Use the correct tense / voice form of the verb.

Model:
A lot of knowledge (*to accumulate*) in the second half of the 20th century.
A lot of knowledge *was accumulated* in the second half of the 20th century.

1. In the early ages, primitive counting (to do) with the help of gestures, objects, fingers and toes.
2. The work of Leibniz (to publish) several years before Newton's results appeared in print.
3. In the past, people could not foresee that their life (to change) radically due to technological advances.
4. Scientists (to make) their discoveries due to the achievements of their predecessors.
5. Mathematics (to be) a science of numbers before it became a science of relations.
6. Archimedes (to make) his discovery while (to take a bath).
7. All spheres of life (to benefit) from computers in the future.
8. Many problems of artificial intelligence (not to solve) yet.
9. A lot of useful gadgets (to appear) in the last 10 years.
10. Nowadays, science and technology (to develop) at a great speed.
11. It is believed that in the future computers (to make) people's life still more comfortable.
12. Mathematics (to contribute) the most to the development of computer science.
13. Without the computer, the present day achievements of many sciences (to be) impossible.
14. Very little (to know) to us about the life of Euclid.
15. Einstein (to be) young when he developed the theory of relativity.
16. Lobachevsky's new idea (to remain) unnoticed for a long time.
17. Till his dying day, Galileo was true to his ideas, though he (to renounce) them before under the pressure of the Inquisition.
18. Some new branches of mathematics (to develop) in the 20th century.
19. It (to take) mathematicians over three hundred years to prove Fermat's last theorem.
20. Mathematical language (to characterize) by its symbolic nature, brevity and precision.

Vocabulary

7. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. account 2. animator 3. upload 4. update 5. applet 6. ISQ 7. bugs 8. banner	a) программа для создания и просмотра анимированных изображений b) модификация лицензионной программы c) логин + пароль для входа в систему d) реклама в Интернете e) интернет-пейджер f) программа на языке Java g) загрузка файла с компьютера пользователя на сервер h) ошибки в программе

Text 2. Computers and Computing

A little over 3 decades ago, computers were small, not very reliable and comparatively slow in operation. Since then, several generations of complex electronic computing equipment have been developed, each being significantly better than the one before it.

Modern computers are of 3 kinds called *analog, digital,* and *hybrid*. An *analog computer* computes by using physical analogs of numerical measurements. A *digital computer* computes by using the numbers *(digits*) and *yeses* and *noes* usually expressed in 1's and 0's. A *hybrid computer* is a machine which combines some of the properties of digital and analog computers.

A computer can take in information or data, perform a sequence of reasonable operations on the information it has received, and put out answers. When it does this, it is *computing.*

A computing machine can take in and store information because the *hardware* inside the machine expresses arithmetical and logical relations, such as adding or subtracting, comparing or selecting. A computer can also put out information and display the answers when it receives them. Hardware is useless without *software* which is computer instructions and programs.

A computer is a general-purpose machine. It is the most important property which distinguishes it from all other kinds of machine constructed by man. Almost every day, a new use is found for these devices to help man. One and the same computer may be required on different occasions to help in the design of airplane wing sections, to detect errors in the design of a computer, to calculate the production of some large factory, to control the mixture of ingredients in some chemical process, or even to play a game of chess. In fact, a computer may be said to perform any task provided that the method of performance can be described in complete detail.

It is important, however, to realize from the beginning that the term *electronic brain* popularly applied to an automatic electronic digital computer is a misnomer. The computer is only automatic in the sense that it can deal with explicit instructions which tell it exactly what to do: it cannot in itself, take steps, deal with difficulties which have not been foreseen by the person who presents the problem. The computer must, therefore, be supplied with a complete and detailed set of operating instructions to solve a given problem, together with the numerical values of the quantities which are to be operated upon.

A set of such operating instructions causing the computer to perform a particular calculation on any values of numerical data presented, and to print the results of the calculation, is called a program. The great merit of computers, that they will accept and obey any program presented to them, is lessened by the fact that they will interpret their instructions with a scrupulous accuracy even, when, as a result of a small mistake in the program, the results produced are obviously absurd. Such mistakes will often be of the sort which would be corrected, perhaps, even intuitively, by an intelligent operator. We would, therefore, stress that the program must be written in such a way that the computer carries out the desired operations in the right sequence, and that it must specify exactly what must be done under every circumstance that may arise in the computation.

The preparation of the problem for the solution by an electronic digital computer thus involves the following tasks:

a) the precise definition of the problem to be solved;

b) the planning of the sequence of operations required for the solution of the problem.

The writing of the program for the fulfillment of these tasks demands great attention to detail on the part of the programmer.

Once a program has been written, the computer is made to read it and store it in its memory. After the complete program has been read and stored, the computer starts to obey it.

Some of the instructions of the program will require the computer to read additional data, and others to print the results of its calculation; these results are then returned to the programmer.

If the program is correct, the results will give the correct answers to the original problem; otherwise, the program will have to be amended and presented again to the computer. The latter occurrence is a very common one, and many programmers find that more time is spent in correcting their programs than in writing them.

Phonetics

1. Read the following words according to the transcription.

Analog [΄ænələg] – аналоговый
digital [΄diʤitəl] – цифровой
hybrid [΄hɑibrid] – гибридный
data [΄deitə] – данные
design [di΄zɑin] – конструкция

misnomer [mis´nəumə] – неправильное употребление названия
ingredient [in´gri:diənt] – ингредиент, составная часть
scrupulous [´skru:pjuləs] – тщательный
absurd [əb´sə:d] – абсурдный
occurrence [ə´kʌrens] – случай, событие

Vocabulary

2. Match the following.

1. physical variables	a) особая ячейка памяти
2. binary system	b) разумные операции
3. particular memory cell	c) физические переменные
4. numerical measurement	d) числовые величины
5. to do the sorting	e) числовое измерение
6. matching	f) двоичная система
7. comparison	g) сортировать
8. selection	h) согласование
9. to store	i) извлекать квадратный корень
10. to take a square root	j) сравнение
11. to raise to a power	k) выбор
12. reasonable operations	l) возводить в степень
13. numerical quantities	m) сохранять

3. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. binary	a) волновая таблица
2. browser	b) паутина
3. hosting	c) жесткий диск
4. user	d) сервис; составная часть Интернета
5. web	e) двоичный
6. wave	f) управление сервером
7. Winchester	g) просмотровик
8. World Wide Web	h) пользователь ПК

Text Comprehension

4. Answer the following questions.

1. How did the first computers differ from modern ones?
2. What are the three kinds of computers known in the computer world?
3. What is computing?
4. What two parts of a computer system are responsible for its functioning?
5. What is the most important property of a computer?
6. What is the most important condition for a computer to function properly?

7. What important tasks are to be fulfilled by the programmer in preparing a problem for solution by the computer?
8. What should be done if the program is not correct?
9. Does it take long to correct a program?

5. Read the text below and answer the following questions.

1. What are the features that computers and calculators have in common?
2. What are the points of difference?

Computers and Calculators

A computer is told how to process the information by instructions, which are stored in coded form inside the machine. In this respect, a computer differs radically from a calculator, which can do the same thing that a computer does, except that the instructions are not stored inside the machine. The coded instructions are called a program.

Any computer or calculator contains devices for five main functions: input, storage, arithmetic, control and output. Input refers to the process by which information is put into a machine. Output is the process by which the results are moved out of the machine. Storage refers to the mechanism that can retain information during calculation and furnish it as needed to other parts of the machine. The arithmetic unit is that part of the machine, which can carry out one or more of the basic arithmetic operations on the information held in storage. Finally, the control refers to those parts of the machine that dictate the functions to be performed by all the other parts. The main difference between computers and calculators is that the instructions telling the computer what to do must be placed in storage before the computer proceeds with the solution of a problem. These instructions, which are made up of ordinary decimal digits, are placed in the same storage device that holds the data.

Translation

6. Translate the sentences into English.

1. Произведите умножение, а затем вычитание следующих чисел: 135 × 7 – 210.
2. Выдайте итог и возведите полученное число в третью степень.
3. Извлеките квадратный корень из числа 64.
4. Разумные операции, совершаемые компьютерной системой, бывают математическими и логическими.
5. Современный компьютер может выполнять более миллиона различных разумных операций в секунду, например, таких как сложение, вычитание, умножение, деление, сортировка, согласование, сравнение или выбор.
6. Любая информация для компьютера должна быть представлена в двоичной системе.
7. Адрес любой информации – это название определённой ячейки памяти, в которой она сохранена.
8. Чем больше внутренняя память компьютера, тем больше действий на нём можно выполнять

Grammar

7. Use the special questions in indirect speech according to the model.

Model:

1. What do you specialize in?

You've asked me what I specialize in.

2. What is the article about?

You've asked me what the article is about.

1. What conclusion was drawn?
2. When was the discovery made?
3. Where did the scientist live during World War II?
4. Which experiment in this article deals with our mental habits?
5. Where did he go to study higher mathematics?
6. Where will he work upon graduation?
7. Why do we habitually link together a person and his name?
8. When was the connection between man's classifying instinct and mathematics recognized?
9. Why can mathematics be applied to the world around us with relative ease?
10. Who was the law of gravitation discovered by?
11. How did people count in the early ages?
12. How long did it take them to create the first computer?

Text 3. What Does a Computer System Consist of?

A computer system consists of two parts: the *software*, which is instructions and programs of the computer, and the *hardware,* which consists of all electronic and mechanical parts of the computer. The basic structure of a computer system contains three main hardware sections: the central processing unit, or CPU, the main memory, or the internal memory, and the peripherals.

The *central processing unit* is the brain of the computer. Its function is to carry out program instructions of the software and to operate the processing of the other computer units. For better video and sound performances or networking, the user can add a specialized expansion card to the CPU of his computer.

The *main memory* stores all the instructions and data processed by the CPU. It usually consists of two sections: RAM (random access memory) and ROM (read only memory). RAM is the memory used for creating, loading and running computer programs. ROM is computer memory which holds the programmed instructions in the system.

The *peripherals* are the devices attached to the computer, which include *input/output units* (mouse, keyboard, monitor, scanner, printer, fax machines, headphones, etc.) and internal storage devices (floppy, hard or optical discs, blue-ray discs, external hard disk drive, flash disc drive, etc.) The input units, such as the mouse and the keyboard, give us an opportunity to transfer data into computer's memory. The output units, for example, the monitor or the printer, enable us to give out the final result of the processing from the computer system. The internal storage devices are used to store both data and programs permanently.

The *software* includes programs for directing all computer operations and electronic data. Software programs are divided into two categories – the *systems software* and the *applications software.* The systems *software* enables the computer system to function. It includes the *operating system*, *drivers* for the hardware devices*, linkers* and *debuggers. The applications software* satisfies the user's specific needs. It is classified according to the sphere of usage, e. g. *games* or *financial* software, *office applications*, etc. Unfortunately, we also have a newer group of software related terms that have a negative association. While the applications software itself may be useful, it may also carry hidden programs or utilities that may cause undesirable effects.

