МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ
УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

СЕВЕРО-КАВКАЗСКАЯ ГОСУДАРСТВЕННАЯ АКАДЕМИЯ

М.Г. Харатокова

ENGLISH FOR STUDENTS OF MATHEMATICS

Учебное пособие

Черкесск, 2023

УДК 811.111
ББК 81.432.1
Х 20

Рассмотрено на заседании кафедры гуманитарных дисциплин.
Протокол № 1 от «21» сентября 2022 г.
Рекомендовано к изданию редакционно-издательским советом СКГА.
Протокол № 24 от «26» сентября 2022 г.

Рецензенты:
Кашароков Б.Т.– доктор филологических наук, профессор
Тлисова С.М. – кандидат педагогических наук, доцент
.
Х20 Харатокова, М.Г. ENGLISH FOR STUDENTS OF MATHEMATICS [Текст]: учебное пособие / М.Г. Харатокова – Черкесск: БИЦ СКГА, 2023 – 96 с.

В учебном пособии представлены задания к практическим занятиям по дисциплине «Иностранный язык (английский)». Целью пособия является развитие коммуникативных умений и навыков различных видов работ на английском языке. Учебное пособие включает различные тексты на иностранном языке, упражнения для закрепления нового материала, словарь математических терминов, приложения. Предназначено для работы в группах бакалавров направлений подготовки «Прикладная математика».

УДК 811.111
ББК 81.432.1

CONTENTS

Методическая записка

Настоящее учебное пособие по английскому языку предназначено для бакалавров. Целью пособия является овладение студентами компетенциями устного и письменного профессионально-ориентированного общения на английском языке. В задачи пособия входит развитие навыков и умений самостоятельно работать с аутентичными текстами на английском языке, Пособие состоит из двух частей (одна из которых включает шесть разделов, вторая – четыре), приложения, содержащие информацию о том, как писать аннотацию, основные математические формулы и словарь математических терминов. Каждый раздел содержит тематические тексты и задания для их полного и точного понимания, а также задания по развитию коммуникативных компетенций. Предтекстовые задания знакомят студентов с содержанием учебных текстов и способствуют усвоению и запоминанию специальных терминов по направлению обучения, устраняют трудности понимания прочитанного материала. Послетекстовые упражнения позволяют определить уровень усвоения изученного материала, способствуют развитию навыков устного и письменного перевода, монологической и диалогической речи. 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. 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.

В пособие также включены творческие задания по подготовке презентаций и докладов. Пособие может быть рекомендовано к использованию для аудиторной и самостоятельной работы студентов.

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. 6 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, 7 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.

1. Read the following words.

Arabic – арабский

Arabs – арабы

arithmetic – арифметика

arithmetic = arithmetical, adj. – арифметический

calculate – вычислять

abacus – счёты

calculator – вычислитель калькулятор

Chinese – китайский

Columbus – Колумб

Calandri – Каландри

record - записывать

reasonable – разумный

manuscript – 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 2. to tell time 3. to perform operations 4. exact time 5. rarely 6. to invent 7. digit 8. to store information 9. to record 10. device 11. ancient times 12. to prosper 13. abacus 14. to print 15. counting table

a) определять время b) далёкое прошлое c) точное время d) выполнять операции e) изобретать f) редко g) хранить информацию h) однозначное число i) приспособление j) записывать k) процветать l) древние времена m) счётная доска n) счёты 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. 9 … 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 19th century, however, mathematics came to be regarded increasingly as the science of relations, or as the science that draws necessary conclusions. The latter view encompasses mathematical or symbolic logic, the science of using symbols to provide an exact theory of logical deduction and inference based on definitions, axioms, postulates, and rules for combining and transforming positive elements into more complex relations and theorems.

Phonetics

1. Read the following words.

processes – процессы
algebra – алгебра
Geometry – геометрия
cognition – познание
deduce – выводить (заключение, следствие, формулу)
encompass – заключать
symbolic – символический
deduction – вычитание
inference – вывод, заключение
postulate – постулат
axiom – аксиома
theorem – теорема

Vocabulary

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

1. foundations 2. concise 3. the study of 4. measuring 5. to deal with 6. applied 7. pure 8. contemporary 9. concept 10. Mixture 11. to transform 12. to regard 13. to constitute 14. magnitude 15. sets 16. quantity

a) наука о b) измерение (действие) c) прикладной d) совокупность e) краткий f) основы g) множества h) понятие i) теоретический j) рассматривать k) величина l) количество m) преобразовывать n) современный o) изучать p) основы 11

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 19th century, mathematics … 4. Mathematics deals with the space forms and quantity relations … 5. Arithmetic is

the study of … 6. Geometry is the study of … 7. Mathematics is the product of … 8. One of the modern definitions of mathematics …

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. 12 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 $5 \times 2 = 10$ (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 – сложение
subtraction – вычитание
multiplication – умножение
division – деление
addend – слагаемое суммы
summand – слагаемое суммы (любой член суммы)
minuend – уменьшаемое
subtrahend – вычитаемое
inverse – обратный
multiplier – множитель
multiplicand – множимое
dividend – делимое
divisor – делитель
equation – уравнение
quotient – 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

1. addend 2. subtrahend 3. minuend 4. multiplier 5. multiplicand 6. quotient 7. divisor 8. dividend 9. remainder 10.inverse operation 11.equation 12.product 13. difference

Table B

a) уменьшаемое b) слагаемое c) частное d) уравнение e) делимое f) множимое g) остаток h) обратное действие i) делитель j) вычитаемое k) разность l) произведение 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.

Ancient – древний
Mesopotamian – месопотамский
Babylonian – вавилонский
Egypt – Египет
Egyptian – египетский
Alexandria – Александрия
Diophantus – Диофант
Al-Khwarizmi –Аль Каризми
Abu Kamil – Абу Камиль
Islamic – мусульманский
Omar Khayyam – Омар Хайям
Persian – персидский
polynomial – многочлен
astronomer – астроном
algebraic – алгебраический
philosopher – философ
Rene Descartes – 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 AlKhwarizmi. 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 2. development 3. solution 4. records 5. quadratic 6. to work out 7. polynomial 8. unknown 9. discovery 10. ancient 11. indeterminate 12. Identity 13.root 14. power 15. cubic

a) решение b) вклад c) достижение d) степень e) кубический f) разрабатывать g) открытие h) неизвестное i) многочлен j) корень k) древний l) неопределённый m) тождество n) письменные материалы 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.

Methodology – методология
trial-and-error – метод проб и ошибок
approximation – приближение
axiomatic – аксиоматичный
external – внешний
paradigm – парадигма
trigonometry – тригонометрия
Muslim – мусульманский
Pierre de Fermat – Пьер де Ферма
Euler – Эйлер
Monge – Монж
Carl Frederich Gauss – Карл Фридрих Гаусс
Janos Bolyai – Ян Боляй
Euclid – Эвклид
Euclidean – Эвклидовый
infinite – бесконечный
Riemann – Риман
Einstein – 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 in- 22 dependently 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.

Nicolaus Copernicus – Николай Коперник

Johannes Kepler – Иоганн Кеплер

Galilei – Галилей

Isaak Newton - Исаак Ньютон

logarithms – логарифмы

John Napier – Джон Напир

Justus Byrgius – Юстас Бирджес

Gottfried Wilhelm Leibniz – Готфрид Вильгельм Лейбниц

integral - интеграл
Rene Descartes – Рене Декарт
Pierre de Fermat – Пьер де Ферма
Joseph Louis Lagrange –Жозеф Луи Лагранж
treatise – трактат
conic - коническое сечение
Appollonius – 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?

PART II

Unit 1. MATHEMATICS AS A SCIENCE

Task 1. In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. What is Mathematics from your point of view? 2. Is Mathematics a science? 3. How does Mathematics function in real life?

Task 2. Practise reading the following words.

№ Word Transcription

1 mathematics ['mæθɪ'mætɪks] 2 arithmetic ['ærɪθ'metɪk] 3 geometry [ʤɪ'ɔmɪtrɪ] 4 pythagorean [paɪ'θægə'rɪən] 5 pure [pjuə] 6 applied [ə'plaɪd] 7 processes ['prəusesiz] 8 generalization ['ʤen(ə)rəlaɪ'zeɪʃ(ə)n] 9 theorem ['θɪərəm] 10 axiom ['æksɪəm] Task 3. Study and remember the following words. № Word Transcription Translation 1 cognition [kɔg'nɪʃ(ə)n] познание 2 deduce [dɪ'dju:s] выводить (заключение, следствие, формулу) 3 encompass [ɪn'kʌmpəs] заключать 4 symbolic [sɪm'bɔlɪk] символический, символьный 5 deduction [dɪ'dʌkʃ(ə)n] вывод, доказательство 6 inference ['ɪnf(ə)rəns] вывод, заключение 7 relation [rɪ'leɪʃ(ə)n] связь, отношение 8 postulate ['pɔstjuleɪt] постулат 9 quantity ['kwɔntɪtɪ] количество, величина 10 magnitude ['mægnɪtju:d]

абсолютная величина 11 property ['prɔpətɪ] показатель, свойство 12 concise [kən'saɪs] краткий, сжатый, сокращенный 6 13 latter ['lætə] последний из двух 14 counting ['kauntɪŋ] счет, вычисление, подсчет 15 concrete ['kɔŋkri:t] определенный

Task 4. Read and translate Text A using a dictionary if necessary.

Text A

MATHEMATICS

Mathematics is the product of many lands and it belongs to the whole of mankind. We know how necessary it was even for the early people to learn to count and to become familiar with mathematical ideas, processes and facts. In the course of time, counting led to arithmetic and measuring led to geometry. Arithmetic is the study of number, while geometry is the study of shape, size and position. These two subjects are regarded as the foundations of mathematics. It is impossible to give a concise definition of mathematics as it is a multifield subject. Mathematics in the broad sense of the word is a peculiar form of the general process of human cognition of the real world. It deals with the space forms and quantity relations abstracted from the physical world. Contemporary mathematics is a mixture of much that is very old and still important (e.g., counting, the Pythagorean theorem) with new concepts such as sets, axiomatics, structure. The totality of all abstract mathematical sciences is called Pure Mathematics. The totality of all concrete interpretations is called Applied Mathematics. Together they constitute Mathematics as a science. One of the modern definitions of mathematics runs as follows: mathematics is the study of relationships among quantities, magnitudes, and properties of logical operations by which unknown quantities, magnitudes and properties may be deduced. In the past, mathematics was regarded as the science of quantity, whether of magnitudes, as in geometry, or of numbers, as in arithmetic, or the generalization of these two fields, as in algebra. Toward the middle of the 19th century, however, mathematics came to be regarded increasingly as the science of relations, or as the science that draws necessary conclusions. The latter view encompasses mathematical or symbolic logic, the science of using symbols to provide an exact theory of logical deduction and inference based on definitions, axioms, postulates, and rules for combining and transforming positive elements into more complex relations and theorems.

Task 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? 7 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?

Task 6. Give Russian equivalents to these word combinations.

1. foundations 2. concise 3. the study of 4. measuring 5. to deal with 6. applied 7. pure 8. contemporary 9. concept 10. mixture

Task 7. Find the English equivalents to the following word combinations.

1. измерение (действие) 2. изучать 3. преобразовывать 4. множества 5. рассматривать 6. современный 7. количество 8. логический вывод 9. чистая математика 10. прикладная математика

Task 8. Match the terms with their translation.