Phonetics

1. Read the following words according to the transcription.

Processing [ˊprəusesiŋ] – обработка
internal [inˊtə:nəl] – внутренний
peripherals [peˊrifərəlz] – периферийные модули
permanently [ˊpə:mənəntli] – постоянно
debugger [diˊbʌgə] – отладчик

Vocabulary

2. Match the following.

1. to load 2. flash card 3. systems software 4. applications software 5. internal storage unit 6. peripherals 7. the central processing unit 8. ROM 9. buffer (store) 10. memory space 11. linker 12. debugger 13. the main memory 14. input/output units 15. floppy disk 16. RAM 17. hardware 18. software	a) карта флэш-памяти b) загрузить c) периферийные устройства d) оперативная память e) внутреннее запоминающее устройство f) прикладные программы g) системное программное обеспечение h) центральный процессор i) главная память j) вводное и выходное устройства (блоки) k) гибкий магнитный диск l) буфер m) линкер, редактор связей n) объём памяти o) отладчик p) постоянная память q) программное обеспечение r) аппаратное оборудование

3. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. download 2. dithering 3. viewer 4. gamer 5. host 6. hypermedia 7. hyperlink 8. domain	a) осуществление связи между элементами интертекстовой системы b) просмотровик для файлов c) скачивать информацию с Интернет-сервера на свой компьютер d) игрок e) механизм получения изображения в HiColor- режимах f) группа компьютеров, управляемых одним сервером g) узел; сервер h) гипермедиа

Text Comprehension

4. Complete the following sentences and translate them into Russian.

1. Software programs are usually divided into …
2. The systems software controls …
3. Applications software is classified …
4. The hardware is all mechanical parts of the computer which consists of …
5. Specialized expansion cards are added to provide …
6. The function of the central processing unit is …
7. The mouse and the keyboard are used …
8. The final results of the processing are given out …
9. The main memory consists of …
10. Software includes programs …

5. Answer the following questions.

1. What two parts does a computer system consist of?
2. What are the three sections of the hardware?
3. What unit is called the brain of the computer?
4. What is the function of the main memory?
5. What units do the peripherals include?
6. What are the main two types of software?
7. What does the systems software include?
8. According to what principle is the applications software classified?

Translation

6. Translate from Russian into English.

1. Прикладные программы приводятся в действие только после установки системного обеспечения.

2. Программы компьютера разделяются на системное программное обеспечение и программное обеспечение по применению (*прикладные программы).*

3. Системное программное обеспечение контролирует все стандартные действия компьютера, такие как включение и выключение, загрузка программ, информирование об объёме памяти и т. д.
4. Программное обеспечение содержит все программы и команды компьютера.
5. Периферийные устройства включают вводный, выходной блоки и внутреннее запоминающее устройство.
6. В системное программное обеспечение входят драйверы для аппаратного оборудования, линкеры и отладчики.
7. Компьютерная система состоит из аппаратного оборудования и программного обеспечения.
8. Прикладные программы классифицируются по сфере применения.
9. Внутреннее запоминающее устройство используется для постоянного хранения информации и программ.
10. Некоторые прикладные программы обладают свойствами, которые приводят к нежелательным последствиям.

Grammar

7. Use the general questions below in indirect speech. Follow the model.

Model:

Did the hypothesis prove to be correct?

You've asked me *if* the hypothesis proved to be correct

1. Does the image of a man usually accompany his name?
2. Is there a connection between the works of mathematicians of all times?
3. Do you visualize a man when hearing his name?
4. Was the theory of relativity a turning point in physical thinking?
5. Has Fermat's last theorem been proved?
6. Was the hypothesis based on the wrong assumption?
7. Does the new method have any advantages over the old one?
8. Do these two phenomena have anything in common?
9. Does he seem to have changed his point of view?
10. Do the results which have been obtained agree with the results that were expected?
11. Did you hear him speak at the conference?
12. Does this law hold for all similar cases?
13. Did you see him switch off the computer?
14. Was Christopher Columbus the first to have travelled from Europe to America?
15. Was your purpose to gain some time?
16. Will you make a report at the seminar?
17. Did you wish to express the same idea in a different way?
18. Did Einstein develop an absolutely new idea of the world we live in?

Text 4. Malware, Adware, Spyware

We have a whole selection of software that may come bundled under the name of malware. Short for *malicious software*, malware is any software that has been designed (*programmed*) specifically to damage or disrupt a computer system. The most common forms of malware are computer viruses, worms, and Trojan horses.

Other common types of software are *adware* and *spyware.* Adware is considered a legitimate alternative offered to consumers who don't wish to pay for software. Today we have a growing number of software developers who offer their goods as *sponsored* freeware until you pay to register. Generally, most or all features of the software are enabled, but you will be viewing sponsored advertisements while the software is being used. If you are using legitimate adware, when you stop running the software, the ads should disappear, and you always have the option of disabling the ads by purchasing a registration key.

Unfortunately, some applications that contain adware track your Internet surfing habits in order to serve ads related to you. When the adware becomes intrusive like this, we move it into the spyware category and it then becomes something you should avoid for privacy and security reasons.

Spyware works like adware, but is usually a separate program that is installed unknowingly when you install another application. Once installed, the spyware monitors user activity on the Internet and transmits that information in the background to someone else. Spyware can also gather information about e-mail addresses and even passwords and credit card numbers.

Unlike adware, spyware is considered a malicious program.

Phonetics

1. Read the following words according to the transcription.

Malware [΄mælwεə] – вредоносные программы
malicious [mə΄liʃəs] – вредоносный
designed [di΄zɑind] – предназначенный
virus [΄vɑiərəs] – вирус
Trojan [΄trɔiən] – троянский
spyware [΄spɑiwεə] – шпионские программы
legitimate [li΄ʤitimit] – законный
purchase, *v* [΄pə:ʧəs] – покупать

Text Comprehension

2. Answer the following questions.

1. What applications are referred to as malware?
2. What are the most common forms of malware?
3. What is adware considered to be?
4. Is adware always freeware?
5. Does the user have the option of disabling the ads?
6. When does adware act as spyware?

7. What is the difference between adware and spyware?
8. How does spyware work?
9. Is spyware as bad as malware?

Vocabulary

3. Match the synonyms.

1. to calculate	a) data
2. to switch on	b) digit
3. to perform	c) to turn on
4. auxiliary devices	d) to carry out
5. information	e) to compute
6. number	f) to watch
7. option	g) peripherals
8. to track	h) to purchase
9. to buy	i) directions
10. instructions	j) choice

4. Match the antonyms.

1. to integrate	a) to disable
2. to receive	b) illegal
3. complex	c) to differentiate
4. to turn on	d) to buy
5. inside	e) inattentive
6. legitimate	f) to put out
7. to sell	g) simple
8. careful	h) sometimes
9. to enable	i) to be alike
10. to differ	j) to release
11. generally	k) soft
12. to accept	l) to disrupt
13. hard	m) to switch off
14. to protect	n) outside

5. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. driver 2. log in 3. zooming 4. Internet 5. card	a) компьютерный аппаратный компонент, выполненный в виде печатной платы b) глобальная всемирная сеть ЭВМ c) щелчок мышью

6. quest 7. click 8. clickability	d) бродилка, разновидность компью-терной игры e) эффективность баннерной рекламы f) масштабирование g) устройство h) подключиться

Grammar

6. Fill in the blanks with appropriate prepositions: ***at, for, in, out, to, of, on, with, by, from.*** **One preposition may be used several times.**

The part …the computer that puts … information is called the output unit. The computer can easily put … information … the form acceptable … people – hardcopy or softcopy forms. The hardcopy output can be held … your hands, such as paper: the text or pictures printed … it. A softcopy is displayed … a monitor. The output unit is varying according … the capacity … the auxiliary equipment receiving information. But all peripherals are slow as compared … the computer. … this case, buffers are used. A buffer is a storage device which is able to accept information … a very high speed … the computer and release the information … the proper speed … the peripheral equipment.

7. Put questions to the following sentences.

1. New mathematical ideas are often developed with no thought of application.
2. The abstractions of mathematics are adopted by scientists to understand the patterns of nature.
3. Mathematical analysis continues to be essential to the development of algorithms.
4. Arithmetic originated with the question: "How much?"
5. Modern algebra has discarded several of the basic conventions of elementary algebra.
6. Einstein showed that Grassman had been 50 years ahead in his thinking.
7. Throughout the centuries, man has refined the ability to record, process, and communicate information.

8. Use the questions in indirect speech following the model (Sequence of Tenses).

Model:

1. They said, "We *will go* to the South". They said that they *would go* to the South.
2 She said, "I *have done* the test." She said that she *had done* the test.
3. They said, "We *saw* the film two years ago." They said that they *had seen* the film two years before."
4. He said, "I *am taking* driving lessons." He said that he *was taking* driving lessons.

5. She said, “I *was reading* for the exam at that time.” She said she *had been reading* for the exam at that time.

1. He said, “I am working on my diploma paper project.”
2. She said, “I haven’t been to the lecture.”
3. They said, “We won’t come to the party.”
4. She said, “We have installed a new antivirus program”.
5. He said, “I wrote the article three years ago.”
6. They said, “We won’t go to France.”
7. He said, “I was working at five o’clock.”
8. She said, “I have been waiting for you since three o’clock.”
9. They said, “The lecture will be held in the assembly hall.”

Text 5. Antivirus Software

Antivirus software can offer protection from the threat of malware: worms, Trojans, viruses and spyware. According to Top Ten Reviews, a good antivirus program can also protect your computer from *phishing scams, keyloggers, rootkits* and *email-borne threats*. *Phishing scams* are programs that appear to be legitimate sites in an attempt to obtain sensitive information from the user. *Keyloggers* track every keystroke made on your computer to steal passwords and account information. A *rootkit* takes control of your computer without your knowledge.

Installation and setup of security software should be simple and quick. In addition, it should be user-friendly, even for beginners. Top Ten Reviews notes that every day users want to be able to install the program and forget about it, without the need for ongoing maintenance.

Antivirus software should include *updates* as new viruses are identified. Automatic updates are often built into the software. Consumer Search notes that most programs include one year of free updates before requiring the purchase of a subscription or a new version.

Signature checking is by far the most common method used by antivirus programs to detect malicious threats. The software has an extensive database of known viruses and malware, and each time it scans a file, it compares the results to the information contained in its database. If the software finds a “signature” match, it will either warn the user or remove it right away, mostly depending on the seriousness of the threat. Some threats can be quarantined by the antivirus program, as well. Basically, it encrypts the file with a different code to render it useless instead of removing it altogether. Of course, with new viruses coming out every day, the database must be kept completely up to date for the software to detect incoming threats.

Another way to detect malicious files or programs on a computer is through *monitoring its behaviour*. Programs that attempt to access certain parts of the root key registry or modify an existing executable file will send a red flag up, and the software will take action against the threat, if necessary. This approach is a good one to use because it can then detect malicious software that has not yet been added to the database simply by the way it is acting. However, this can also lead to the program warning the user about every single thing it finds, which may get irritating over time. Antivirus software is becoming more advanced by the second, though, and these false warnings are being lessened every day.

The third common way for antivirus programs to pick out threats is to *emulate* the file in a safe environment created by the software itself. For instance, if a suspicious file has entered the computer, the program will take the executable files of the program and run them behind the scenes in a simulated setting to see what it does. If the software finds it is indeed malicious and a threat, it will then either quarantine or delete the harmful material before real damage can be done. This method can also trigger false warnings, and at that point it usually leaves it up to the user to decide what to do with the file. If the user recognizes and trusts the program, the antivirus software will let it remain. If the user chooses for the program to take action against it, the perceived threat will be removed.

Phonetics

1. Read the following words according to the transcription.

Antivirus [ˊæntiˊvaiərəs] – антивирусный
phishing scams [ˊfiʃiŋ ˊskæms] – фишинг
keyloggers [ˊki:lɔgəz] – кейлоггеры
rootkits [ˊru:tkit] – руткиты
threat [θret] – угроза
installation [ˌinstəˊleiʃn] – установка (программы)
maintenance [ˊmeintənəns] – техническое обслуживание
upgrade, *v* [ˊʌpˊgreid] – обновить
signature [ˊsignətʃə] – подпись
quarantine [ˊkwɔrənti:n] – карантин
encrypt [inˊkript] – зашифровать
executable [igˊzekjutəbl] – исполняемая программа

Text Comprehension

2. Answer the following questions.

1. What is the purpose of antivirus software?
2. What programs are called phishing scams?
3. What do keyloggers do?
4. What is the danger of a rootkit?
5. What should be done to protect the computer from viruses and malware?
6. Why does antivirus software need updating?
7. How can malicious threats be detected?
8. What does the software do if it detects a threat?
9. Are there any other ways of picking out threats?
10. What is the downside of antivirus programs picking out threats?

Vocabulary

3. Choose the Russian equivalent for the English words given below.

(a) зашифровать – (b) исполняемая программа – (c) эмулировать – (d) устранить угрозу – (e) принять меры –(f) – замеченная угроза – (g) принести вред – (h) ликвидировать – (i) фишинг – (j) изолировать – (k) проникнуть в компьютер – (l) ложные предупреждения – (m) кейлоггер - (n) обновление – (o) пароль – (p) – нажатие клавиши – (q) руткит – (r) вредоносный

(1) – to do damage – (2) to remove the threat – (3) to delete - (4) the perceived threat – (5) executable file – (6) keylogger – (7) to quarantine – (8) to encrypt – (9) rootkit – (10) password – (11) to emulate – (12) upgrading – (13) keystroke – (14) harmful – (15) phishing scams – (16) to enter the computer – (17) false warnings – (18) to take action

Check your skills (***revision***)

4. Match the following.

1. input unit	a) a hand-held device connected with the computer by means of a small cable or Bluetooth
2. hardcopy	b) the part of the computer that takes in information
3. keyboard	c) the output that can be held in your hands (text, pictures)
4. softcopy	d) the part of the computer that coordinates the activity of all other units
5. the mouse	e) the output displayed on a monitor
6. the central processing unit	f) an input device that looks like an electric typewriter
7. malware	g) devices attached to the computer
8. floppy disc	h) malicious software
9. hardware	i) electronic and mechanical parts of a computer
10. software	j) a program installed unknowingly to monitor the user's activity
11. spyware	k) programs for directing all computer operations
12. adware	
13. antivirus software	

14. peripherals	l) internal storage device m) a program offering protection from worms, Trojans, spyware, viruses and malware n) a legitimate alternative for those who do not wish to pay for software ("sponsored" freeware until you pay to register)

5. Choose the right variant.

1. A machine that performs a sequence of reasonable operations is called
a) hardware b) internet c) computer d) buffer

2. A computer system which includes programs for directing all computer operations and electronic data is computer's
a) operative system b) software c) hardware d) main memory

3. The basic structure of … contains three hardware units: the central processing unit, the main memory and the peripheral devices.
a) monitor b) software c) input unit d) hardware

4. … coordinates and controls the activities of all other computer units, reads, interprets software instructions and performs all activities applied to data.
a) Bluetooth b) CPU c) hardcopy d) keyboard

5. The … stores all the instructions and data being currently processed by the CPU.
a) main memory b) flash memory c) external memory d) secondary memory

6. The brain of the computer is its …
a) mouse b) printer c) CPU d) flash drive

7. Computations are performed by
a) RAM b) ROM c) the arithmetic and logic unit d) a power supply unit

8. …give us an opportunity to transfer data into computer's memory
a) input units b) floppy discs c) storage devices d) CD discs

9. The final result of the processing from the computer system is given out by
a) control unit b) keyboard c) buffer d) output unit

10. The computer virtual display device is called
a) internet b) processor c) peripheral device d) monitor

6. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. CODEC 2. creative 3. hosting 4. unit 5. cash memory 6. log in 7. macro 8. master-disk	a) буферная память b) основной диск c) вход d) последовательность действий или команд e) программно-аппаратные средства для работы с аудио- и видеоинформацией f) творческий, создающий что-л. g) управление сервером h) модуль

Grammar

7. Use the imperative sentences in indirect speech.

Model.

1. Don't contradict him.
You've told me not to contradict him.
2. Come at 8.30, please.
You've asked me to come at 8.30.

1. Don't change the conditions of the experiment.
2. Use the rule that you have learnt today.
3. Don't postpone the discussion.
4. Speak louder, please.
5. Don't go into details.
6. Read and memorize the terms.
7. Don't continue working until you process the obtained results.
8. Don't apply the same rule for the two different procedures.
9. Use the same words to denote the same notions.
10. Don't fail to switch off the printer.
11. Read the task carefully so as to avoid the possible errors.
12. Don't test the new method without being given additional time.
13. Copy out the new words.
14. Don't start working on the project without speaking to the head of the laboratory.
15. Don't sign the contract until you have read it to the end.

Text 6. Information, Machine Words, Instructions, Addresses and Reasonable Operations

Information is a set of marks or signs that have meaning. These consist of letters and numbers, digits or characters, typewriter signs and other kinds of signs. A computer reacts differently to different digits or characters, and reacts to them as units that have meaning. For example, information for an analog computer has to be in the form of distances, or rotations, or voltages, or other physical variables. And for a digital computer information has to be in the form of digits or numbers.

Any information can be represented by the binary system including two digits: one (1) and zero (0). Each 1 and zero is a separate binary digit called a *bit*. A *bit* is the smallest part of information. Bits are typically grouped in units that are called *bytes*. A *byte* is the basic unit of information used in modern computers. It consists of eight bits.

The bytes are usually handled in standard groups called *machine words*, or just words. There are two basic types of information or words that can be put into a memory cell or location: words that are numerical quantities and words that are computer instructions. Regularly, an instruction to the machine is expressed as a word; and so the same set of characters may have meaning sometimes as a number, sometimes as an instruction. A speed of 96,000 characters per second is the same as a speed of 8,000 words per second. Most human beings could not take even a 12-digit number per second.

Physically, the set of bits is a set of arrangements of some physical equipment. One of the ways of storing information in a computer is storing by using a set of small magnetically polarized spots on a magnetic surface.

The computer is told what operations to perform by means of instructions. An instruction is a command to the computer. It consists of a verb (an operational code) and a noun (an operand). For example, if the computer is instructed “Add 365 the number of times stated in the register R”, and if the register R stores the code for number 3, then the computer will perform that operation 3 times. An instruction word looks like a number, and there is no way telling from the word itself, whether it is a quantity or an instruction. The computer must be told exactly which address contains an instruction and which contains a quantity.

An address is the name of a particular memory location or cell. Each memory location (word or byte) has its own unique address or number just like a post office box. For example, if the computer contains 100 memory cells, their respective addresses might be the numbers from 1 to 100 (*or 0 through 99).* And instead of saying “A word is in a memory cell”, the computer personnel say, “The content of an address is a word.”

Reasonable operations are mathematical and logical. Mathematical operations include arithmetic and algebraic operations. Arithmetic operations are addition, subtraction, multiplication, division, taking a square root, etc.; and algebraic operations are raising to a power as well as differentiating and integrating.

Logical operations include comparing, selecting, sorting, matching, etc. These are operations which may be performed either on numbers or on expressions consisting of letters such as ordinary words. A very important logical operation performed by a computer is determining, e.g. which of the two operations is to be performed next.

Phonetics

1. Read the following words according to the transcription.

Rotation [rəu΄teiʃən] – вращение
voltage [΄vəultiʤ] – электрическое напряжение
variables [΄vɛəriəblz] – переменные
binary [΄bɑinəri] – двоичный
byte [bɑit] – байт
unique [juː΄niːk] – уникальный
algebraic [ˏælʤi΄breiik] – алгебраический
differentiating [ˏdife΄renʃieitiŋ] – дифференцирование
integrating [΄integreitiŋ] – интегрирование
determine [di΄təːmin] – решать, определять

Vocabulary

2. Match the terms used in the text (1-9) with their definitions (a-g).

1. a bit 2. instruction 3. a byte 4. an address 5. addition 6. selecting 7. a verb 8. a noun 9. determining	a) the name of a particular memory location or cell b) the smallest part of information c) the basic unit of information d) an operational code e) a logical operation f) a mathematical operation g) a very important logical operation h) an operand i) a command to the computer

3. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. motherboard 2. mip-mapping 3. morphing 4. multitexturing 5. multihosting 6. Chat (Internet Relay Chat) 7. multimedia 8. mail	a) интерактивный разговор b) множественная адресация c) электронная почта d) системная плата e) текстура, нарисованная с несколькими уровнями детализации f) многоплановое представление информации

	g) метод рендеринга с использованием нескольких текстур за минимальное число проходов h) проведение преобразования

Text Comprehension

4. Complete the following sentences.

1. Reasonable operations are …
2. Differentiating and integrating are … operations.
3. Comparing is a … operation.
4. There is no way telling from the word itself, whether it is a … or an …
5. The bytes are usually handled in standard groups called …
6. Any information can be represented by the … system including two digits.
7. An instruction word looks like …
8. An address is the name of …
9. The basic unit of information is called …
10. Each memory location has its own …
11. Regularly, an instruction to the machine is expressed …
12. Bits are typically grouped in units that …
13. The computer is told what operations to perform …
14. Algebraic operations are …
15. Information is a set …
16. Each 1 and zero is a separate binary digit called …

5. True or false?

1. An instruction word looks like a phrase.
2. The binary system includes two digits.
3. For an analog computer, information has to be in the form of digits.
4. For a digital computer, information has to be in the form of numbers or digits.
5. An instruction consists of a verb and a noun.
6. Logical operations may be performed only on expressions.
7. Information consists of letters and numbers, digits and different kinds of signs.
8. For a computer, digits and characters are units that have meanings.
9. It is not necessary to tell the computer which address contains an instruction and which contains a quantity.
10. The speed of characters and words per second is the same.