№ Term Translation 1 mankind a подсчет, вычисление 2 to become familiar with b привести к 3 counting c человеческое познание 4 to belong to d познакомиться с 5 human cognition e совокупность 6 to lead to f составлять 7 in the broad sense g принадлежать 8 totality h число 9 to constitute i человечество 10 number j в широком смысле 8 Task 9. Mark true (T) or false (F) sentences. 1. Mathematics is the product of many lands. 2. Arithmetic and calculus are regarded as the foundations of mathematics. 3. Geometry is the study of shape, size and position. 4. The totality of all abstract mathematical sciences is called Applied Mathematics. 5. The totality of all concrete interpretations is called Pure Mathematics. 6. Mathematics is the study of relationships among quantities, magnitudes, and properties of logical operations by which unknown quantities, magnitudes and properties may be deduced. 7. In the past, mathematics was regarded as the science of quantity, whether of magnitudes, as in geometry. 8. Toward the middle of the 18th century mathematics came to be regarded as the science of relations. 9. The theory of logical deduction and inference is based on definitions, axioms, postulates, and rules for combining and transforming positive elements into more complex relations and theorems. 10. Contemporary mathematics is a mixture of much that is very old and still important with new concepts such as sets, axiomatics, structure. Task 10.Insert the necessary word from the chart into the gaps. science, magnitudes, geometry, number, count, multifield, mankind, measuring, quantity relations, conclusions 1. Mathematics belongs to the whole of … . 2. It was necessary even for the early people to learn to … 3. In the course of time, … led to geometry. 4. Arithmetic is the study of … . 5. Mathematics is a … subject. 6. Mathematics deals with the space forms and … abstracted from the physical world. 7. Applied mathematics and pure mathematics constitute mathematics as a …. 8. Mathematics is the study of relationships among quantities …, and properties of logical operations. 9. Mathematics was regarded as the science of quantity, whether of magnitudes, as in … . 10. Mathematics came to be regarded as the science that draws necessary ….

Task 11.

Match the beginnings and the endings of the given sentences.

№ Beginnings Endings 1 It was necessary for the early people to become familiar a with new concepts such as sets, axiomatics, structure. 2 In the course of time, counting led b mathematical or symbolic logic. 3 Geometry is the study c is called Pure Mathematics. 4 Mathematics is a peculiar form of the general process d with mathematical ideas, processes and facts. 9 5 Contemporary mathematics is a mixture of much that is very old and still important (e.g., counting, the Pythagorean theorem) e by which unknown quantities, magnitudes and properties may be deduced. 6 The totality of all abstract mathematical sciences f of shape, size and position. 7 The totality of all concrete interpretations g of human cognition of the real world. 8 Mathematics is the study of relationships among quantities, magnitudes, and properties of logical operations h on definitions, axioms, postulates, and rules for combining and transforming positive elements into more complex relations and theorems. 9 The science that draws necessary conclusions encompasses i is called Applied Mathematics. 10 The theory of logical deduction and inference is based j to arithmetic.

Task 12.

In pairs, take turns to interview your partner about understanding what mathematics is. What questions do you think are the most relevant?

Task 13.

Retell Text A.

Task 14. Write a short essay on the suggested topics. The volume of the essay is 200-250 words. Suggest some other relevant essay topics.

1. Mathematics is the product of many lands. 2. Mathematics as a science. 3. Mathematics: past, present, future.

Task 15.

Read the words and try to remember the pronunciation.

1. primitive man ['prımıtıv 'mæn] – первобытный человек 2. count [kaunt] – считать 3. possessions [pə'zeʃ(ə)nz] – собственность 4. express a number [ık'spres ə 'nʌmbə] – обозначить число 5. inseparable part [ın'sep(ə)rəb(ə)l] – неотделимая часть 6. everyday life ['evrıdeı 'laıf] – повседневная жизнь 7. decimal system ['desım(ə)l 'sıstım] – десятичная система 8. value ['vælju:] – значение 9. digit ['dıʤıt] – цифра 10. ten times as great ['ten 'taımz æs'greıt] – в десять раз больше 11. Hindu-Arabic ['hındu: 'ærəbık] – индоарабская 12. number system ['nʌmbə 'sıstım] – числовая система 13. suffice for [sə'faıs'fɔ:] – быть достаточным для 14. proper place ['prɔpə 'pleıs] – подобающее место 10 15. large numbers ['lɑ:ʤ 'nʌmbəz] – многозначные числа 16. separate ['sep(ə)rıt] – отделять 17. unit ['ju:nıt] – единица 18. comma ['kɔmə] – запятая 19. billion ['bılјən] – миллиард

Task 16.

Read Text B.

Translate it from English into Russian.

Text B

MATHS IN REAL LIFE

Many thousands of years ago this was a world without numbers. Nobody missed them. Primitive men knew only ten number-sounds. The reason was that they counted in the way a small child counts today, one by one, making use of their fingers. The needs and possessions of primitive men were few: they required no large numbers. When they wanted to express a number greater than ten they simply combined certain of the ten sounds connected with their fingers. Thus, if they wanted to express “one more than ten” they said “one-ten” and so on. Nowadays Maths has become an inseparable part of our lives and whether we work in an office or spend most of our time at home, each one of us uses Maths as a part of our everyday life. No matter where we are as well as whatever we are doing, Maths is always there whether you notice it or not. The system of numbers we use, called Arabic system, is a decimal system: that is, it is based on tens. In this system the value a digit represents is determined by the place it has in the number; if a digit is moved to the left one place, the value it represents becomes ten times as great. Our present-day number-symbols are Hindu characters. It is important to notice that no symbols for zero occur in any of these early Hindu number system. They contain symbols for numbers like twenty, forty, and so on. A symbol for zero had been invented in India. The invention of this symbol for zero was very important, because its use enabled the nine Hindu symbols 1, 2, 3, 4, 5, 6, 7, 8 and 9 to suffice for the representation of any number, no matter how great. The work of a zero is to keep the other nine symbols in their proper place. To make it easier to read large numbers, we separate the figures of the numbers by commas into groups of three, counting from right to left. Each group is called a period and has its own name. 682,000,000,000 847,000,000 136,000 592 Billions Millions Thousands Ones / Units 4 periods 3 periods 2 periods 1 period These numbers are read: six hundred eighty-two billion, eight hundred fortyseven million, one hundred thirty-six thousand, five hundred and ninety-two.

AFTER TEXT TASK

Task 17.

Answer the following questions on Text B.

1. When did people begin to count? 2. What purposes did the primitive people use numbers for? 3. Why are mathematics and numbers important? 4. What spheres of our life do we use Maths in? 5. What numeration system do we use nowadays? 6. How many digits do we use in our Hindu-Arabic system of numeration? 7. Why do we separate figures of the numbers by commas? 8. How is each group of three figures called? 9. How is the system of numbers we use called? 10. How many digits does a period of a number contain? 11. What is the function of a zero?

Part 2

MAIN BRANCHES OF MATHEMATICS

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. What are the main branches of mathematics? 2. What does each branch of mathematics study? 3. Why is it important to be aware of the specific branches of mathematics?

Task 2.

Practise reading the following words.

№ Word Transcription

1 foundations [faun'deɪʃ(ə)nz] 2 algebra ['ælʤɪbrə] 3 probability ['prɔbə'bɪlɪtɪ] 4 statistics [stə'tɪstɪks] 5 trigonometry [trɪgəˈnɒmɪtrɪ] 6 calculus [ˈkælkjʊləs] 7 fundamental ['fʌndə'mentl] 8 theory ['θɪ(ə)rɪ] 9 topology [tə'pɒlədʒi,

tə'pɑ:l-] 10 concept ['kɔnsept] 11 triangle ['traɪæŋg(ə)l] 12 addition [əˈdɪʃn] 13 subtraction [səbˈtrækʃn] 14 multiplication [mʌltɪplɪˈkeɪʃn] 15 division [dɪˈvɪʒən]

Task 3.

Study and remember the following words.

№ Word Transcription

1 interlinked [ˌɪntə'lɪŋkt] взаимосвязанный 2 overlapping ['əuvə'læpɪŋ] перекрывающийся, частично совпадающий 3 pursue [pə'sju:] добиваться, стремиться 4 exponent [ɪk'spəunənt] экспонент, степень 5 manipulate [mə'nɪpjuleɪt] управлять, оперировать 6 equation [ɪ'kweɪʒ(ə)n] уравнение, равенство 7 rate of change ['reɪt ɔv 'ʧeɪnʤ] скорость изменения 8 curve [kɜ:v] кривая 9 determine [dɪ'tɜ:mɪn] устанавливать, определить 10 indispensable ['ɪndɪ'spensəb(ə)l] необходимый, обязательный 11 integer ['ɪntɪʤə] целое число 12 stretching ['stretʃɪŋ] растяжение 13 crumpling ['krʌmplɪŋ] комкание, смятие 14 twisting ['twɪstɪŋ] скручивание, верчение 15 bedding ['bedɪŋ] наслоение

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

MAIN BRANCHES OF MATHEMATICS

Mathematics is a complex area of study and comprises interlinked topics and overlapping concepts. An extensive analysis of the branches of mathematics helps students in organizing their concepts clearly and develop a strong foundation. Being aware of the specific branches of mathematics also guides students in deciding the branch they would like to pursue as a career. Here are the main branches of mathematics: 1. Foundations 2. Arithmetic 3. Algebra 4. Geometry 5. Trigonometry 6. Calculus 7. Probability and Statistics 8. Number Theory 9. Topology 10. Applied mathematics Arithmetic This is one of the most basic branches of mathematics. Arithmetic deals with numbers and their applications in many ways. Addition, subtraction, multiplication, and division form its basic groundwork as they are used to solve a large number of questions and progress into more complex concepts like exponents, limits, and many other types of calculations. This is one of the most important branches because its 13 fundamentals are used in everyday life for a variety of reasons from simple calculations to profit and loss computation. Algebra A broad field of mathematics, algebra deals with solving generic algebraic expressions and manipulating them to arrive at results. Unknown quantities denoted by alphabets that form a part of an equation are solved for and the value of the variable is determined. A fascinating branch of mathematics, it involves complicated solutions and formulas to derive answers to the problems posed. Geometry Dealing with the shape, sizes, and volumes of figures, geometry is a practical branch of mathematics that focuses on the study of polygons, shapes, and geometric objects in both two-dimensions and three-dimensions. Congruence of objects is studied at the same time focusing on their special properties and calculation of their area, volume, and perimeter. The importance of geometry lies in its actual usage while creating objects in practical life. Trigonometry Derived from Greek words “trigonon” meaning triangle and “metron” meaning “measure”, trigonometry focuses on studying angles and sides of triangles to measure the distance and length. Amongst the prominent branches of mathematics used in the world of technology and science to develop objects, trigonometry is a study of the correlation between the angles and sides of the triangle. It is all about different triangles and their properties! Calculus It is one of the advanced branches of mathematics and studies the rate of change. With the advent of calculus, a revolutionary change was brought about in the study of maths. Earlier maths could only work on static objects but with calculus, mathematical principles began to be applied to objects in motion. Used in a multitude of fields, the branch can be further categorized into the differential and integral calculus both starkly different from each other. Differential calculus deals with the rate of change of a variable and it is a means of finding tangents to curves. Integral calculus is concerned with the limiting values of differentials and is a means of determining length, volume, or area. Probability and Statistics The abstract branch of mathematics, probability and statistics use mathematical concepts to predict events that are likely to happen and organize, analyze, and interpret a collection of data. Amongst the relatively newer branches of mathematics, it has become indispensable because of its use in both natural and social sciences. The scope of this branch involves studying the laws and principles governing numerical data and random events. Presenting an interesting study, statistics, and probability is a branch full of surprises. Number Theory It is a branch of pure mathematics devoted primarily to the study of integers and integer-valued functions. Number theorists study prime numbers as well as the properties of mathematical objects made out of integers (for example, rational 14 numbers) or defined as generalizations of the integers (for example, algebraic integers). The basic level of Number Theory includes introduction to properties of integers like addition, subtraction, multiplication, modulus and builds up to complex systems like cryptography, game theory and more. Topology Topology is a much recent addition into the branches of Mathematics list. It is concerned with the deformations in different geometrical shapes under stretching, crumpling, twisting and bedding. Deformations like cutting and tearing are not included in topologies. Its application can be observed in differentiable equations, dynamical systems, knot theory, and Riemann surfaces in complex analysis. Applied Mathematics Applied mathematics is the application of mathematical methods by different fields such as physics, engineering, medicine, biology, finance, business, computer science, and industry. Thus, applied mathematics is a combination of mathematical science and specialized knowledge. The term "applied mathematics" also describes the professional specialty in which mathematicians work on practical problems by formulating and studying mathematical models.

AFTER TEXT TASKS

Task 5.

Answer the following questions.