6. Answer the following questions.

1. What is information?
2. What does information consist of?
3. Is the form of information different for analog and digital computers?
4. What system can information be represented by?
5. What is the name for the smallest part of information?
6. What is the basic unit of information?

7. How many bits does a byte consist of?
8. What are the two basic types of information that can be put into a memory cell?
9. What is the ratio of the speed of characters per second and the speed of words per second?
10. What is the role of instructions in computer performance?
11. What does an instruction consist of?
12. What is an address?
13. What are the two types of reasonable operations?
14. What do mathematical operations include?
15. What operations do logical operations include?
16. What is a very important logical operation performed by a computer?

Grammar

7. Translate these sentences paying special attention to the ing-forms.

1. Newton created his theory of Universal Gravitation being only 24 years old.
2. All the necessary changes having been made, the experiment showed different results.
3. With the work completed, it was possible to use the new data in the article.
4. We have defined these sets as being equal.
5. It is no use performing this operation now.
6. Having reduced the fraction, we obtained the expected result.
7. When working with these signs, one must be very careful.
8. On obtaining the difference, one must check the result by addition to make sure it is correct.
9. Being reduced to its lowest terms, the fraction is not changed.
10. Reducing the fraction to its lowest terms leaves it unchanged.
11. The speed of light being extremely great, we cannot measure it by ordinary means.
12. Other things being equal, the given relationship holds for this particular case.
13. With the distance defined, you can expect to find the speed.
14. With an object moving at constant speed, the distance covered is directly proportional to time.
15. The sides of triangles having the same measure, the angles opposite these sides have the same degree measure.
16. The two scientists doing research independently made it possible to create two essentially different ways of solving the same problem.

Text 7. What Is Programming?

A program (routine) is a complete set of instructions for doing a particular task**.** The process of preparing such a program is known as programming. Programming involves the following items:

a. *Consideration of the problem.* Is the problem completely defined? Can we find a method of solution? Will the method fit the computer we use? Will we have enough time, both to prepare the solution on the computer and to run out the answers?

b. *Analysis of the problem*. Does the algorithm that we can use exist? Are there "canned" routines that we can apply? That is, are there parts of this problem for which we may already have the computer solution? How much accuracy do we want? How well we assure ourselves that the solutions are correct? Can we construct test data to check the computer solution?

Thus, *programming* covers all activities from the start of the job up to the end and including flowcharting.

There are *five steps of programming:*

1. making a flow chart
2. actual coding
3. storing the final code into the computer's memory
4. debugging the code
5. running the code and tabulating the result

The first step requires a clear and exact determination of all future calculations which are then presented in a flow chart. The *flow chart* is a diagram or a picture of a code, which is always useful for visualizing the relations between different parts of the code. This diagram is usually made before putting in a particular instruction. There are three types of symbols used in a flow chart: (1) to represent calculation functions; (2) to show various alternatives of decisions; (3) to eliminate the spare lines and indicate which line to follow if the diagram has to follow on the next page.

The second step is the process of actual coding, in which all digits are assigned to the symbols to prepare the final code. At this phase, symbolic coding aids are used.

Then comes the third step when *the final code is entered into the computer memory.* A subroutine (*subcode*) may be used many times, but stored only once in the final code.

The fourth step is the *debugging of the code.* This is the technique of detecting, diagnosing and correcting the errors which may appear in the program.

And finally comes the fifth step, which consists *in running the code and tabulating the results.*

One of the most important details of coding is that the actual bits in the instruction are given not in a binary code. The instruction is represented in the octal equivalent. This means that two octal numbers represent the instruction, and every address will be represented by three octal numbers.

Phonetics

1. Read the following words according to the transcription.

Involve [in´vɔlv] – включать
flow chart [´fləu´tʃɑ:t] – блок-схема
various [´vɛəriəs] – разнообразные
diagram [´dɑiəgræm] – диаграмма
visualize [´viʒjuəlɑiz] – зрительно представить
eliminate [i´limineit] – устранить
phase [´feiz] – этап
assign [ə´sɑin] – присваивать
subroutine [´sʌbru:´ti:n] – подпрограмма
debugging [di´bʌgiŋ] – отладка
technique [tek´ni:k] – способ, метод, приём
octal [´ɔktəl] – восьмеричный

Text Comprehension

2. Answer the following questions.

1. What is a program?
2. What process is known as programming?
3. What items does programming involve?
4. What questions should be kept in mind while preparing a program?
5. What are the five steps of programming?
6. What is a flow chart?
7. What is done to prepare the final code?
8. What is the third step characterized by?
9. What does debugging of the code mean?
10. What does the fifth step of programming consist in?

Vocabulary

3. Match the following.

1. debugging the code	a) ошибка, погрешность
2. to define	b) табулировать, сводить в таблицы
3. to eliminate the spare lines	c) отладка кода
4. error	d) подпрограмма
5. flow chart	e) блок-схема
6. to retain	f) восьмеричные числа
7. subroutine	g) сохранять, удерживать
8. to tabulate	h) объём памяти
9. the final code	i) конечный код
10. memory space	j) рабочие ячейки памяти
11. octal numbers	k) средства символического кодирования
12. symbolic coding aids	l) устранять лишние линии
13. memory location temporaries	
14. crossing lines	

	m) линии пересечения n) формулировать (задачу)

4. Choose the right variant.

1. Coding is
   a) a process in which all digits are assigned to the symbols to prepare the final code
   b) a process of making a flow chart
   c) tabulating the results

2. Programming is
   a) a diagram or a picture of a code
   b) the preparation of a program
   c) a specific address

3. The flow chart is … of a code which is always useful for visualizing the relations between different parts of the code.
   a) a diagram or a picture
   b) a letter
   c) a number

4. Debugging of the code is
   a) running the code
   b) correcting the errors
   c) a process of making subcodes

5. A program is
   a) a complete set of instructions for doing a particular task
   b) a flow chart
   c) a set of subcodes

5. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. boot 2. palette 3. pixel 4. plug-in 5. OS/2 6. provider 7. plug and play 8. proxy server	a) палитра b) сервер заместитель c) подключение новых устройств без необходимости настройки d) самозагрузка системных программных средств e) элемент изображения f) операционная система, разработанная фирмой IBM g) организация, предоставляющая услуги по доступу в Интернет

	h) подключаемый дополнительный модуль для расширения возможностей программы

Translation

6. Check your knowledge translating the text into English.

Что такое программирование?

Робот, производственный станок или бытовой прибор управляется человеком. При этом человек не стоит у прибора и не отдаёт ему команды одна за другой, а определённым образом записывает их последовательность в память машины.

Последовательность команд, определяющая деятельность вычислительной машины в заданных условиях, представляет собой программу. Составление подобных программ – программирование – широко распространённый на сегодняшний день вид человеческой деятельности.

Программа – это план деятельности исполнителя, например, компьютера, по решению определённого типа задач. Для того чтобы составить план, важны логические и иные формы мышления, знание условий выполнения программы и возможностей исполнителя, предугадывание возможных ошибок, а также умение писать программы на понятном исполнителю языке – конкретном языке программирования. Это и есть основные знания, умения и навыки программиста.

Grammar

7. Translate the following sentences paying attention to the use of the Gerund.

1. The students expected being included in the experimental group.
2. Drawing a line in one direction gives you a one-way extension.
3. In naming geometric objects we often use capital letters.
4. We discussed improving the shape of the model.
5. The method is certainly worth applying.
6. He remembered having seen her at the last conference.
7. You should avoid changing the direction of your further investigation.
8. He suggested exchanging information on the subject.
9. They could not avoid including him in their research group.
10. This terminology needs improving.
11. One cannot feel the Earth's moving.
12. The idea of using symbols instead of words proved very helpful.
13. Writing a sentence in algebraic way involves two steps.
14. Our task is proving the correctness of the given statement.
15. The researchers began looking for another solution.

Text 8. Programming Languages

A programming language is an artificial language invented to communicate instructions, or commands, to a computer. In order to distinguish the spectrum of programming languages, we divide them according to the convenience of the machine computing or the work of a programmer. Mnemonic language, mnemonic machine language and assembly language are best for machines, whereas such languages as FORTRAN, ALGOL, BASIC, PASCAL, etc. are best for programmers.

Sometimes the term *machine language* is used to denote computer instructions written in a machine code. This machine code can be immediately obeyed by a computer without translation. It is the coding system adopted in the design of a computer to represent the set of its instructions. The actual machine language is generated by the software, not by the programmer.

A *mnemonic language* deals with symbolic names for each instruction's part. That is easier for the programmer to remember than the numeric code for the machine. These alphanumeric names usually begin with a letter and refer to fields, files and subroutines in a program.

An *assembly language* is mnemonic, its addresses are symbolic, and introduction of data to a program as well as reading of the program is much easier. All these three types of programming languages are the so-called low level languages because they have a single corresponding machine equivalent.

High level programming languages, on the contrary, use the instruction corresponding to several machine code instructions. Such languages as FORTRAN, ALGOL, BASIC, PASCAl, etc. are oriented to the problem, while low level languages are oriented to the computer's machine code.

The programming languages are also divided into three basic categories according to their similarity to English: *machine languages, symbolic languages* and *automatic coding languages*. Comparing the convenience of the languages for the computer and the programmer usages, we can say that the machine languages are used by the computer directly, while symbolic and automatic coding languages are more similar to English, so they are more convenient for the use of the programmer.

Phonetics

1. Read the following words according to the transcription.

Spectrum [ˊspektrəm] – спектр
convenience [kənˊvi:njəns] – удобство
mnemonic [ni(:)ˊmɔnik] – мнемонический
assembly [əˊsembli] – ассемблированный
alphanumeric [ˊælfənju:ˊmerik] – буквенно-цифровой
subroutine [ˊsʌbru:ˊti:n] – подпрограмма
equivalent [iˊkwivələnt] – эквивалент
similarity [ˌsimiˊlæriti] – сходство
automatic [ˌɔ:təˊmætic] – автоматический

Text Comprehension

2. Answer the following questions.

1. What is the function of a programming language?
2. What two groups are programming languages classified into?
3. What is the machine code?
4. What does a mnemonic language deal with?
5. What is characteristic of an assembly language?
6. What is the main point of difference between low level and high level programming languages?
7. Which languages are more similar to English?
8. Are they more convenient for the use of the machine or the programmer?

Vocabulary

3. Choose the variant that suits best.

1. A programming language is a language
   a) a language generated by a programmer
   b) spoken by the programmers
   c) specially designed to communicate instructions to a computer

2. A mnemonic machine language uses:
   a) the numeric code
   b) symbols, such as letters and numbers
   c) symbolic addresses

3. An assembly language has the following advantages for the programmer's use:
   a) it is a low level language
   b) the processes of reading and introduction of data are made easier
   c) it uses numeric names

4. According to the article,
   a) high level programming languages use the instruction corresponding to several machine code instructions
   b) such high level programming languages as FORTRAN, ALGOL, BASIC, PASCAL, etc. are oriented to the computer's machine code
   c) low level languages have several corresponding machine equivalents

5. Symbolic and automatic coding languages are more convenient for
   a) the computer
   b) the programmer usages
   c) English speaking users

6. The machine code, or auto code can be … by a computer without translation.
   a) stored
   b) immediately obeyed
   c) sequentially retained

4. Complete the following sentences with one of the words given below.

(a) recognition – (b) simplicity – (c) originally – (d) convenient – (e) advantages – (f) problems – (g) descendent – (h) reasonable – (i) variety

1. An indirect address allows great ... (1) ... in programming.
2. The PASCAL programming language was ... (2) ... developed by Niklaus Emil Wirth.
3. Symbolic and automatic coding languages are more similar to English, so they are more ... (3) ... for the use of the programmer.
4. ALGOL was developed as an international language which gained more ... (4) ... in Europe than in the United States.
5. The ... (5) ... of using GLOBOL are that it is simple in learning, programs can be quickly written and tested.
6. The idea of an automatic computer that would not only add, multiply, subtract, and divide but perform the sequence of ... (6) ... operations was given by the English scientist Charles Babbage.
7. PASCAL is noted for its ... (7) ... and structured programming design.
8. ADA is a PASCAL-based language designed for both commercial and scientific ... (8)....
9. PASCAL, which was named after the mathematician Blaise Pascal, is a direct ... (9) ... from ALGOL60, which Wirth helped to develop.

5. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. resampling	a) новое, переделанное из старого
2. chip, chip set	b) подкачивать
3. rendering	c) компьютер, управляющий сетью
4. remake	d) место; совокупность веб-страниц
5. site	e) растеризация; отрисовка
6. swap	f) считыватель
7. scanner	g) процедура изменения размера изображения в пикселях
8 server	h) микросхема

Grammar

6. Read the text below and put different types of questions to the contents of each paragraph.

The Internet

The *Internet* is a global computer network which embraces hundreds of millions of users all over the world and helps people to communicate with each other.

The history of the Internet began in the United States in 1969. It was a military experiment designed to ensure survival during a nuclear war when everything around could be polluted by radiation, and it would be dangerous for anybody to get out and obtain some information.

Nowadays, the most popular Internet services are *e-mail* and *Social Networks*. Most of the people use the Internet for sending and receiving e-mail messages and communicating in social networks, over Viber or Skype. Lots of people gamble and play through the net.

However, there are some problems. *Security* is the most important of them. Although there are some encoding programs to secure the information, they are not perfect and can be easily cracked.

Another serious problem of the net is *control.* The Internet is like a tremendous library and a huge market, over which there is no effective control yet. In the future, the situation will, hopefully, change for the better, but for the time being, we have to put up with the shortcomings of the present day international, or global computer network.

7. Fill in the blanks with appropriate forms (passive voice, participle, gerund, forming nouns from verbs, singular and plural nouns).

The History and Future of the Internet

The Internet technology ... (to create)[1] … by Vinton Cerf in early 1973 as part of a project ...(to head)[2] … by Robert Kahn and ... (to conduct)[3] … by the Advanced Research Projects Agency, part of the United States Department of Defence. In 1984, the technology and the network ... (to turn over)[4] … to the private sector and to government scientific agencies for further ... (to develop)[5] … . The ... (to grow)[6] … has continued exponentially. Service-provider ... (company)[7] … that make *gateways* to the Internet available to home and business users enter the market in ever-increasing numbers. The Internet and its technology continue to have a profound effect in ... (to promote)[8] … the exchange in information, ... (to make)[9] … possible rapid transactions among businesses, and ... (to support)[10] … global collaboration among individuals and organizations. The ... (to develop)[11] … of the World Wide Web ... (to lead)[12] … to the rapid introduction of new business tools and activities and to the constant growth of business transactions on the Internet.

8. Follow the model and insert the required form of the verb.

Model:
It would be helpful if you (to find) the article.
It would be helpful if you found the article.

1. It would be natural if they (to give) you their data.
2. It would be useful if they (to see) how you worked.
3. It would be natural if they (to stimulate) the research.
4. It would be very helpful if she (to make) these calculations.
5. You would solve this problem if you (to find) the value of the unknown.
6. They would improve the situation if they (to suggest) some modification.

7. He would be sure of the result if he (to check) it.
8. It would be easier to make a correct conclusion if they (to describe) the process in greater detail.
9. You would understand his work in case you (to know) the work of his predecessors in this area.
10. We would have a better situation if he (to clarify) his statement.

Text 9. Algorithms

Several decades ago the word *algorithm* was unknown to most educated people; indeed, it was scarcely necessary. The rapid rise of computer science, which has the study of algorithms as its focal point, has changed all that: the word is now essential. There are some other words that almost, but not quite, capture the concept that is needed: procedure, recipe, process, routine, method. Like these things, an algorithm is a set of rules or directions *(instructions*) for getting a specific output from a specific input. The distinguishing feature of an algorithm is that all vagueness must be eliminated; the rules must describe operations that are so simple and well-defined that they can be executed by a machine. Furthermore, an algorithm must always terminate after a finite number of steps.

A computer program is the statement of an algorithm in some well-defined language, although the algorithm itself is a mental concept that exists independently of any representation. Anyone who has prepared a computer program will appreciate the fact that an algorithm must be very precisely defined, with attention to detail that is unusual in comparison with other things people do. Programs for numerical problems were written as early as 1800 B. C., when Babylonian mathematicians gave rules for solving many types of equations. The rules as step-by-step procedures were applied systematically to particular numerical examples. The word *algorithm* itself originated in the Middle East, although, at a much later time. Curiously enough, it comes from the Latin version of the last name of the Persian scholar Abu Jafar Mohammed ibn Musa Al-Khwarizmi (Algorithmi), whose textbook on arithmetic gave birth to algebra as an independent branch of mathematics. It was translated into Latin in the 12^{th} century and had a great influence on the development of computing procedures. The name of the textbook's author became associated with computations in general and used as a term *algorithm.*

Originally, algorithms were concerned solely with numerical calculations; Euclid's algorithm for finding the greatest common divisor of two numbers is the best illustration. Euclid's powerful algorithm has become a basic tool in modern algebra and number theory. Nowadays, the concept of algorithm is one of the most fundamental notions not only in mathematics, but in science and engineering.

Experience with computers has shown that the data manipulated by programs can represent virtually anything. In all branches of mathematics, the task to prove the solvability or insolvability of any problem requires a precise algorithm. In computer science, the emphasis has now shifted to the study of various structures by which information can be represented and to the branching or decision-making aspects of algorithms, which allow them to fall on one or another sequence of operations depending on the state of affairs at the time. It is precisely these features of algorithms that sometimes make algorithmic models more suitable than traditional mathematical models for the representation and organization of knowledge.

Although numerical algorithms have many interesting features, there are non-numerical ones and, in fact, algorithms in Cybernetics deal primarily with manipulation of symbols that need not represent numbers. Algorithm-designing is both pure and applied branches of Cybernetics. Current algorithms are becoming more and more refined and sophisticated.

Since computers "think" differently from people, methods that work well for the human mind are not necessarily the most efficient when they are translated to a machine.

Phonetics

1. Read the following words according to the transcription.

Algorithm[ˈælgəriθm] – алгоритм
scarcely [ˈskεəsli] – едва
Al-Khwarizmi [ʻæl kəˈrizmi]- Аль-Харизми
cybernetics [ˌsɑibəˈnetiks] – кибернетика
sophisticated [səˈfistikeitid] – сложный

Text Comprehension

2. Complete the following sentences.

1. Nowadays, the concept of algorithm is …
2. Originally, algorithms were concerned …
3. Algorithm-designing is both …
4. Current algorithms are becoming …
5. Experience with computers has shown that …
6. A computer program is the statement of …
7. The distinguishing feature of an algorithm is that …
8. Algorithms in Cybernetics deal primarily with …
9. The name of the textbook's author became associated with …
10. In computer science, the emphasis has now shifted to the study of the decision-making …

3. Answer the following questions.

1. How did the rise of computer science affect the use and fate of the word *algorithm?*
2. What words are close to the word *algorithm* in their general meaning?
3. How is an algorithm defined?
4. What is the most characteristic feature of an algorithm?
5. Can a computer program be called the statement of an algorithm?
6. What should a programmer remember while defining a logarithm?
7. Was the notion of algorithm applied to numerical problems in the past?

8. What is the origin of the word *algorithm*?
9. Is the concept of algorithm a fundamental notion in mathematics only?
10. What does Cybernetics study in the field of computer science?
11. Are algorithmic models sometimes more suitable than traditional mathematical models?
12. Has Cybernetics both pure and applied branches?
13. Is a machine expected to "think" the same way with people or differently from them?

Vocabulary

4. Fill in the gaps using the words / forms of the words given below.

(a) basic tool – (b) represent – (c) number – (d) representation – (e) organization – (f) originate – (g) insolvability –(h) set – (i) change – (j) exist

1. There are many properties of Euclid's powerful algorithm which has become a …(1)... in modern algebra and number theory.

2. Euclid's algorithms for finding the greatest common divisor of … (2) ... – is the best illustration.

3. In all branches of mathematics, the task to prove the solvability or … (3)... of any problem requires a precise algorithm.

4. In computer science, the emphasis has now shifted to the study of various structures by which information … (4) ... .

5. It is precisely these features of algorithms that sometimes make algorithms models more suitable than traditional mathematical models for the … (5) ... and … (6) ... of knowledge.

6. The word *algorithm* itself … (7) ... in the Middle East.

7. An algorithm is a … (8) ... of rules or directions (instructions) for getting a specific output from a specific input

8. The algorithm itself is a mental concept that … (9) ... independently of any representation.

9. The rapid rise of computer science, which has the study of algorithms as its focal point, has radically … (10) ... the fate of the term *algorithm:* its use has become essential.

5. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. scanning 2. script 3. smile	a) накопитель на магнитной ленте b) образец c) гладкая кривая, проходящая через

4. soft 5. hard disk 6. spline 7. streamer 8. sample	точки, управляющие формой сплайна d) смайлик e) сценарий, макрос f) просмотр, поиск, анализ g) программируемый; *сокр*. от software h) жёсткий магнитный диск

Grammar

6. Put questions to the following sentences.

1. A. M. Turing pioneered research in computer logic, undecidability theory and artificial intelligence.
2. It is clear that the intellectual capabilities of a human being are directly related to the functioning of his brain.
3. The ability to solve certain types of problems has been studied and made the basis of intelligence tests, but the generality and validity of these tests are disputable.
4. Newton, for example, might have scored low on such tests when he was an adolescent (11-16); yet, he is estimated by some researchers to have had an Intelligence Quotient (I. Q.) near 200.
5. One of the shortcomings of these tests is that they predict little concerning the development of a person's intelligence, especially what problems he could learn to solve.
6. The ordinary conception of human intelligence is that it is limited, but it can learn and, thereby, improve its performance of certain tasks with time.
7. The central goals of artificial intelligence are to make computers more useful and to understand the principles which make intelligence possible.
8. Computers are ideal experimental subjects, for they exhibit unlimited patience and require no feeding.
9. Moreover, it is usually simple to deprive a computer program of some piece of knowledge in order to test how important that piece really is.

7. Comment on the speaker's statements. Follow the model.

Model:

She cannot give you the journal now. (next week).

I hope she will be able to do it next week.

1. They could not operate the machine well. (in some time)
2. She cannot translate scientific articles. (next year)
3. I cannot obtain enough information. (in a few days)
4. He cannot solve this complicated problem. (with your help)
5. They cannot produce such complicated computers now. (in the future)
6. She cannot present her abstract today. (tomorrow).
7. He cannot speak English fluently now. (after he has completed the language course)

8. They cannot take part in the work of the research group this year. (next year)

8. Answer the speaker's question using the model.

Model:

1. Did you have to change the whole system? (the method)
No, we didn't. We had to change the method.
2. Are they to take an examination? (a credit test)
No, they aren't. They are to take a credit test.

1. Do you have to speak to the teacher? (the dean)
2. Does he have to work in the lab? (in the library)
3. Did they have to control the operation? (to check the result)
4. Will we have to perform many operations? (only one)
5. Does he have to translate only one text? (both texts)
6. Are they to take 5 exams? (only 3)
7. Are you to begin your work now? (in a few days)
8. Are you to write an essay? (to make a report)
9. Were you to go to the lecture? (to the seminar)
10. Were you to take part in the competition? (in the Olympiad)

Text 10. Cybernetics

The word *cybernetics* originated from the Greek *kybernetike* meaning *control, management* and *supervision.* In this sense, it is related to the Latin *gubernator* and the English *governor. Cybernetics* was used by Norbert Wiener as a name for his book dealing with a concrete wartime problem. Nowadays the word has become associated with the solution of problems dealing with activities for computers. As such, Cybernetics must rely on exact sciences, as well as such sciences as biology, psychology, biochemistry and biophysics, neurophysiology and anatomy.

Before studying computer systems, it is necessary to distinguish between computers and calculators. The term *calculator* will refer to a machine which (1) can perform arithmetic operations (2) which is mechanical (3) which has a key-board input (4) which has manually operated controls. (Examples: adding machines, desk calculators). The term *computer* will refer to automatic digital computers which can (1) solve complete problems, (2) are generally electronic, (3) have various rapid input-output devices, (4) have internally stored control programs (routines). Speed and general usefulness make a computer equivalent to thousands of calculators and their operators. The ability of electronic computers to solve mathematical and logical problems, augmenting the efficiency and productivity of the human brain, has made the sphere of their application practically boundless.

It is difficult to say what the future holds in store for Cybernetics. Every day, we are learning more and more about the penetration of Cybernetics into different spheres of human activity. The launching of sputniks and the delivery of our space rockets to their orbits with such high accuracy could have been hardly possible without computers. This, however, does not mean that a machine can ever become "cleverer" than its creator. The point is that the machine does not replace man, it only increases his work output and multiplies his power over the forces of nature. It should be remembered that it is the machine that serves the man, and not the other way round. Without man, even the most perfect machine would be only a useless heap of metal.

In terms of computer development, Cybernetics is concerned with the design and construction of electronic analogs of living entities. In terms of understanding the operation of the human nervous system, Cybernetics contributes a new insight into such processes as learning, regulation and the emotional behaviour of individual human beings as well as societies.

So far, Cybernetics has made a significant contribution to the technology of guided missiles, business and scientific computer applications, communications and automatic control. Invading a wide range of fields in human activity, it endeavours to find the answer to two major questions: the best way of controlling this or that process, and the best way of utilizing a machine (if possible) for controlling this process.

Phonetics

1. **Read the following words according to the transcription**.

Supervision [ˏsju:pəˈviʒən] – наблюдение
biology [bɑiˈɔləʤi] – биология
psychology [sɑiˈkɔləʤi] – физиология
biophysics [ˏbɑiəuˈfiziks] – биофизика
neurophysiology [ˏnjuərəuˏfiziˈɔləʤi] – нейрофизиология
anatomy [əˈnætəmi] – анатомия
calculator [ˈkælkju:leitə] – калькулятор, вычислительный прибор
augment [ɔ:gˈment] – увеличивать, усиливать
accuracy [ˈækjurəsi] – точность
entity [ˈentiti] – существо
insight [ˈinsɑit] – понимание
guided [ˈgɑidid] – управляемый
missile [ˈmisɑil] – снаряд
endeavour, *v* [inˈdevə] – пытаться
utilize [ˈju:tilɑiz] – использовать

Text Comprehension

2. Answer the following questions.

1. What is the meaning of the Greek word the term *cybernetics* originated from?
2. Who was the name Cybernetics first used by?
3. Did Norbert Wiener solve a concrete or an abstract theoretical problem?
4. How is Cybernetics related to computers?
5. What sciences is Cybernetics connected with?
6. What is the efficiency of computers as compared with that of calculators?
7. What is the goal of Cybernatics in the sphere of computer development?
8. How does Cybernetics contribute to the study of man?
9. What is the contribution of Cybernetics to science and technology?

10. What are the two questions Cybernetics is concerned with nowadays?

Vocabulary

3. Choose the right word.

1. (a) A computer/ (b) calculator solves complete problems.
2. The word *cybernetics* is of (a) Latin / (b) Greek origin.
3. Norbert Wiener wrote his book (a) to develop the foundations of the science / (b) to solve a practical problem.
4. The word *cybernetics* is related to the meaning (a) *to control*/ (b) *to create*.
5. Cybernetics relies on (a) linguistics / (b) anatomy.
6. A computer's aim is (a) to substitute for man / (b) to enlarge man's abilities.
7. Cybernetics aims at (a) creating a machine that is cleverer than man / (b) searching for the best way of controlling this or that process.

4. Match the synonyms.

1. to multiply	a) important
2. to replace	b) speaking about
3. to penetrate	c) to differentiate
4. to endeavour	d) connected with
5. to utilize	e) to do
6. in terms of	f) to understand
7. to distinguish	g) to prepare (to have in the future)
8. to perform	h) precision
9. the other way round	i) control
10. to hold in store	j) on the contrary
11. dealing with	k) to use
12. accuracy	l) to increase
13. to gain an insight into	m) to get into
14. significant	n) to substitute
15. regulation	o) to try

5. Match the most frequently used computer terms with their definitions or equivalents in Russian.

1. thesaurus	a) шрифт
2. tracking	b) наушники
3. utility	c) словарь
4. head-phones	d) сервисная программа (для устранения ошибок и др.)
5. flash memory	e) простановка межбуквенных пробелов для растягивания или сжатия пространства между ними
6. font	f) перезаписываемая память
7. hacker	g) сокр. от *hardware*
8.hard	h) программист, использующий воз-
9. HTML	

	можности компьютера в обход средств операционной системы i) язык для гипертекстовой разметки документов

Grammar

6. Put questions to the following sentences.

1. N. Wiener, the father of Cybernetics, is the author of 200 scientific papers and 11 books.
2. Wiener's mathematical prodigy helped him obtain his doctorate in science at the age of 19.
3. He had laid the foundations of the new science and coined the title *Cybernetics*.
4. The use of the word Cybernetics, however, goes back to Plato, who applied it to the science of steering ships.
5. The French scientist Ampere (XIX c.) used the same word, *Cybernetics,* for the study of the control of society.
6. Wiener's definition of Cybernetics is still generally being used.
7. Cybernetics bears all the hallmarks of an explosive science.
8. Man has been building more and more powerful computers since 1940s.
9. Nevertheless, man has remained computer's slave as he has still to control them.
10. The Third Industrial Revolution with computers capable of controlling themselves is looming on the horizon.
11. One is justified to call cybernetics a veritable 20th century Queen of Sciences.
12. The social sciences will have much to gain from Cybernetics in the future.
13. There is no realm of human activity in which Cybernetics will have no role to play in the future.

Discussion

7. Read the text and express your opinion of the questions tackled in it. See the questions following the text.

What Does it Take to Be an Educated Person?

One of the definitions of an *educated man* offered at a discussion organized in the United States of America runs as follows:

An educated man:

- is able to read, write, and do arithmetic;
- has a basic knowledge of the history and geography of world and man;
- understands the scientific method, and has an elementary knowledge of at least one science;
- has an elementary knowledge of mathematics and logic;
- knows at least one other language besides his own well enough to read it and talk a little in it;
- can say what he means in suitable words, both speaking and writing;

- is able to listen, knows how to learn, and enjoys learning;
- never forgets that his views and opinions may be wrong, and is always ready to change them on evidence;
- has an elementary knowledge of computers and programming, and some active experience with a computer is highly desirable.

An educated man 200 years ago in the United States did not need to know anything about science. The educated man of 40 – 45 years ago did not need to know anything about computers. But the educated man of today needs to have at least some significant knowledge of science, and at least a little significant knowledge about computers.

The summary knowledge that an educated man should know about computers could be put down on ten sheets of paper, in about 3,000 words.

Questions to focus on:

1. Do you agree with all the points mentioned in the text?
2. Which of them do you consider to be the most important?
3. What role is assigned to learning mathematics?
5. Is the knowledge of computers important in different spheres of life nowadays?
6. Are computer-related jobs in great demand now?
7. Does computer literacy influence an applicant's employment prospects?
8. Are advanced computer user's skills an advantage?
9. How can a person benefit from having programming skills?
10. Why is the knowledge of a foreign language mentioned among the other points?
11. Does the knowledge of history and geography broaden the mind?
12. How do you enlarge your knowledge of these subjects? Do you read books and magazines, use the Internet, travel and watch interesting TV programmes?
13. Do you agree that it is really important for an educated person to be able to express himself/herself adequately? Why is it a problem with many people nowadays?
14. Why is it important for any man to learn to think clearly?
15. Do all people have the gift of listening?
16. Is an ability to listen a result of learning or is it an inborn gift?
17. Is it essential for a contemporary specialist to be able to study on his own and refresh his knowledge all his life?
18. Should every child be taught to experience the joy of learning? Does the school instill in the pupils an emotional drive for creation and a desire to do research?
19. Are all people capable of changing their views with time?
20. Do people readily side with their opponents in a discussion?