1. What are the specific branches of mathematics? 2. What does arithmetic deal with? 3. What does algebra involve? 4. Why is geometry called a practical

branch of mathematics? 5. What Greek words did the word ‘trigonometry’ derive from? 6. What objects does trigonometry study? 7. Why did calculus bring a revolutionary change in the study of maths? 8. What do differential calculus and integral calculus deal with? 9. Why are probability and statistics called indispensable? 10. What is Number Theory devoted to? 11. What does the basic level of Number Theory include? 12. What is topology concerned with? 13. What does applied maths deal with?

Task 6.

Look through the text to search for unfamiliar words and try to understand their general meanings.

Task 7.

Write down the transcription and definitions of unfamiliar words, practise reading the words and try to remember them.

Task 8.

Give Russian equivalents to these word combinations.

1. to pursue as a career 15 2. basic groundwork 3. simple calculations 4. congruence of objects 5. the rate of change 6. to find tangents to curves 7. limiting values of differentials 8. to predict events 9. integer-valued functions 10. differentiable equations 11. Riemann surface 12. specialized knowledge 13. stretching 14. twisting 15. professional specialty

Task 9.

Find the English equivalents to the following words and word combinations.

1. множество причин 2. прийти к результатам 3. неизвестная величина 4. измерять расстояние и длину 5. в движении 6. резко отличаться 7. дифференциальное исчисление 8. интегральное исчисление 9. набор данных 10. случайные события 11. обобщения целых чисел 12. геометрические фигуры 13. теория узла 14. комкание 15. Наслоение

Task 10.

Match the terms with their definitions.

№ Term Defenition

1 Arithmetic a deals with the rate of change of a variable and it is a means of finding tangents to curves. 2 Algebra b use mathematical concepts to predict events that are likely to happen and organize, analyze, and interpret a collection of data. 3 Geometry c is concerned with the deformations in different geometrical shapes under stretching, crumpling, twisting and bedding. 4 Differential d deals with numbers and their applications in many 16 calculus ways. 5 Integral calculus e is the application of mathematical methods by different fields such as physics, engineering, medicine, biology, finance, business, computer science, and industry. 6 Probability and statistics f is devoted primarily to the study of integers and integer-valued functions. 7 Number Theory g focuses on the study of polygons, shapes, and geometric objects in both two-dimensions and threedimensions. 8 Topology h studies entirely abstract concepts. 9 Pure mathematics i deals with solving generic algebraic expressions and manipulating them to arrive at results.

10 Applied mathematics j is concerned with the limiting values of differentials and is a means of determining length, volume, or area.

Task 11.

Mark true (T) or false (F) sentences.

1. The term "applied mathematics" also describes the professional specialty in which mathematicians work on practical problems by formulating and studying mathematical models. 2. The application of probability can be observed in differentiable equations, dynamical systems, knot theory, and Riemann surfaces in complex analysis. 3. Deformations like cutting and tearing are not included in topologies. 4. Statisticians study prime numbers as well as the properties of mathematical objects made out of integers. 5. The scope of probability and statistics involves studying the laws and principles governing numerical data and random events. 6. Calculus is one of the advanced branches of mathematics and studies the rate of change. 7. Differential calculus is concerned with the limiting values of differentials and is a means of determining length, volume, or area. 8. Algebra is a study of the correlation between the angles and sides of the triangle. 9. Dealing with the shape, sizes, and volumes of figures, trigonometry is a practical branch of mathematics that focuses on the study of polygons, shapes, and geometric objects in both two-dimensions and three-dimensions. 10. Addition, subtraction, multiplication, and division form the basic groundwork of arithmetic.

Task 12.

Match the beginnings and the endings of the given sentences.

№ Beginnings Endings

1 The basic level of Number Theory builds up to complex systems a and specialized knowledge. 2 Applied mathematics is a combination of mathematical b to be applied to objects in motion. 3 Topology is concerned with the deformations in different geometrical shapes c from simple calculations to profit and loss computation. 4 Earlier maths could only work d triangles and their properties. 5 Congruence of objects is studied at the same time focusing on their special properties and e while creating objects in practical life. 6 With calculus, mathematical principles began f like cryptography, game theory and more. 7 Trigonometry is all about different g calculation of their area, volume, and perimeter. 8 The fundamentals of arithmetic are used in everyday life for a variety of reasons h are solved for and the value of the variable is determined. 9 Unknown quantities denoted by alphabets that form a part of an equation i on static objects. 10 The importance of geometry lies in its actual usage j under stretching, crumpling, twisting and bedding.

Task 13.

Write out key words from the text.

Task 14.

Use the key words of the text to make up the outline of the text.

Task 15.

Write out the main idea of the text. Be ready to speak about it.

Task 16.

Give the summary of Text A.

Task 17.

In pairs, take turns to interview your partner about different branches of mathematics. What questions do you think are the most relevant?

Task 18. Write a short essay on the suggested topics. Suggest some other relevant essay topics.

1. Arithmetic is one of the most basic branches of mathematics. 2. Geometry is a practical branch of mathematics. 3. Topology is a much recent addition into the branches of mathematics list. 4. Calculus is one of the advanced branches of mathematics. 5. Probability and statistics are the abstract branches of mathematics.

Task 19.

Read the words and try to remember the pronunciation.

1. mental arithmetic [mentl 'ærıθ'metık] – устный счет в уме 2. artificial intelligence ['ɑ:tı'fıʃ(ə)l ın'telıʤ(ə)ns] – искусственный интеллект 3. superficial part ['s(j)u:pə'fıʃ(ə)l 'pɑ:t] – поверхностная часть 18 4. essence ['es(ə)ns] – сущность 5. set tasks ['set 'tɑ:sks] – ставить задачи 6. numerical sequences [nju:'merık (ə)l 'si:kwənsiz] – числовые последовательности 7. humanities [hju'mænətiz] – гуманитарные дисциплины 8. social science ['səuʃ(ə)l 'saıəns] – обществознание 9. soroban ['sɔ:rəbɑ:n] – соробан, японские счеты 10. abacus ['æbəkəs] – абака, счетная доска 11. ancient people ['eınʃ(ə)nt 'pi:p(ə)l] – древние люди

Task 20.

Read Text B.

Translate it from Russian into English.

Text B

МАТЕМАТИКА – ЦАРИЦА НАУК

Зачем нужна устная математика и устный счет в уме? Этот вопрос мучает всех школьников и их родителей. Хитрость ответа заключается в том, что математика – это чистый интеллект, логические операции, установление закономерностей, причинно-следственных связей и систем. Действительно, развитие информационных технологий, искусственного интеллекта делает ненужными самостоятельные человеческие операции, но проблема в том, что без владения математического логического аппарата, невозможно в принципе развитие интеллекта. Да, любой человек может посчитать цену товара, его вес и объем. Но это видимая, поверхностная и формальная часть математического знания. Сущность математики в том, что человек учится видеть различные варианты решения одной и той же задачи, умеет ставить перед собой задачи и находить на них ответы, ищет доказательства и аргументы. Без числовых последовательностей, закономерностей и способов решения детский ум не способен решать абстрактные и конкретные задачи. Это касается любой области знаний: физика, химия, биология и другие. Как бы это странно не звучало, такие гуманитарные дисциплины как история и русский язык – это теория логических систем, которые лучше всего усваиваются именно на примерах математики. Поэтому неудивительно, что ребенок, не овладевший устным счетом, математикой и быстрыми операциями в уме достаточно слабо развирается и в таких, казалось бы, не связанных с математикой дисциплиной, как русский язык, литература, обществознание. Это хорошо понимали и люди на востоке, откуда пошли и теория чисел и таблицы сложения, вычитания, умножения и деления. Тогда же и были разработаны специальные системы устного счета под названием соробан или абакус, развивающие логику, память, внимание ребенка и интеллект в целом. Развитие интеллектуальных способностей человека приводит к тому, что он начинает хорошо ориентироваться и в других дисциплинах, там, где требуются эти же навыки. Фактически можно сказать, что математика – это основа человеческого интеллектуального потенциала или, как говорили древние – «царица наук».

Unit 2.

HISTORY OF MATHEMATICS

Task 1. In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. When did the history of mathematics begin? 2. How did people count in the dim and distant past? 3. What are the greatest achievements of early ages? 4. Who are the prominent mathematicians of antiquity? Task 2. Practise reading the following words.

№ Word Transcription

1 Arabic ['ærəbık]

2 Arabs ['ærəbz]

3 Chinese ['ʧaı'ni:z]

4 abacus ['æbəkəs]

5 Columbus [kə'lʌmbəs]

6 calculator ['kælkjuleıtə]

7 finger ['fıŋgə]

8 numeral ['nju:m(ə)rəl]

9 Florence ['flɔrəns]

10 digit ['dıʤıt]

Task 3.

Study and remember the following words.

№ Word Transcription

1 dim [dım] смутный, темный 2 savage ['sævıʤ] дикий 3 tribe [traıb] племя 4 pebble ['peb(ə)l] булыжник, камешек 5 toe [təu] палец ноги 6 apply [ə'plaı] относиться (to), распространяться 7 instead [ın'sted] взамен, вместо 8 merchant ['mɜ:ʧ(ə)nt] купец, торговец 9 manuscript ['mænjuskrıpt] рукопись 10 bead [bi:d] шарик (со сквозным отверстием) 11 groove [gru:v] канавка, прорез 12 carry ['kærı] нести, довозить 20 13 capture ['kæpʧə] захват, овладение 14 sign [saın] знак 15 Calandri [ka: 'la:ndri] Каландри

Task 4. Read and translate Text A using a dictionary if necessary.

Text A

COUNTING IN THE EARLY AGES

Counting is the oldest of all processes. 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. 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. 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. 21 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.

AFTER TEXT TASKS

Task 5.

Answer the following questions.

1. What is the text about? 2. What signs did people use instead of numerals? 3. What numbers sound alike in many languages? 4. What number names is the word digit applied to? 5. How long has it taken people to learn to use numbers? 6. What is a numeral? 7. What is the role of numerals in our life? 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?

Task 6.

Find synonyms for the following words in the text.

1. to make calculation easier 2. to do operations 3. to show one finger 4. the etymology of the word calculate 5. to be quickly done 6. to be seldom used 7. to be marked by two great achievements 8. first printed in Italy

Task 7.

Supply antonyms for the following words. Subtract, before, hard, unknown, begin, unlikely, multiply, small, addition, ancient times, first, simple, easy, past, rapidly, often, division.

Task 8.

Match the terms with their translation.

№ Term Translation

1 distant past a выполнять операции

2 digit b приспособление

3 abacus c складывать

4 device d делить

5 ancient times e счёты

6 add f далёкое прошлое

7 subtract g умножать

8 multiply h вычитать

9 divide i однозначное число

10 perform operations j древние времена

Task 9.

Mark true (T) or false (F) sentences.

1. Counting is the oldest of all processes. 2. Suppose you wanted to buy a chicken. You might point toward some chickens and then hold up two fingers. 3. Latin word digiti means toes. 4. People counted fingers and toes together and used a number scale of twenty. 5. The name digits was first applied to the ten numerals from 0 to 9. 6. The numerals came to us through a book on arithmetic which was written in Florence about twelve hundred years 7. In abacus units, fives, tens and so on were represented by beads which could be moved in grooves. 8. The operations that could be rapidly done on the abacus were addition, subtraction and division. 9. Our present method, often called long division, began to be used in the 15th century. 10. The first machines that could perform all the operations with numbers appeared in modern times and were called computers.

Task 10.

Insert the necessary word from the box into the gaps.

Latin, Calandri's, Arabic, Romans, calculators, alike, pebbles, twenty, abacus, developments

1. If you wanted to buy two chickens, you could point to two … . 2. The … word digiti means fingers. 3. People counted fingers and toes together and used a number scale of … . 4. The numbers from one to ten sound … in many languages. 5. The numerals we use nowadays are known as … . 6. The … used a counting table. 7. The operations that could be rapidly done on the … were addition and subtraction. 8. Our present method, often called long division, first appeared in print in … arithmetic. 9. The simplest types of … could give results in addition and subtraction only. 10. The twentieth century was marked by two great … .

Task 11.

In pairs, take turns to interview your partner about understanding what mathematics is. What questions do you think are the most relevant?

Task 12.

Retell Text A.

Task 13.

Write a short essay on the suggested topics. The volume of the essay is 200-250 words. Suggest some other relevant essay topics.

1. Counting systems of early civilizations. 2. The greatest mathematicians of ancient times. 3. Counting is the oldest of all processes.

Task 14.

Read the words and try to remember the pronunciation.

1. Archimedes [ˌɑːkɪ'miːdiːz] – Архимед 2. Syracuse ['s(a)ɪ(ə)rəkju:s] – Сиракузы 3. antiquity [æn'tɪkwɪtɪ] – древний мир 4. phenomenon [fɪ'nɔmɪnən] – явление 5. hydrostatics ['haɪdrə'stætɪks] – гидростатика 6. eureka [ju(ə)'ri:kə] – эврика! озарение 7. immerse [ɪ'mɜ:s] – погружать, окунать 8. genius ['ʤi:nɪəs] – гениальность 9. cylinder ['sɪlɪndə] – цилиндр 10. lever ['li:və] – рычаг 11. buoyancy ['bɔɪənsɪ] – плавучесть (погружённых тел)

Task 15.

Read

Text B.

Translate it from English into Russian.

Text B

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. Downloaded from Archimedes of Syracuse. URL: https://www.math.tamu.edu/~don.allen/history/archimed/archimed.html

AFTER TEXT TASK

Task 16.

Answer the following questions on Text B.

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?

Part 2

HISTORY OF MATHEMATICS: 17th – 20th centuries

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. How did mathematics develop in the Middle Ages? 2. How does mathematics evolve in modern times? 3. What do you know about famous mathematicians and their contribution to science?

Task 2.

Practise reading the names of mathematicians.

Nicolaus Copernicus [ˈnɪkələs kə'pɜːnɪkəs] – Николай Коперник

Johannes Kepler [jə'hænɪs ˈkeplə] – Иоганн Кеплер

Galileo [ˌgælɪ'leɪəʊ] – Галилей

Isaac Newton ['aɪzək 'nju:t(ə)n] – Исаак Ньютон

John Napier [ʤɔn 'neɪpiə] – Джон Напье

Justus Byrgius ['ʤʌstəs 'bɜːʤəs] – Юстас Бирджес

Gottfried Wilhelm Leibniz [ˈgɒtfrid ˈwɪlˌhelm ˈliːbˌnɪz] – Го́тфрид Ви́льгельм Ле́йбниц

Isaac Barrow [ˈaɪzək ˈbærəʊ] – Исаак Барроу

Rene Descartes [rəˈneɪ deˈkɑːt] Рене Декарт

Pierre de Fermat [ˈpɪr ˈdeɪ fɛː(r) ˈmɑː] – Пьер де Ферма

Joseph Louis Lagrange [ˈʤəʊzɪf ˈluɪs ˈlægreɪnʤ] – Жозеф Луи Лагранж

Leonard Euler [ˈlenəd ˈɔɪlər] – Леонард Эйлер

Carl Frederich Gauss [kɑːl fredˈrɪk gaʊs] – Карл Фридрих Гаусс

Augustin Louis Cauchy [ɔːgʌstɪn ˈluɪs ˈkɔːkɪ] – Августин Луи Коши

Karl Weierstrass ['kɑːl wɪˈstreɪs] – Карл Вейерштрасс

Jean Baptiste Fourier [ʤiːn bəptɪst ˈfjʊərɪeɪ] – Жан Баптист Фурье

Georg Cantor [ˈgeɪəg ˈkæntər] – Георг Кантор

Julius Dedekind [ˈʤuːlɪəs ˌdediːˈkɪnd] – Юлиус Дедекинд

Task 3.

Study and remember the following words.

№ Word Transcription

1 mathematician [ˌmæθəmə'tɪʃn] математик 2 integral ['ɪntɪgrəl] интеграл 3 treatise ['tri:tɪs] трактат 4 conic ['kɔnɪk] коническое сечение 5 logarithm ['lɒgərɪðəm] логарифм 6 root [ru:t] корень 7 differential ['dɪfə'renʃ(ə)l] дифференциальный 8 priority [praɪ'ɔrɪtɪ] приоритет 9 vitality [vaɪ'tælɪtɪ] жизненность, жизнеспособность 10 celestial [sɪ'lestɪəl] небесный 11 contribute [kən'trɪbju:t] вносить вклад 12 series ['sɪ(ə)ri:z] ряд 13 infinite ['ɪnfɪnɪt] бесконечный 14 rigorous ['rɪgərəs] строгий 15 succeed [sək'si:d] преуспевать

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

MATHEMATICS DEVELOPMENT 17th Century Mathematic

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 27 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 in dependently 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. 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 28 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 19th 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 20th century.

AFTER TEXT TASKS

Task 5.

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? 10. What did the discovery of calculus lead to? 11. What was Lagrange's contribution to pure and applied mathematics? 12. What did Euler's works contribute to? 13. What is the essence of differential geometry? 14. What event marked the beginning of modern era in number theory? 15. When was a rigorous foundation for calculus finally supplied? 16. What is the theoretical and practical value of Fourier series? 17. What was Georg Cantor's contribution to mathematical studies? 18. Who were irrational numbers investigated and defined by? 19. What was the first reaction to Cantor's set theory? 20. Was the attitude to the discovery later changed?

Task 6. Look through the text to search for unfamiliar words and try to understand their general meanings.

Task 7. Write down the transcription and definitions of unfamiliar words, practise reading the words and try to remember them.

Task 8. Give Russian equivalents to these word combinations.

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 11. simplification 12. to approach 30 13. to elongate 14. pace 15. tangents to curves

Task 9.

Find the English equivalents to the following words and word combinations.

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 11. искривленное пространство 12. теория чисел 13. достичь 14. ускорять 15. несмотря на то, что

Task 10.

Match the mathematicians with their contributions to science.

№ Mathematician Contribution

1 George Cantor a infinite series in which the terms are trigonometric functions 2 Julius W. R. Dedekind b analytic geometry 3 Augustin Louis Cauchy c pure mathematics, including differential equations, the calculus of variations, probability theory, and the theory of equations 4 Jean Baptiste Fourier d a theory of irrational numbers 5 Augustin Louis Cauchy e tables of logarithms 6 Joseph

Louis Lagrange f integral and differential calculus 7 Rene Descartes and Pierre de Fermat g irrational numbers and their properties 8 Gottfried Wilhelm Leibniz h theory of limits, a purely arithmetic theory 9 John Napier i laws of motion 10 Isaac Newton j foundation for calculus with his theory of limits, a purely arithmetic theory

Task 11.

Mark true (T) or false (F) sentences.

1. The 17th century opened with the discovery of logarithms by the Swiss mathematician John Napier and the Scottish mathematician Justus Byrgius. 2. Kepler's enthusiasm for the tables of logarithms ensured their rapid spread. 3. Gottfried Wilhelm Leibniz of Germany noted, "If I have seen further, it is by standing on the shoulders of giants." 4. The greatest achievement of Carl Frederich Gauss was the invention of integral and differential calculus. 5. Leonard Euler of Switzerland wrote works that covered the entire fields of pure and applied mathematics. 6. In the work "Introduction to the Analysis of Infinites" Euler approached calculus in terms of functions rather than the geometry of curves. 7. During the 18th century, calculus became the cornerstone of mathematical analysis on the European continent. 8. The 19th century began with the mathematician Jean Baptiste Fourier. His book "Inquiries into Arithmetic" marks the beginning of modern era in number theory. 9. The necessary precision for calculus and mathematical analysis was attained in the 1850s by the German mathematician Karl T. W. Weierstrass. 10. The application of set theory greatly advanced mathematics in the 20th century.

Task 12.

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. preceded Lagrange's work e. Newton and Leibniz f. the scientific revolution of the 17th century g. the tables of logarithms h. physics, astronomy, and engineering i. celestial mechanics j. Fourier series k. Karl T. W. Weierstrass l. mechanics and astronomy m. number theory and differential geometry n. Carl Frederich Gauss o. Cantor and Dedekind

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. Euler's major works on mechanics …. 8. Mathematicians applied the discovery of calculus to …. 9. Lagrange managed to solve some practical problems in …. 10. Euler's works contributed to …. 11. Euler won a number of prizes for his work on …. 12. Mathematics was called the queen of sciences by …. 13. Cantor's study of infinite sets became possible due to the study of …. 14. The properties of irrational numbers were established by …. 15. A precise foundation for calculus was supplied by ….

Task 13.

Write out key words from the text.

Task 14.

Use the key words of the text to make up the outline of the text.

Task 15.

Write out the main idea of the text. Be ready to speak about it.

Task 16.

Give the summary of Text A.

Task 17.

In pairs, take turns to interview your partner about different branches of mathematics. What questions do you think are the most relevant?

Task 18.

Write a short essay on the suggested topics. Suggest some other relevant essay topics.

1. Advances in mathematics in the 17th century. 2. The cornerstone of mathematical analysis in the 18th century. 3. The queen of mathematics in the 19th century. 4. Prominence of mathematics in the 20th century. 5. Development of mathematics in the 21st century.

Task 19.

Read the words and try to remember the pronunciation.

1. quantum ['kwɔntəm] – квантовый 2. chaos ['keɪɔs] – хаос, неупорядоченность 3. topology [tə'pɒlədʒi] – топология 4. fertile ['fɜːtaɪl] – зд. благодатный 5. Princeton [ˈprɪnstən] – Принстон 6. Chicago [ʃɪ'kɑːgəu] – Чикаго 7. Cambridge ['keɪmbrɪʤ] – Кэмбридж 8. Bertrand Russel ['bɜːtrənd 'rʌs(ə)l] – Бертранд Рассел 9. premise ['premɪs] – предпосылка 10. Hermann Weyl [ˊhɜːmən ˊweil] – Герман Вэйль 11. Emmy Noether [ˊemi ˈnɜːtə] –Эмми Нётер 12. econometrics [ɪ'kɔnə'metrɪks] – эконометрика 13. maximize ['mæksɪmaɪz] – предельно увеличить 14. Von Neumann [vɒn ˈnɔɪmən] – фон Нойман 15. series ['sɪ(ə)riːz] – ряд 16. supply [sə'plaɪ] – зд. разработать 17. profiled ['prəufaɪld] – изображённый (в фильме) 18. the Nobel Prize [ðə nəʊˈbel ˈpraɪz] – Нобелевская премия

Task 20.

Read Text B. Translate it from English into Russian.

Text B

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. 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 34 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.

AFTER TEXT TASK

Task 21.

Answer the questions on Text B.

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 20th 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 20th 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 20th century? 11. What does game theory deal with? 12. Who were the theoretical foundations of game theory supplied by?

Unit 3.

NUMERATION SYSTEMS AND NUMBERS

”Without mathematics, there’s nothing you can do. Everything around you is mathematics. Everything around you is numbers”. Shakuntala Devi, a prominent Indian mathematician known as the ‘Human Computer’

Part 1

TYPES OF NUMBERS

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. What kind of numbers do we use for counting in everyday life? 2. What numbers are called rational? 3. Can you give some examples of irrational numbers?

Task 2.

Practise reading the following words.

№ Word Transcription

1 natural [ˈnætʃrəl] натуральный 2 decimal [ˈdesɪml] десятичный 3 whole [həʊl] целый, весь 4 integer [ˈɪntɪdʒə] целый, целочисленный 5 to encompass [ɪnˈkʌmpəs] охватывать 6 to assume [əˈsuːm] предполагать 7 rarely [ˈreəlɪ]

редко 8 ***π*** [paɪ] число ***π*** 9 √2 [ˈskweə ˈruːt əv ˈtuː] квадратный корень из 2 10 completely [kəmˈpliːtlɪ] полностью, совершенно

Task 3.

Study and remember the following words and expressions.