21. Judging by the number of the points you've scored, are you an educated person or are you on the way to being one?

8. Agree or disagree with the following statements. Use the formulas of agreement and disagreement.

Formulas of agreement	*Formulas of disagreement*
That's right.	I don't think so.
Exactly. Certainly.	It's wrong, I am afraid.
I fully agree with it.	Quite the reverse.

1. Some people believe that a computer is a monster that will ultimately destroy us.
2. Others see in the powers of computers an Arabian genie that will create new wonders and a higher living standard for the human race.
3. Computers are mysterious, incomprehensible, stupid, and frightening.
4. Computing math specialists are not abstract-minded persons, they are applied mathematicians.
5. People do not deal with algorithms in their daily life.
6. Man is a Turing machine.
7. Computers possess subconscious faculties.
8. A robot could be dangerous to humans.
9. Contradiction is a stimulus to thought.
10. Men are better than women in math.
11. Math requires logic, not intuition.
12. Some people have a *math mind*, and some don't.
13. Math is done by working intensely until the problem is solved.
14. There is a best way to solving math problems.
15. Math is not creative.

Part III. Scientists

Text 1. ARCHIMEDES

Archimedes was the greatest mathematician, physicist and engineer of antiquity. He was born in the Greek city of Syracuse on the island of Sicily about 287 B.C. and died in 212 B. C. Roman historians have related many stories about Archimedes. There is a story which says that once when Archimedes was taking a bath, he discovered a phenomenon which later became known in the theory of hydrostatics as Archimedes' principle. He was asked to determine the composition of the golden crown of the King of Syracuse, who thought that the goldsmith had mixed base metal with the gold. The story goes that when the idea how to solve this problem came to his mind, he became so excited that he ran along the streets naked shouting "Eureka, eureka!" ("*I have found it!*"). Comparing the weight of pure gold with that of the crown when it was immersed in water and when not immersed, he solved the problem.

Archimedes was obsessed with mathematics, forgetting about food and the bare necessities of life. His ideas were 2000 years ahead of his time. It was only in the 17th century that his works were developed by scientists.

There are several versions of the scientist's death. One of them runs as follows. When Syracuse was taken by the Romans, a soldier ordered Archimedes to go to the Roman general, who admired his genius. At that moment, Archimedes was absorbed in the solution of a problem. He refused to fulfill the order and was killed by the soldier.

Archimedes laid the foundations of mechanics and hydrostatics and made a lot of discoveries. He added new theorems to the geometry of the sphere and the cylinder and stated the principle of the lever. He also discovered the law of buoyancy.

Pronunciation guide

Archimedes [ˌɑ:ki΄mi:diz] – Архимед
Syracuse [΄sɑirəkju:z] – Сиракузы
antiquity [æn΄tikwiti] – древний мир
phenomenon [fi΄nɔminən] – явление
hydrostatics [ˌhɑidrəu΄stætiks] – гидростатика
eureka [juə΄ri:kə] – эврика!
Immerse [ɪ΄mə:s] – погружать
genius [΄ʤjniəs] – гениальность
cylinder [΄silində] – цилиндр
lever [΄li:və] – рычаг
buoyancy [΄bɔiənsi] – плавучесть (погружённых тел)

Comprehension check

1. When and where was Archimedes born?
2. How did he discover the famous principle known under his name in the theory of hydrostatics?
3. What was his emotional reaction to the solution of the problem?
4. What was Archimedes ordered to do when Syracuse was taken by the Romans?
5. Why did he refuse to fulfill the order?
6. What happened to him upon the refusal?
7. What were his contributions to science?

Text 2. EUCLID

Little is known to us about the life of Euclid. Very few of his works have survived. It is believed that Euclid lived in Egypt in approximately 330—275 B.C. When the famous Library of Alexandria was founded, he was invited to open the mathematical school. His most famous book on geometry which was called "Elements" was written by him between 330 and 320 B. C. This fundamental book written more than 2,000 years ago, is still regarded as the best introduction to the mathematical sciences. The book has been translated into many languages. Euclid's "Elements" is still used in Britain as a textbook on geometry.

It is said that when Euclid was asked if there was an easier way to master geometry than by studying "Elements", he said, "There is no royal road to geometry." Besides "Elements", there is a collection of his geometrical theorems, "The Data". The first printed edition of Euclid's books appeared in the 15th century.

Pronunciation guide

Euclid [΄ju:klid] – Эвклид
Egypt [΄i:gipt] – Египет
survive [sə΄vɑiv] *зд.* дойти до наших дней
Alexandria [ˏælig΄zɑ:ndriə] – Александрия
fundamental [΄fʌndə'mentl] – фундаментальный (труд)
"Elements"[΄eliments] – «Начала»
geometrical [ʤiə΄metrikəl] – геометрический

Comprehension check

1. Is much known to our contemporaries about the life of Euclid?
2. What country did he live in?
3. What is his most famous book on geometry called?
4. What is the scientific importance of this book?
5. In what quotation did Euclid stress the difficulty of mastering geometry?
6. What other book by Euclid is well known in the mathematical world?
7. When were his books printed?

Text 3. GALILEI

Galileo Galilei was an outstanding Italian astronomer who contributed to mathematics in the early part of the 17^{th} century. Galilei was born in Pisa in 1564. He was the son of an impoverished Florentine nobleman. Galilei began as a medical student, but later he took up science and mathematics, in which he possessed remarkable talent.

When Galilei was 25, he was appointed professor of mathematics at Pisa, and at the same time he continued to perform experiments. But the social atmosphere was not friendly in Pisa, and in 1592, Galilei left that city and became professor of mathematics at Padua. Here, for nearly 18 years, he continued his experiments and his teaching and he became very popular.

In about 1607, Galilei heard of the invention of the telescope and he decided to make some instruments of his own. Soon he produced a telescope that had a magnifying power of more than 30 diameters. With his telescope, he observed sun-spots, the mountains on the Moon, the phases of Venus, Saturn's rings, and the four bright satellites of Jupiter. These discoveries roused the opposition of the Church, and in 1633, Galilei was summoned to appear before the Inquisition and forced to recant and declare publicly that the Earth did not move. But the fight was not over. In 1634, Galilei finished another book, in which the ideas condemned by the Church were voiced again. Some years later, he became blind. He died in 1642.

To Galilei, we owe the idea of a harmony between experiment and theory. He founded the mechanics of freely falling bodies and laid the foundation of dynamics in general. He invented the first modern type of microscope. Galilei made very interesting statements showing that he had grasped the idea of equivalence of infinite classes, a fundamental point in Cantor's theory of sets in the 19^{th} century, which has influenced the development of modern analysis. These statements and many of Galilei's ideas in dynamics were published in Leyden in 1638.

Pronunciation guide

Galileo Galilei [gæli΄leiəu gæli'lei] – Галилео Галилей
Pisa [΄pi:zə] – Пиза
Florentine [΄flɔ: rəntɑin] – флорентийский
Padua [΄pɑ: dəvə] – Падуя
Venus [΄vi:nəs] – Венера
Saturn [΄sætən] – Сатурн
Jupiter [΄ʤu:pitə] - Юпитер
satellite [΄sætilɑit] – спутник
inquisition [ˏinkwi΄ziʃən] – инквизиция
condemn [kən΄dem] – осуждать
telescope [΄teliskəup] – телескоп
equivalence [ɪ΄kwivələns] – тождество, эквивалентность
dynamics [dɑi΄næmiks] – динамика
Leyden [΄leidən] – Лейден

Comprehension check

1. What was Galilei by origin?
2. What centuries did he live in?
3. What did Galilei study when he first became a student?
4. What post was he offered when he was 25?
5. Why did he leave for Padua?
6. When did Galilei produce a telescope?
7. What did he observe with his telescope?
8. What was the attitude of the Church to Galilei's discovery?
9. What was he forced to do when he was summoned to appear before the Inquisition in 1633?
10. Did he give up scientific work after that?
11. What happened to him before he died?
12. What was Galilei's contribution to science?

Text 4. Pierre de Fermat

Pierre de Fermat was born in Toulouse, France, on the 17th of August, 1601, and died on the 12th of January, 1665. He came from a wealthy family and studied law in Orleans. After graduating, he began to practise law. By 1652, he had become the chief magistrate of the criminal court. Magistrates in those days spent large amounts of time on their own. It was during this time that de Fermat worked in the field of mathematics. In fact, his devotion to this science was so great, that he spent as much free time as he could, working on mathematical problems and solutions. Although de Fermat published very little in his lifetime, he is still considered to be one of the greatest mathematicians of all times.

Pierre de Fermat made his greatest contribution to mathematics in number theory, and it had an important impact on the study of calculus. His works foreshadowed the later analytic geometry of Descartes and allowed him to define such important curves as hyperbola and parabola, the spiral of Fermat, and the cubic curve, known as the witch of Agnesi. In optics, Fermat formulated the principle of least time.

Together with the great French mathematician and inventor of the first calculating machine Blaise Pascal, Fermat also laid the foundation of probability theory.

Fermat's methods were so advanced that many of his results were not proved for a century after his death, and Fermat's last theorem took more than three hundred years to prove. He made his most important conjecture in number theory while reading the *Arithmetica* by Diophantus. He stated the problem, but added that there was too little room in the margin for his proof (he used to make notes in the margin of the books he was reading). His theorem was finally proved in 1994.

Pronunciation guide

Pierre de Fermat [pi΄er də fer΄mɑ:] – Пьер Ферма
Toulouse [tu΄lu:z] – Тулуза
magistrate [΄mæʤistrit] – судья

contribution [ˏkɔntriˈbju:ʃən] – вклад
impact [ˈimpækt] – влияние
foreshadow [fɔ:ˈʃædəu] – предвосхищать
hyperbola [hɑiˈpə:bələ] – гипербола
parabola [pəˈræbələ] – парабола
spiral [ˈspɑiərəl] – спираль
conjecture [kənˈʤektʃə] – предположение
Blaise Pascal [ˈbleiz pæˈskæl] – Блез Паскаль
Diophantus [dɑiˈɔfəntəs] – Диофант

Comprehension check

1. Where and when was Pierre de Fermat born?
2. What was the social status of his family?
3. What was his qualification?
4. How did he spend his spare time working as a judge?
5. Did Fermat publish much in his lifetime?
6. What was his greatest contribution to mathematics?
7. Were Fermat's results easily proved?
8. The work of what great mathematician helped him to develop number theory?
9. Where did he use to make notes and write proofs?
10. When was his last theorem finally proved?

Text 5. ISAAC NEWTON

Isaac Newton, one of the greatest men in the history of science, was born in a little village in England in 1642. His father was a farmer and he had died before Isaac was born. The farm was situated in a lonely place where there were no schools, and Newton got his education in a school in the neighbouring village. At the age of twelve, he was sent to the Grammar school. Soon he became the best pupil in his school. Newton did not take part in games like his schoolmates, he spent a lot of time constructing models. He made a model of a windmill, a wooden clock that was driven by water, and other things. The mother wanted her son to become a farmer, so when he was fourteen, he began working on the farm. But soon his mother realized that it was no use teaching him farm work, because he was always busy reading books, constructing models or observing various phenomena in nature. At the age of nineteen, he became a student of Cambridge University. He began to study physics, astronomy and mathematics. Soon he became one of the best students there.

Once, when young Newton was sitting in the garden of his home, a ripe apple fell on his head. Newton took the apple and thought, "Why does the apple fall down? Why doesn't it fall up instead?" So, he came to the conclusion that the apple and the Earth were pulling each other and began to think that the same laws of gravity extended far beyond the Earth. Newton deduced and calculated the force of gravity acting between the Sun and the planets, thus establishing the law of gravitation in its most general form.

He studied the nature of light and colour and came to the conclusion that white light is composed of many different colours known to us as the spectrum. Such a phenomenon was quite unknown before Newton's work. These results laid the foundation of modern spectroscopy and greatly enriched the field of optics.

Newton developed a mathematical method indispensable in all questions concerning motion. This method is known by the name of differential and integral calculus. He discovered laws of motion which are still considered to be the basis of all calculations concerning motion.

Newton's contribution to science is so great that he may be considered the founder of modern mathematics, physics and spectroscopy. So long as humanity lives, Isaac Newton, the greatest of men of science, will never be forgotten.

Newton died in 1727 at the age of eighty-four and was buried in Westminster Abbey.

Pronunciation guide

Isaak Newton [΄ɑizək ΄nju:tən] – Исаак Ньютон
Cambridge [΄keimbriʤ] – Кэмбридж
astronomy [əst΄rɔnəmi] – астрономия
gravity [΄ɡræviti] – притяжение
spectrum [΄spektrəm] – спектр
spectroscopy [spekt΄rɔskəpi] – спектроскопия

Comprehension check

1. What was Isaak Newton by origin?
2. Did he study well at school?
3. Was he interested in games?
4. What was his favourite occupation?
5. What did his mother want him to be?
6. What did he study at Cambridge University?
7. What helped him establish the law of gravitation in its most general form?
8. How did his works contribute to the field of optics?
9. What was his contribution to mathematics?
10. When did he die and where was he buried?

Text 6. ALBERT EINSTEIN

Albert Einstein is known as the greatest mathematical physicist. His relativity theory was one of the five or six great discoveries comparable to those of Galilei and Newton. Albert Einstein was born in southern Germany in 1879. As a boy, Albert was unsociable, slow and very honest. His unusual talent for mathematics and physics began to show very early. He was very good at mathematics, and at the age of twelve, he worked out his own methods for solving equations.

In 1896, Albert Einstein was admitted to the Zurich Polytechnic as a student in mathematics and physics. He soon realized that he was a physicist rather than a mathematician. At the age of 21, after four years of study at the university, which he graduated brilliantly, he began to work as a clerk at an office. And in 1905, he made some revolutionary discoveries in science. He published three papers. In his first paper, he explained the photoelectric effect with the help of M. Plank's quantum theory. His second paper was a mathematical development of the theory of Brownian motion. His third paper was entitled "Special Theory of Relativity". It must be mentioned that a great contribution to the theory of relativity had been made earlier by the great mathematicians Lorenz and Poincare. Einstein's work was published in a physical journal. It stated that energy equals mass multiplied by the square of the speed of light. This theory is expressed by the equation: $E = mc^2$ [si΄skwεəd].

Scientists all over the world met this work with interest and surprise. But only very few physicists realized the importance of his theory at that time.

The word *relativity* refers to the fact that all motion is purely relative; in a ceaselessly moving universe, no point can be fixed in place and time from which events can be measured absolutely.

Another of Einstein's great discoveries was *unified field theory*. It was the result of 35 years of intensive research work. He expressed it in four equations where he combined the physical laws that control forces of light and energy with the mysterious force of gravitation.

After his discoveries, Albert Einstein became famous. Soon he was appointed Professor of Physics at Zurich Polytechnic. Then he got the professorship at Prague, where he remained until 1913.

Albert Einstein gave all his life to science. He was an extremely talented man and a great thinker. He was always looking at the world around him with his eyes wide open, and he was always asking: "Why? Why is that so?"

Einstein was a very simple, open man. His greatest quality was modesty. He was always highly critical of his own work. Einstein improved the old law of gravitation to satisfy more of the facts. In 1921, he received the Nobel Prize for physics and was elected member of the Royal Society.

When the Nazis came to power in Germany in the 1930s, Einstein, who hated them, went to England, living in semi-secrecy and appearing from time to time at public protest meetings. In 1933, he went to America where he took up the post of Professor of Theoretical Physics at the Institute of Advanced Studies at Princeton.

Albert Einstein died in 1955 at the age of 76. His ideas made a revolution in natural sciences of the 20th century, and his contribution to science is so great that his name is now familiar to all educated people on the planet.

Pronunciation guide

Albert Einstein [΄ælbət ΄ɑinstɑin] – Альберт Эйнштейн
Zurich [΄zu(ə)rik] – Цюрих
Prague [prɑ:g] – Прага
the Royal Society [΄rɔiəl sə΄sɑiəti] –Академия наук

the Nazis [ˈnɑ:tsiz] – нацисты
Princeton [ˈprinstən] – Принстон

Comprehension check

1. Is Albert Einstein known mostly as a mathematician or as a physicist?
2. Whose discoveries was his relativity theory comparable to?
3. What country was he born in?
4. What qualities did he reveal in his childhood?
5. How old was Albert when he worked out his own methods for solving equations?
6. Where did he study when he realized the he preferred physics to mathematics?
7. Where did he work as professor when he became famous?
8. What kind of man was Einstein?
9. When was he awarded the Nobel Prize for physics?
10. Why did Einstein emigrate to England?
11. Where did he work in America?
12. Is Einstein one of the best known scientists of the world?

Text 7. N. I. Lobachevsky

Nikolai Ivanovich Lobachevsky was born in 1792 in Nizhny Novgorod. After his father's death in 1797, the family moved to Kazan where Lobachevsky graduated from the University. He stayed in Kazan all his life, occupying the position of dean of the faculty of Physics and Mathematics and president of Kazan University. He lectured on mathematics, physics, and astronomy.

Lobachevsky is the creator of a non-Euclidean geometry. His first book appeared in 1829. Few people took notice of it. Non-Euclidean geometry (as a matter of fact, the name is due to Gauss) remained for several decades an obscure field of science. Most mathematicians ignored it. The first leading scientist who realized its full importance was Riemann.

There is one axiom of Euclidean geometry whose truth is not obvious. This is the famous postulate of the unique parallel which states that through any point not on a given line, one and only one line can be drawn parallel to the given line. For centuries, mathematicians have tried to find proof of it in terms of the other Euclidean axioms because of the wide-spread feeling that the parallel postulate is of a character essentially different from the others. It lacks the plausibility which an axiom of geometry should possess.

At that time, any geometrical system not in absolute agreement with that of Euclid's would have been considered as obvious nonsense. Kant, the most outstanding philosopher of the period, formulated this attitude in his statement that Euclid's axioms are inherent in the human mind, and, therefore, have no objective validity for *real* space. But, in the long run, there appeared a conviction that the unending failure in the search for a proof of the parallel postulate was due not to any lack of ingenuity, but rather to the fact that the parallel postulate is really independent of the others.

What does the independence of the parallel postulate mean? Simply that it is possible to construct a consistent system of geometrical statements dealing with points, lines, etc., by deduction from a set of axioms in which the parallel postulate is replaced by a contrary postulate. Such a system is called a non-Euclidean geometry. It required the intellectual courage of Lobachevsky to realize that such a geometry, based on a non-Euclidean system of axioms, can be perfectly consistent.

Lobachevsky settled the question by constructing in all detail a geometry in which the parallel postulate does not hold.

Non-Euclidean geometry has developed into an extremely useful instrument for application in the physical world.

After 1840, Lobachevsky published a number of papers on convergence of infinite series and the solution of definite integrals. In modern reference books on definite integrals, about 200 integrals were solved by Lobachevsky.

Non-Euclidean geometry is of great importance in the study of the foundations of mathematics. Lobachevsky was the father of the most famous revolution in mathematics, but the tsarist government erected no monument to commemorate the event. Instead, the government relieved him of his job as head of the University of Kazan at the age of fifty-four – this with no explanation whatsoever, to a mathematician so great and well-known throughout the world. Lobachevsky survived this disgrace, but his health failed and he went blind.

Pronunciation guide

non-Euclidean geometry [ˊnɔn juːˊkliːdjən] – не-Эвклидова геометрия
Gauss [ˊgɑus] – Гаусс
Riemann [ˊriːmən] – Риман
Kant [ˊkɑːnt] – Кант
decade [ˊdekeid] – десятилетие
obscure [əbˊskjuə] – незаметный
unique [juːˊniːk] – уникальный
plausibility [ˊplɔːzəˊbiliti] – очевидность, правдоподобность
inherent [inˊhiərənt] – врождённый, изначальный
ingenuity [ˏinʤiˊnjuːiti] – оригинальность (мышления)
convergence [kənˊvəːʤəns] – сходимость (бесконечного ряда)

Comprehension check

1. What place was Lobachevsky born in?
2. Where did he get his higher education?
3. Where did he live and work all his life?
4. What discovery is Lobachevsky known by in the world of mathematics?
5. Did his first book on non-Euclidean geometry produce a sensation?
6. Who is the term *non- Euclidean* geometry due to?
7. Who was the first great scientist that paid attention to Lobachevsky’s work?

8. Why couldn't mathematicians find proof of the parallel postulate?
9. Euclidean geometry was firmly rooted in the scholars' minds, wasn't it?
10. What philosopher contributed to such an attitude?
11. Is the parallel postulate replaced by a contrary postulate in the non-Euclidean geometry?
12. What quality did Lobachevsky reveal when he came out with a new theory?
13. What is the scientific value of Lobachevsky's discovery?
14. What were his other contributions to mathematics?
15. Was Lobachevsky duly appreciated by the tsarist government during his life time?
16. Is he held in high esteem by his descendants at present?

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Assignment

Tell your groupmates about one more famous scientist, his biography, achievements, discoveries and contribution to science. Do it in writing and, if possible, in the form of presentation.

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