№ Word Transcription

1 to be referred to [rɪˈfɜːd] упоминаться, называться 2 to denote [dɪˈnəʊt] обозначать 3 layer [ˈleɪə] слой, уровень 4 to include [ɪnˈkluːd] включать 5 instead of [ɪnˈsted] вместо 6 to be expressed [ɪkˈsprest] быть выраженным 7 to assume [əˈsjuːm] полагать, предполагать 8 fraction [ˈfrækʃn] дробь 9 definition [ˌdefɪˈnɪʃn] определение 10 to consider [kənˈsɪdə] рассматривать 11 imaginary number [ɪˈmædʒɪnerɪ] мнимое число 12 since [sɪns] здесь: поскольку 36

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

TYPES OF NUMBERS

Numbers are an integral part of our everyday lives, right from the number of hours we sleep at night to the number of rounds we run around the racing track and much more. In math, numbers can be even and odd numbers, prime and composite numbers, decimals, fractions, rational and irrational numbers, natural numbers, integers, real numbers, rational numbers, irrational numbers, and whole numbers. In this chapter, we'll get an introduction to the different types of numbers and to all the concepts related to it. The most basic type of classification of numbers are the natural numbers. Natural numbers include the symbols as 1,2,3,4,5… and so on. They are often referred to as ‘counting numbers’. Natural numbers do not include 0 or any negative numbers, as well as any decimals. An easy way to remember it is to think of it like this: we all naturally count things starting from one, and go on to two, three, four, five, six, and so on. But we rarely count starting from zero. This is the most basic classification of numbers, it can be denoted as N. The next layer of numbers are the whole numbers. Whole numbers can often be denoted using this symbol (W). Whole numbers include all natural numbers and it also includes zero (0). Instead of starting from 1, the whole numbers start from 0. The set of whole numbers includes natural numbers, and this means that any natural number is also considered a whole number. But not necessarily, the other way round, since zero is not a natural number. The next classification of numbers is called integers. Integers can often be denoted using symbol Z. Integers include all the same numbers called as whole numbers, and they also include all the negatives of them. But integers do not include decimals or fractions of numbers. The next classification of numbers is called rational numbers. It can be denoted using this symbol: Q. And again, the set of rational numbers encompasses all sets of numbers that we have mentioned so far, as well as decimals and fractions. However, the decimal numbers must be numbers that can be expressed as a fraction p/q, where p and q are integers, and q is not 0. If we think of number x, and it is a natural number, can we assume that it is also a rational number? Definitely, and we can also assume that it is a whole number, since that is a bigger set. We can even assume that it is an integer since it is even a bigger set. And finally, we can also assume that it is a rational number, since rational numbers are a bigger set. We can compare this situation to something like this. If we take some person in Tokyo, can we also assume that this person is in Japan? Obviously, we can! And would it be correct to assume that this person is also in Asia? Absolutely, since Tokyo is in Japan, and Japan is in Asia. And finally, would it be OK to assume that this person is on the Earth? Of course, because the Earth is even a bigger set than Asia. 37 But there is a completely different set of numbers that is not within any of these. This set of numbers cannot be expressed as a fraction. This set is completely separate from rational numbers altogether. We can call them irrational numbers and denote them using symbol P. An example of an irrational number would be $\boldsymbol{\pi}$. We know that $\boldsymbol{\pi}$ is a never-ending number that does not repeat with a constant decimal or any pattern fashion. And this is what makes it irrational. √2 also turns out to be an irrational number since it cannot be expressed as a fraction. A complex number is a number that can be expressed in the form (a + bi) where a and b are real numbers, and i is a solution of the equation x2 = −1. Because no real number satisfies this equation, i is called an imaginary number. Complex numbers have a real part and an imaginary part. And lastly, the definition or real number is the last classification that we will consider. Real numbers are simply all of the rational and irrational numbers. Positive or negative, large or small, whole numbers or decimal numbers are all real numbers. They are called "Real Numbers" because they are not imaginary numbers. We denote them using symbol R.

AFTER TEXT TASKS

Task 5.

Answer the following questions.

1. What is the oldest and the most basic type of classification of numbers? 2. How is the set of natural numbers denoted? 3. What is the difference between the classifications of natural and whole numbers? 4. Is the set W included into the set N? 5. How can the set of rational numbers be denoted? 6. What is the definition of a rational number? 7. If we take some person in Japan, can we also assume that this person is inTokyo? 8. Can irrational numbers be represented as the ratio of two integers? 9. What are the examples of irrational numbers? 10. How can real numbers be defined and how are they denoted?

Task 6.

Give Russian equivalents to these word combinations.

1. they are often referred to as 2. as well as 3. it can be denoted as 4. the set of whole numbers 5. the other way round 6. since zero is not a natural number 7. something like this 8. Cannot be expressed as a fraction 9. a never-ending number 10. this is what makes it irrational

Task 7.

Find English equivalents to the following word combinations.

1. числа, используемые для счета 2. самая простая классификация чисел 3. в точности такой, как 4. множество целых чисел 5. но не обязательно бывает наоборот 6. часто обозначается как 7. включает в себя все множества

чисел 8. может быть выражено как дробь 9. верно ли предположить, что… 10. именно это делает число $\boldsymbol{\pi}$ иррациональным

Task 8.

Match the terms with their definitions.

№ Term Definition

1 natural numbers a a number with no fractional part 2 fraction b designating a quantity less than zero 3 integer c any collection of objects (elements) 4 rational d positive integers used as counting numbers 5 negative e a numerical quantity that is not a whole number 6 set f a number that can be expressed as a quotient of two integers 7 imaginary number g a number that cannot can be expressed as a quotient of two integers 8 irrational h a number that, when squared, has a negative result

Task 9.

Mark the sentences true (T) or false (F).

1. The most basic type of classification of numbers are the whole numbers. 2. Natural numbers do not include any decimals. 3. According to the text, natural numbers include 0. 4. Whole numbers include all natural numbers, zero and negative numbers. 5. Integers include some kinds of fractions. 6. Any rational number can be expressed as a fraction p/q, where p and q are integers. 7. The set of rational numbers is included into natural numbers. 8. If we take some person in Tokyo, we can also assume that this person is in Japan. 9. $\boldsymbol{\pi}$ is a never-ending irrational number. 10. Real numbers comprise all numbers, including irrational ones.

Task 10.

Insert the necessary word from the chart into the gaps. Some words can be used more than once. positive, decimals, encompasses, natural, zero, rational, integers, Japan, denoted negative, assume, fractions

1. The most basic type of classification of numbers are the (1) … numbers. 39 2. Natural numbers do not include (2) … or any (3) … numbers, as well as any decimals. 3. Whole numbers include all (4) … numbers and also include (5) … . 4. The set of integers does not include (6) … or (7) … of numbers. 5. The set of (8) … numbers can be denoted using this symbol: Q. 6. The set of rational numbers (9) …all sets of numbers that we have mentioned so far, as well as decimals and (10) … . 7. All (11) … numbers can be expressed as a fraction p/q, where p and q are (12) …, and q is not 0. 8. If we think of number x, and it is a natural number, can we assume that it is also a (13) … number? 9. If we take some person in Tokyo, would it be correct to (14) … that this person is in (15) …? 10. Irrational numbers are (16) … using symbol P.

Task 11.

Look through the text again. Make up a plan for the text.

Task 12. Render Text A according to the plan using mathematical terms.

Task 13. Translate the sentences from Russian into English.

1. Натуральные числа включают символы 1,2,3,4, 5… и так далее. 2. Натуральные числа не включают 0 или отрицательные числа, а также десятичные дроби. 3. Это самая основная классификация чисел, ее можно

обозначить как N. 4. Целые числа включают в себя все натуральные числа, а также нуль. 5. Любое натуральное число также считается целым числом, но не обязательно наоборот, поскольку нуль не является натуральным числом. 6. Множество целых чисел часто обозначается с помощью символа Z. 7. В множество целых чисел не включаются дроби. 8. Рациональные числа обозначаются символом Q. 9. Множество рациональных чисел включает в себя все множества чисел, которые мы упомянули до сих пор, а также дроби. 40 10. Все рациональные числа можно выразить как дробь p / q, где p и q - целые числа, а q не равно 0. 11. Если мы загадаем натуральное число x, то будет ли оно являться рациональным? 12. Эту ситуацию можно сравнить со следующей. Если взять какого-то человека в Токио, можно утверждать, что он находится в Японии, поскольку Токио - столица Японии. 13. Иррациональные числа нельзя выразить с помощью дроби. 14. Примерами иррациональных чисел являются √2 и $\boldsymbol{\pi}$. 15. Действительные числа включают в себя все рациональные и иррациональные числа.

Task 14.

Read the words and try to remember the pronunciation.

1. circumference [səˈkʌmfərəns] – окружность, длина окружности 2. ratio [ˈreɪʃɪəʊ] – соотношение, коэффициент, пропорция 3. Babylonian [ˌbæbɪˈləʊnɪən] – вавилонский 4. hexagon [ˈheksəg(ə)n] – шестиугольник 5. Rhind papyrus [raɪnd pəˈpaɪrəs] – папирус Ахмеса 6. Archimedes [ˈɑːkɪˈmiːdəs] – Архимед 7. accuracy [ˈækjʊrəsɪ] – точность 8. ensuing [ɪnˈsjuːɪŋ] – последующий 9. Srinivasa Ramanujan [ˈsrɪnɪˈvɑːsə ˈrəmənɪˈjɑːn] – Сриниваса Рамануджан 10. pendulum [ˈpendjʊləm] – маятник

Task 15.

Read Text B. Translate it from English into Russian.

Text B

NUMBER $\boldsymbol{\pi}$ $\boldsymbol{\pi}$ in mathematics, the ratio of the circumference of a circle to its diameter. The symbol $\boldsymbol{\pi}$ was devised by British mathematician William Jones in 1706 to represent the ratio and was later popularized by Swiss mathematician Leonhard Euler. Because $\boldsymbol{\pi}$ is irrational (not equal to the ratio of any two whole numbers), its digits do not repeat, and an approximation such as 3.14 or 22/7 is often used for everyday calculations. To 39 decimal places, $\boldsymbol{\pi}$ is 3.141592653589793238462643383279502884197. The Babylonians (c. 2000 BCE) used 3.125 to approximate $\boldsymbol{\pi}$, a value they obtained by calculating the perimeter of a hexagon inscribed within a circle and assuming that the ratio of the hexagon’s perimeter to the circle’s circumference was 24/25. The Rhind papyrus (c. 1650 BCE) indicates that ancient Egyptians used a value of 256/81 or about 3.16045. Archimedes (c. 250 BCE) took a major step forward by devising a method to obtain $\boldsymbol{\pi}$ to any desired accuracy, given enough patience. By inscribing and circumscribing regular polygons about a circle to obtain upper and lower bounds, he obtained $223/71 < \boldsymbol{\pi} < 22/7$, or an average value of about 3.1418. Archimedes also proved that the ratio of the area of a circle to the square of its radius is the same constant. Over the ensuing centuries, Chinese, Indian, and Arab mathematicians extended the number of decimal places known through tedious calculations, rather than improvements on Archimedes' method. By the end of the 17th century, however, new methods of mathematical analysis in Europe provided improved ways of calculating π involving infinite series. For example, Sir Isaac Newton used his binomial theorem to calculate 16 decimal places quickly. Early in the 20th century, the Indian mathematician Srinivasa Ramanujan developed exceptionally efficient ways of calculating π that were later incorporated into computer algorithms. In the early 21st century, computers calculated π to 31,415,926,535,897 decimal places, as well as its two-quadrillionth digit when expressed in binary (0). π occurs in various mathematical problems involving the lengths of arcs or other curves, the areas of ellipses, sectors, and other curved surfaces, and the volumes of many solids. It is also used in various formulas of physics and engineering to describe such periodic phenomena as the motion of pendulums, the vibration of strings, and alternating electric currents.

AFTER TEXT TASK

Task 16.

Answer the following questions on Text B.

1. What does π mean? 2. Who was π devised by? 3. What approximation of π is often used for everyday calculations? 4. What number did Babylonians use to approximate π? 5. Why did the Rhind papyrus indicate? 6. What major step forward did Archimedes take? 7. What did he also prove? 8. What did new methods of mathematical analysis in Europe provide? 9. What did Newton use to calculate 16 decimal places quickly? 10. Who developed exceptioally efficient ways of calculating π early in the 20th century? 11. What progress in calculating π was reached in the early 21st century? 12. In which formulas of physics and engineering π is used?

Part 2

NUMERATION SYSTEMS

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. Why do you think we have a numeration system based on ten digits? 2. What numeration system is used in computers? 3. What kinds of numbers do you know?

Task 2.

Practise reading the following words.

№ Word Transcription

1 ancient [ˈeɪnʃənt] древний 2 awkward [ˈɔːkwərd] громоздкий, неуклюжий 3 binary [ˈbaɪnərɪ] двоичный 4 digit [ˈdɪdʒɪt] 1) цифра 2) палец 5 Egyptian [ɪˈdʒɪpʃn] египетский 6 hieroglyphics [ˌhɑɪərəˈglɪfɪks] иероглифы 7 Mesopotamia [ˌmesəpəˈteɪmɪə] Месопотамия 8 society [səˈsaɪətɪ] общество 9 toe [təʊ] палец на ноге 10 worthwhile [ˌwɜːrθˈwaɪl] стоящий Task 3. Study and remember the following words and expressions. № Word / Expression

Transcription Translation 1 ruler [ˈruːlər] правитель 2 to record [ˈrekɔːd] записывать 3 ceremonial mace [serɪˈməʊnɪəl] церемониальная булава 4 the art of counting [ðiː ˈɑːt əv ˈkaʊntɪŋ] искусство счета 5 system of numeration [ˈsɪstəm əv njuːməˈreɪʃ(ə)n] система счисления 6 crude [kruːd] сырой, недоработанный 7 clumsy [ˈklʌmzɪ] громоздкий 8 related to [rɪˈleɪtɪd tə] относящийся к чему-либо 9 give a deeper insight [ˈgɪv ə ˈdiːpə ˈɪnsaɪt] дать более глубокое представление

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

ANCIENT NUMERATION SYSTEMS

More than 5000 years ago an Egyptian ruler recorded, perhaps with a bit of exaggeration, the capture of 120, 000 prisoners, 400, 000 oxen and 1, 422, 000 goats. The event was inscribed on a ceremonial mace which is now a museum in Oxford, England. The ancient Egyptians developed the art of counting to a high degree, but their system of numeration was very crude. For example, the number 1,000 was symbolized by a picture of lotus flower, and the number 2,000 was symbolized by a picture of two lotus flowers growing out of a bush. Although these systems called hieroglyphics permitted the Egyptians to write large numbers, the numeration system was clumsy and awkward to work with. For instance, the number 999 required 27 individual marks. 43 In our system of numeration we use ten symbols called digits – 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 – and combinations of these symbols. Our system of numeration is called decimal, or base-ten system. There is little doubt that out ten fingers influenced the development of a numeration system based on ten digits. Other numeration systems were developed in early cultures and societies. Two of the most common were the base five-system, related to the number of fingers on one hand, and the base twenty-system, related to the number of fingers and toes. In some languages the word for ‘five’ is the same as the word for ‘hand’, and the word for ‘ten’ is the same as the word for ‘two hands’. In English the word ‘digit’ is the synonym for the word ‘finger’ – that is, ten digits, ten fingers. Another early system of numeration was a base-sixty system developed by Mesopotamians and used for centuries. These ancient people divided the year into 360 days (6 x 60); today we still divide the hour into 60 minutes and the minute to 60 seconds. Numeration system of current interest include a binary, or base-two system used in electronic computers and a base-twelve, or duodecimal system. It is worthwhile to become familiar with the principles of the base-twelve numeration system and with those of base-two, base five and other systems. Working with other bases gives you deeper insight into the decimal system you have used since childhood.

AFTER TEXT TASKS

Task 5.

Answer the following questions.

1. What information did an Egyptian ruler order to record about 5000 years ago? 2. What kind of numeration system did ancient Egyptians have? 3. Did the

system permit the Egyptians to write large numbers? 4. How many digits does our numeration system use? 5. What influenced the development of our numeration system? 6. What other numeration systems were developed in early cultures and societies? 7. What systems were the most common of them? 8. Which word is the word 'digit' the synonym for in English? 9. What numeration system was developed by Mesopotamians? 10. What field is binary numeration system used nowadays?

Task 6.

Give Russian equivalents to these words or word combinations.

1. with a bit of exaggeration 2. to a high degree 3. permitted to write large numbers 4. awkward to work with 5. base-ten system 6. the most common 7. there is little doubt that 44 8. related to to the number 9. numeration system of current interest 10. to become familiar Task 7. Find the English equivalents to the following words and word combinations. 1. с некоторой долей преувеличения 2. было высечено на церемониальной булаве 3. изображаться в виде цветка лотоса 4. громоздкая и неудобная в использовании 5. система счисления с основанием 10 6. нет сомнений в том, что 7. шестидесятиричная система счисления 8. двенадцатеричная система счисления 9. представляющий интерес в данный момент 10. следует ознакомиться (с) 11. получить более глубокое представление (о)

Task 8.

Match the terms with their definitions.

№ Term Definition

1 exaggeration a constructed in a primitive way 2 numeration system b any of the five digits at the end of the human foot 3 crude c a statement that represents something as better or worse than it really is 4 clumsy d worth of spending time 5 toe e a mathematical notation for representing numbers 6 duodecimal system f difficult to handle or use 7 worthwhile g a system of counting or numerical notation that has twelve as a base

Task 9.

Mark the sentences true (T) or false (F).

1. The event was inscribed on a ceremonial mace which is now a museum in Cambridge, England 2. The ancient Egyptian system of numeration was imperfect. 3. This system did not permit the Egyptians to write large numbers. 4. In our numeration system we use nine digits and zero. 5. It's doubtful that our ten fingers influenced the creation of our numeration system. 6. The two most common systems in the ancient world were the base five-system and base fifteen systems. 7. Base-sixty system developed by ancient Indians. 8. Nowadays we still divide the hour into 60 minutes. 9. Duodecimal system is currently used in electronic computers. 10. It is no use to become familiar with the principles of other numeration systems.

Task 10.

Insert the necessary word from the chart into the gaps.

Mesopotamians, related, hieroglyphics, binary, numeration, hand, digit, counting, divide, inscribed, duodecimal

1. The ancient Egyptians developed the art of (1) … to a high degree. 2. A base-sixty system was developed by (2) … and was used for centuries. 3. The event was (3) … on a ceremonial mace. 4. These systems called (4) … permitted the Egyptians to write large numbers. 5. In our system of (5) … we use ten symbols called digits. 6. Base five-system is (6) … to the number of fingers on one hand. 7. In some languages the word for 'five' is the same as the word for (7)'…'. 8. In English the word (8) '…' is the synonym for the word 'finger'. 9. Today we still (9) … the hour into 60 minutes. 10. Numeration system of current interest include a (10) … and a (11) … system.

Task 11.

Match the beginnings and the endings of the sentences.

№ Beginnings Endings

1 Although hieroglyphics permitted the Egyptians to write large numbers, a the development of a numeration system based on ten digits. 2 The number 1,000 was symbolized b the number of fingers on one hand. 3 The event was inscribed on a ceremonial mace c the synonym for the word 'finger'. 4 There is little doubt that out ten fingers influenced d which is now a museum in Oxford, England. 5 The base five-system was related to e to the number of fingers and toes. 6 The base twenty-system was related f deeper insight into the decimal system. 7 In English the word 'digit' is g the numeration system was clumsy and awkward to work with. 8 Working with other bases gives you h by a picture of lotus flower.

Task 12.

Translate from Russian into English.

1. Древние египтяне развили искусство счета, но их система счисления была очень примитивной. 2. Например, число 1 000 символизировалось изображением цветка лотоса. 3. Хотя эта система позволяла египтянам писать большие числа, она была неуклюжей и неудобной в работе. 4. В нашей системе счисления мы используем десять символов, называемых цифрами, и комбинации этих символов. 5. Несомненно, что наши десять пальцев повлияли на развитие системы счисления, основанной на десяти цифрах. 46 6. Двумя наиболее распространенными системами счисления были пятиричная система, связанная с количеством пальцев на одной руке, и двадцатиричная система, связанная с количеством пальцев на руках и ногах. 7. В английском языке слово "digit" является синонимом слова "finger", то есть десять цифр - десять пальцев. 8. Другой ранней системой счисления была шестидесятиричная система, разработанная месопотамцами. 9. Эти древние люди делили год на 360 дней (6 x 60); сегодня мы по-прежнему делим час на 60 минут, а минуту – на 60 секунд. 10. В настоящее время интерес представляет двоичная система счисления, используемая в электронных компьютерах.

Task 13.

Write out key words from the text.

Task 14.

Use the key words of the text to make up the outline of the text.

Task 15.

Write out the main idea of the text. Be ready to speak about it.

Task 16.

Retell Text A.

Task 17.

In pairs, take turns to interview your partner about different numeration systems. What questions do you think are the most relevant?

Task 18.

Write a short essay on the suggested topics. 1. Numeration systems used in the ancient cultures. 2. Binary numeration system. 3. The reasons for the origin of decimal system.

Task 19.

Read the words and try to remember the pronunciation.

1. digit [ˈdɪdʒɪt] – цифра, разряд 2. hexadecimal [ˌheksəˈdesɪml] – шестнадцатеричный 3. switch [swɪtʃ] – переключатель, коммутатор 4. digitize [ˈdɪdʒɪtaɪz] – преобразовывать в цифровую форму 5. discrete [dɪˈskriːt] – дискретный, отвлеченный, абстрактный 6. grid [grɪd] – сетка 7. expanded [ɪkˈspandɪd] – расширенный 8. storage space [ˈstɔːrɪdʒ ˈspeɪs] – пространство для хранения 47

Task 20.

Read Text B. Translate it from English into Russian.

Text B

BINARY NUMBER SYSTEM

The binary number system, also called the base-2 number system, is a method of representing numbers that counts by using combinations of only two numerals: zero (0) and one (1). Computers use the binary number system to manipulate and store all of their data including numbers, words, videos, graphics, and music. The term bit, the smallest unit of digital technology, stands for "BInary digiT." A byte is a group of eight bits. A kilobyte is 1,024 bytes or 8,192 bits. Using binary numbers, 1 + 1 = 10 because "2" does not exist in this system. A different number system, the commonly used decimal or base-10 number system, counts by using 10 digits (0,1,2,3,4,5,6,7,8,9) so 1 + 1 = 2 and 7 + 7 = 14. Another number system used by computer programmers is the hexadecimal system, base-16 , which uses 16 symbols (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F), so 1 + 1 = 2 and 7 + 7 = E. Base-10 and base-16 number systems are more compact than the binary system. Programmers use the hexadecimal number system as a convenient, more compact way to represent binary numbers because it is very easy to convert from binary to hexadecimal and vice versa. It is more difficult to convert from binary to decimal and from decimal to binary. The advantage of the binary system is its simplicity. A computing device can be created out of anything that has a series of switches, each of which can alternate between an "on" position and an "off" position. These switches can be electronic, biological, or mechanical, as long as they can be moved on command from one position to the other. Most computers have electronic switches. When a switch is "on" it represents the value of one, and when the switch is "off" it represents the value of zero. Digital devices perform mathematical operations by turning binary switches on and off. The faster the computer can turn the switches on and off, the faster it can perform its calculations. Bits are a fundamental element of digital computing. The term "digitize" means to turn an analog signal—a range of voltages—into a digital signal, or a series of numbers representing voltages. A piece of music can be digitized by taking very frequent samples of it, called sampling, and translating it into discrete numbers, which are then translated into zeros and ones. If the samples are taken very frequently, the music sounds like a continuous tone when it is played back. A black and white photograph can be digitized by laying a fine grid over the image and calculating the amount of gray at each intersection of the grid, called a pixel . For example, using an 8-bit code, the part of the image that is purely white can be digitized as 11111111. Likewise, the part that is purely black can be digitized as 00000000. Each of the 254 numbers that fall between those two extremes (numbers from 00000001 to 11111110) represents a shade of gray. When it is time to reconstruct the photograph using its collection of binary digits, the computer decodes the image, assigns the correct shade of gray to each pixel, and the picture appears. To improve resolution, a finer grid can be used so the image can be expanded to larger sizes without losing detail. 48 A color photograph is digitized in a similar fashion but requires many more bits to store the color of the pixel. For example, an 8-bit system uses eight bits to define which of 256 colors is represented by each pixel (28 equals 256). Likewise, a 16-bit system uses sixteen bits to define each of 65,536 colors (216 equals 65,536). Therefore, color images require much more storage space than those in black and white.

AFTER TEXT TASKS

Task 21.

Answer the questions on Text B.

1. What is the binary number system? 2. What does the term ‘bit’ stand for? 3. How many symbols does the hexadecimal system use? 4. What does programmers use the hexadecimal number system for? 5. What 2 values can switches have? 6. What does the term "digitize" mean? 7. How can a piece of music be digitized? 8. What is used to digitize a black and white photograph? 9. How can we improve the resolution? 10. What is the difference between digitizing black and white photo and a color photo?

Task 22.

Make up a plan for the text and write a summary.

Unit 4.

ARITHMETIC

“Arithmetic is a kind of knowledge in which the best natures should be trained, and which must not be given up.” – Plato

Part 1

BASIC ARITHMETIC OPERATIONS

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. Can people live without numerals? 2. What is Arithmetic from your point of view? 3. What are the main operations of arithmetic? 4. What arithmetic properties do you know?

Task 2.

Study and remember the following words and expressions.

ADDITION [ə'dɪʃn] – сложение 3 + 2 = 5 3 & 2 + 5 = Addends ['ædendz] Plus sign [plʌs 'saɪn] Sum [sʌm] Equals sign ['iːkwəlz 'saɪn] слагаемые знак плюс сумма знак равенства

SUBTRACTION [səb'trækʃn] – вычитание 3 – 2 = 1 3 – 2 1 Minuend ['mɪnjʊend] Minus sign ['maɪnəs 'saɪn] Subtrahend [ˌsʌbtrə'hend] Difference ['dɪfrəns] уменьшаемое знак минус вычитаемое разность

MULTIPLICATION ['mʌltɪplɪ'keɪʃ(ə)n] – умножение 3 × 2 = 6 3 × 2 6 3 & 2 Multiplicand ['mʌltɪplɪ'kand] Multiplication sign ['mʌltɪplɪ'keɪʃ(ə)n 'saɪn] Multiplier ['mʌltɪplaɪə] Product ['prɒdʌkt] Factors ['fæktəz] множимое (множитель 1) знак умножения множитель (множитель 2) произведение сомножители

DIVISION [dɪ'vɪʒən] – деление 6: 2 = 3 6: 2 3 Dividend ['dɪvɪdend] Division sign [dɪ'vɪʒən 'saɪn] Divisor [dɪ'vaɪzə] Quotient ['kwəʊʃ(ə)nt] делимое знак деления делитель частное 50

Task 3.

Read and translate Text A using a dictionary if necessary.

Text A

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.

AFTER TEXT TASKS

Task 4.

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? 51

Task 5.

Match the terms in Column A with their Russian equivalents in Column B. Column A Column B 1 addend (summand) 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 делить 10 inverse operation j вычитаемое 11 equation k разность 12 product l произведение 13 difference m множитель 14 subtract n делитель 15 add o умножать 16 divide p вычитать 17 multiply q складывать

Task 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.

Task 7.

Complete the following definitions.

Pattern: The operation, which is the inverse of addition, is subtraction.

1. The operation, which is the inverse of subtraction, is _______. 2. The quantity, which is subtracted, is ________. 3. The result of adding two or more numbers, is _______. 4. The result of subtracting two or more numbers, is _______. 5. To find the sum is _______. 6. To find the difference is _______. 7. The quantity number or from which another number (quantity) is subtracted is _______. 8. The terms of the sum is _______. 52 9. A number that is divided is _______. 10. The inverse operation of multiplication is ______. 11. A number that must be multiplied is _______. 12. A number by which we multiply is _______. 13. A number by which we divide _______. 14. A part of the dividend left over after division is _______. 15. The number, which is the result of the operation of multiplication, is ________.

Task 8.

Match the answers to the following questions.

№ Question Answer 1 What is the result of addition called? a Remainder 2 What is the result of subtracting whole numbers called? b Zero 3 What arithmetic operation is usually used to check the answer of addition? c Product 4 What is the result of multiplication called? d Meaningless 5 What is the result of division called? e Sum 6 What is the product of any number multiplied by zero? f Quotient 7 What is the name of the part that is left over after the dividend has been divided equally? g Difference 8 What can we say about the following operation “n:0” for all values of n? h Subtraction

Task 9.

Read the following equations aloud. 7 + 5 = 12 is read seven plus five equals twelve seven plus five is equal to twelve seven plus five is (are) twelve seven added to five makes twelve 7 – 5 = 2 is read seven minus five equals two seven minus five is equal to two seven minus five is two five from seven leaves two the difference between seven and five is two 5 x 2 = 10 is read five multiplied by two is equal to ten five multiplied by two equals ten five times two is ten two times five make(s) ten 10 : 2 = 5 is read ten divided by two is equal to five ten divided by two equals five two into ten goes five times 1. 16 + 22 = 38 2. 280 – 20 = 260 3. 1345 + 15 = 136015 4. 2017 – 1941 = 76 53 5. 15200 – 1300 + 738 = 14638 6. 70 × 3 = 210 7. 48 : 8 = 6 8. 3419 × 2 = 6838 9. 4200 : 2 = 2100 10. 750 : 10 × 4 = 300

Task 10.

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

Task 11.

In pairs, take turns to interview your partner about the basic operations of arithmetic. What questions do you think are the most relevant?

Task 12.

Speak on the Topic “Four Basic Operations of Arithmetic”, give your own examples.

Task 13.

Translate into English in writing.

1. Числа, которые нужно сложить, называются слагаемыми, а результат сложения, то есть число, получающееся от сложения, называется суммой. 2. Вычитанием называется действие, посредством которого (by means of which) по данной сумме и одному слагаемому отыскивается другое слагаемое. 3. Число, которое умножают, называется множимым; число, на которое умножают, называется множителем. 4. Результат действия, то есть число, полученное при умножении, называется произведением. 5. Число, которое делят, называется делимым; число, на которое делят, называется делителем; число, которое получается в результате деления, называется частным.

Task 14.

Translate into Russian in writing. Signs of Operations Used in Arithmetic

The signs most used in arithmetic to indicate operations with numbers are plus (+), minus (–), multiplication (×), and division (:) signs. When either of these is placed between any two numbers it indicates respectively that the sum, difference, product, or quotient of the two numbers is to be found. The equality sign (=) shows that any indicated operation or combination of numbers written before it (on the left) produces the result or number written after it.

Task 15.

Read the words and try to remember the pronunciation.

1. property ['prɔpətı] – свойство 2. equation [ı'kweıʒ(ə)n] – уравнение, равенство 3. commutative [kə'mju:tətıv] – перестановочный; коммутационный 4. associative [ə'səuʃıətıv] – сочетаемый 5. distributive [dıs'trıbjutıv] – разделительный 54 6. quantity ['kwɔntıtı] – величина 7. affect ['æfekt] – влиять, отразиться на 8. involve [ın'vɔlv] – включать в себя 9. describe [dıs'kraıb] – описывать 10. order ['ɔ:də] – порядок

Task 16.

Read Text B. Translate it from English into Russian.

Text B

THE BASIC ARITHMETIC PROPERTIES

Commutative Property The commutative property describes equations in which the order of the numbers involved does not affect the result. Addition and multiplication are commutative operations: • 2+3=3+2=5 • 5×2=2×5=10 Subtraction and division, however, are not commutative. Associative Property The associative property describes equations in which the grouping of the numbers involved does not affect the result. As with the commutative property, addition and multiplication are associative operations: • (2+3)+6=2+(3+6)=11 • (4×1)×2=4×(1×2)=8 Once again, subtraction and division are not associative. Distributive Property The distributive property can be used when the sum of two quantities is then multiplied by a third quantity. • (2+4) ×3=2×3+4×3=18

AFTER TEXT TASK

Task 17.

Answer the following questions on Text B.

1. What are the basic arithmetic properties? 2. What equations does the commutative property describe? 3. What equations does the associative property describe? 4. When is the distributive property used? 5. Which arithmetic operations are not commutative and associative?

Part 2

ARITHMETIC OPERATIONS OF FRACTIONS

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. What does a fraction represent? 2. Who invented fractions? 3. What arithmetic operations of fractions do you know?

Task 2. Study and remember the following words and expressions.

№ Word Transcription

1 value ['vælju:] значение 2 equal ['i:kwəl] равный 3 term of a fraction ['tɜ:m ɔf ə 'frækʃ(ə)n] числитель, знаменатель дроби 4 numerator ['nju:məreɪtə] числитель 5 denominator [dɪ'nɔmɪneɪtə] знаменатель 6 mixed number [mɪkst 'nʌmbə] смешанное число 7 whole number [həul 'nʌmbə] целое число 8 proper fraction ['prɔpə 'frækʃ(ə)n] правильная дробь 9 improper fraction [ɪm'prɔpə 'frækʃ(ə)n] неправильная дробь 10 fraction line [laɪn 'frækʃ(ə)n] дробная черта

Task 3.

Practise reading the following fractions.

1 2 a half, one half 1 3 a third, one third 1 4 one fourth, a quarter 1 10 one tenth 2 3 two thirds 3 7 three sevenths 7 2 seven halves

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION OF FRACTIONS

A fraction represents a part of one whole thing! A fraction indicates that something has been cut or divided into a number of equal parts. For example, a pie has been divided into four equal parts. If you eat one piece of the pie, you have taken one part out of four parts. This part of the pie can be represented by the fraction 1⁄4. 56 The remaining portion of the pie, which consists of three of the four equal parts of the pie, is represented by the fraction 3⁄4. In a fraction the upper and lower numbers are called the terms of the fraction. The horizontal line separating the two numbers in each fraction is called the fraction line. The top term of a fraction or the term above the fraction line is called the numerator; the bottom term or the term below the fraction line is called the denominator. To add fractions having the same denominator (like fractions) add their numerators and write the sum over the common denominator (do not add the denominators). Reduce the resulting fraction to lowest terms. To add fractions having different denominators (unlike fractions) the fractions must be changed to equivalent fractions which have the same or a common denominator. The least number which will be a common denominator, for example, of 2/3 and 3/5 is 15, 15 is the least common denominator, or lowest common denominator of 2/3 and 3/5. The least common denominator is sometimes denoted by the letters L.C.D. To subtract fractions having the same denominator subtract the numerators and write the difference over the common denominator (do not subtract denominators). To subtract fractions having different denominators first change the fractions to equivalent fractions having a common denominator. To subtract the fractions when they have a common denominator, subtract the numerators and write the difference over the denominator. To multiply a mixed number and a fraction: 1) reduce the fraction to its lowest terms; 2) change the mixed number to an improper fraction; 3) multiply the two numerators to obtain the numerator of the answer; 4) multiply the denominators to obtain the denominator of the answer; 5) reduce the fraction obtained when possible. Reduction can be done by dividing a numerator and a denominator by the same number. The numbers that are divided are crossed out, and the quotients are written as the new numerator and the new denominator. To divide a whole number by a fraction, multiply the whole number by the denominator of the fraction and divide the result by the numerator of the fraction. Changing Fractions The numerator and denominator of a fraction may be multiplied by the same number without changing the value of the fraction. The resulting equivalent fraction is actually the same fraction expressed in higher terms. To change a mixed number to an improper fraction we must: 1) multiply the denominator of the fraction by the whole number; 2) add the numerator of the fraction to the product of the multiplication; 3) write the result over the denominator. To change an improper fraction to a whole or a mixed number we must divide the numerator by the denominator. If there should be a remainder, write it over the denominator. The resulting fraction should then be reduced to its lowest terms. To change a whole number to an improper fraction with a specific denominator: 1) multiply the specific denominator and the whole number; 2) write the result over the specific denominator. 57 Fractions can be compared. To compare unlike fractions we must change them to equivalent fractions so that all have like denominators. When fractions have different numerators but the same denominator, the fraction having the largest numerator has the greatest value. When fractions have different denominators but the same numerator, the fraction having the largest denominator has the smallest value.

AFTER TEXT TASKS

Task 5.

Answer the following questions.

1. What does a fraction represent? 2. What do we call "the terms of fractions"? 3. What is the numerator? 4. What is the denominator? 5. What should one do in order to add fractions having the same denominator? 6. What should one do in order to add fractions having different denominators? 7. What should one do in order to subtract fractions having the same denominator? 8. What should one do in order to subtract fractions having different denominators? 9. How do you multiply fractions having the same denominators? 10. How do you multiply fractions having different denominators? 11. How do you multiply a mixed number and a fraction? 12. What is an equivalent fraction? 13. How do you change a mixed number to an improper fraction? 14. How do you change an improper fraction to a whole number or mixed number? 15. How do you change a whole number to an improper fraction with a specific denominator? 16. What must you do to compare unlike fractions? 17. How do you compare fractions?

Task 6.

Look through the text to search for unfamiliar words and try to understand their general meanings.

Task 7.

Write down the transcription and definitions of unfamiliar words, practice reading the words and try to remember them.

Task 8.

Give Russian equivalents to these word combinations.

1. to represent 2. to indicate 4. upper number 5. lower number 6. bottom term 7. top term 58 8. like fractions 9. unlike fractions 10. common denominator

Task 9.

Find the English equivalents to the following words and word combinations.

1. дробная черта 2. значение дроби 3. уменьшать 4. разделить 5. сложить, добавить 6. сравнивать 7. получать, достигать 8. частное 9. наименьший общий знаменатель 10. Обозначать

Task 10.

Match the terms with their definitions.

№ Term Definition

1 a mixed number a the number which is left over in a division in which one quantity does not exactly divide another 2 like fractions b the process of combining matrices, vectors, or other quantities under specific rules to obtain their product 3 reduction c fractions which have the same denominator 4 equivalent fractions d a result obtained by dividing one quantity by another 5 multiplication e different fractions that name the same number 6 unlike fractions f a number consisting of an integer and a proper fraction 7 a remainder g fractions with different numbers in the denominator 8 a quotient h the process of converting an amount from one denomination to a smaller one, or of bringing down a fraction to its lowest terms 9 numerator i the horizontal line separating the two numbers in each fraction 10 fraction line j the top term of a fraction or the term above the fraction line

Task 11.

Mark true (T) or false (F) sentences.

1. A fraction represents a part of one whole thing! 2. In a fraction the upper and lower numbers are called the terms of the fraction. 3. The bottom term or the term below the fraction line is called the numerator. 4. The least common denominator is sometimes denoted by the letters L.C.D. 5. The numerator and denominator of a fraction may be multiplied by the same number, but the value of the fraction changes. 6. When fractions have different numerators but the same denominator, the fraction having the largest numerator has the greatest value. 7. When fractions have different denominators but the same numerator, the fraction having the largest denominator has the greatest value.

Task 12.

Match the beginnings and the endings of the given sentences.

№ Beginnings Endings

1 To add fractions having the same denominator (like fractions) add their numerators and a so that all have like denominators. 2 To compare unlike fractions we must change them to equivalent fractions b divide the result by the numerator of the fraction. 3 To change an improper fraction to a whole or a mixed number we must c fractions which have the same or a common denominator. 4 To divide a whole number by a fraction, multiply the whole number by the denominator of the fraction and d write the sum over the common denominator (do not add the

denominators). 5 To subtract the fractions when they have a common denominator, subtract the numerators and e write the difference over the common denominator (do not subtract denominators). 6 To subtract fractions having the same denominator subtract the numerators and f divide the numerator by the denominator. 7 To add fractions having different denominators (unlike fractions) the fractions must be changed to equivalent g write the difference over the denominator.

Task 13.

Fill in the gaps with the words from the box.

A. subtrahend divide denominator product L.C.D. sum When fractions have a common (1) _______, they can be added by simply adding the numerators and writing the (2) _______ over the same denominator. Any fractions with a common denominator are subtracted by subtracting the numerator of the (3) _______ fraction from that of the minuend fraction, and writing the remainder over the common denominator to form the remainder fraction. Thus to add or subtract fractions, first change them into ones with the (4) _______, and then add or subtract the numerators, writing the result as the numerator of a fraction with the common denominator. This fraction is the desired sum or difference respectively. To multiply a fraction by a whole number, multiply the numerator by that number, and write the (5) _______ as the numerator of a new fraction with the same denominator. This 60 fraction is the desired product. In order to (6) _______ a fraction by any number, multiply the denominator by that number.

B. affect values principles division same When denominators and numerators of different fractions are both different, the (1) _______ of the fractions cannot be compared until they are converted so as to have the (2) _______ denominators. Since fractions indicate (3) _______, all changes in the terms of a fraction (numerator and denominator) will (4) _______ its value (quotient) according to the general principles of division. These relations constitute the general (5) _______ of fractions.

Task 14.

Write out key words from the text.

Task 15.

Use the key words of the text to make up the outline of the text.

Task 16.

Write out the main idea of the text. Be ready to speak about it.

Task 17.

Give the summary of Text A.

Task 18.

In pairs, take turns to interview your partner about addition, subtraction, multiplication and division of fractions. What questions do you think are the most relevant?

Task 19.

Translate the sentences from Russian into English in writing.

A. 1. Чтобы сложить дроби с одинаковыми знаменателями, надо сложить их числители и оставить тот же знаменатель. 2. Чтобы сложить дроби с разными знаменателями, нужно предварительно привести их к наименьшему общему знаменателю, сложить их числители и написать общий знаменатель. 3. Чтобы вычесть дробь из дроби, нужно предварительно привести дроби к наименьшему общему знаменателю, затем из числителя уменьшенной дроби вычесть числитель вычитаемой дроби и под полученной разностью написать общий знаменатель. 4. Чтобы умножить дробь на целое число, нужно умножить на это целое число числитель и оставить тот же знаменатель. 5. Чтобы разделить дробь на целое число, нужно умножить на это число знаменатель, а числитель оставить тот же.

B. 1. Чтобы обратить смешанное число в неправильную дробь, нужно целое число умножить на знаменатель дроби, к произведению прибавить числитель и сделать эту сумму числителем искомой (sought for) дроби, а знаменатель оставить прежним. 2. Чтобы обратить неправильную дробь в смешанное число, нужно числитель дроби разделить на знаменатель и найти остаток. 3. Частное покажет число целых единиц; остаток нужно взять в качестве числителя, а знаменатель оставить прежним. 4. Если числитель дроби уменьшить в несколько раз, не изменяя знаменателя, то дробь уменьшится во столько же раз. 5. Если числитель и знаменатель дроби увеличить в одинаковое число раз, то дробь не изменится.

Task 20.

Read the words and try to remember the pronunciation.

1. emergence [ɪ'mɜːʤ(ə)ns] – возникновение 2. relationship [rɪ'leɪʃ(ə)nʃɪp] – отношение 3. measurement ['meʒəmənt] – измерение 4. reliable [rɪ'laɪəb(ə)l] – достоверный 5. Babylon ['bæbɪlən] – Вавилон 6. Egypt ['iːʤɪpt] – Египет 7. approximate [ə'prɔksɪmeɪt] – приближенный, приблизительный 8. nautical ['nɔ:tɪk(ə)l] – мореходный, морской 9. impetus ['ɪmpɪtəs] – толчок, импульс

Task 21.

Read Text B.

Translate it from Russian into English.

Text B

ИСТОРИЯ АРИФМЕТИКИ

История арифметики охватывает период от возникновения счёта до формального определения чисел и арифметических операций над ними с помощью системы аксиом. Арифметика — наука о числах, их свойствах и отношениях — является одной из основных математических наук. Она тесно связана с алгеброй и теорией чисел. Причиной возникновения арифметики стала практическая потребность в счёте, простейших измерениях и вычислениях. Первые достоверные сведения об арифметических знаниях обнаружены в исторических памятниках Вавилона и Древнего Египта, относящихся к III-II тысячелетиям до н. э. Большой вклад в развитие арифметики внесли греческие математики, в частности пифагорейцы, которые пытались с помощью чисел определить все закономерности мира. В Средние века основными областями применения арифметики были торговля и приближённые вычисления. Арифметика развивалась в первую очередь в Индии и странах ислама и только затем пришла в Западную Европу. В XVII веке мореходная астрономия, механика, более сложные коммерческие расчёты поставили перед арифметикой новые запросы к технике вычислений и дали толчок к дальнейшему развитию.

UNIT 5.

ALGEBRA

The algebraic sum of all the transformations occurring in a cyclical process can only be positive, or, as an extreme case, equal to nothing. – Rudolf Clausius

Part 1

ALGEBRA AS A BROAD FIELD OF MATHEMATICS

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. What do you know about the development of algebra as a field of mathematics? 2. What was characteristic of ancient Mathematics? 3. Where did the history of algebra begin?

Task 2.

Practise reading the following words.

№ Word Transcription

1 generic [ʤɪˈnerɪk] 2 quantities [ˈkwɒntɪtɪs] 3 indeterminate equation [ɪndɪˈtɜːmɪnɪt ɪˈkweɪʒ(ə)n] 4 variable [ˈve(ə)rɪəb(ə)l] 5 solutions [səˈluːʃn] 6 derive [dɪˈraɪv] 7 measurement [ˈmeʒəmənt] 8 quadratic [kwɒˈdrætɪk] 9 formulas [ˈfɔːmjʊlə]

Task 3.

Study and remember the following words and proper names.

№ Word Transcription Translation

1 ancient [ˈeɪnʃnt] древний 2 Mesopotamian [mesɪpɪˈteɪmɪən] месопотамский 3 Babylonian [bæbɪˈləʊnɪən] вавилонский 4 Egypt [ˈɪʤɪpt] Египет 5 Egyptian [ɪˈʤɪpʃn] египетский 7 Alexandria [ælɪgˈzɑːndrɪə] Александрия 8 Diophantus [daɪəˈfæntəs] Диофант 9 Al-Khwarizmi [æl karizmi] Аль Каризми 10 Abu Kamil [abu kəˈmɪl] Абу Камиль 11 Islamic [ɪzˈlæmɪk] исламский 12 Omar Khayyam [ˈəʊmɑː keɪˈjæm] Омар Хайям 13 Persian [ˈpɜːʒən] персидский 14 polynomial [pɒlɪˈnəʊmɪəl] многочлен 15 astronomer [əsˈtrɒnəmə] астроном 16 algebraic [ælʤɪˈbreɪɪk] алгебраический 17 philosopher [fɪˈlɒsəfə] философ 18 Rene Descartes [rɪˈneɪ dəˈkɑːt] Рене Декарт 19 equation [ɪˈkweɪʒ(ə)n] уравнение

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

HISTORY OF ALGEBRA

A broad field of mathematics, algebra deals with solving generic algebraic expressions and manipulating them to arrive at results. Unknown quantities denoted by alphabets that form a part of an equation are solved for and the value of the variable is determined. A fascinating branch of mathematics, it involves complicated solutions and formulas to derive answers to the problems posed. 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.

AFTER TEXT TASKS

Task 5.

Answer the following questions.

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

Task 6.

Give Russian equivalents to these word combinations.

1. to solve generic algebraic expressions 2. to arrive at results 3. unknown quantities 4. a part of an equation 5. the value of the variable 6. a fascinating branch of mathematics 7. complicated solutions and formulas 8. to derive answers to the problems 9. measurement and calculation in geometry 10. axioms or proofs

Task 7.

Find the English equivalents to the following word combinations.

1. решать линейные и квадратные уравнения 2. неопределенные уравнения 3. когда задействовано несколько неизвестных 4. основные законы и тождества алгебры 5. к средневековым временам 6. базовая алгебра многочленов 7. корни кубических уравнений 8. введение символов 9. алгебраические степени и операции 10. значительный вклад в математику

Task 8.

Match the terms with their definitions.

№ Term Definition

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 65 8 unknown h многочлен 9 discovery i неизвестное 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

Task 9.

Mark true (T) or false (F) sentences.

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 AlKhwarizmi. 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.

Task 10.

Insert the necessary word(s) from the chart into the gaps. polynomials; algebraic expressions; measurement; solutions (2); algebra; equations; the basic laws; roots; mathematics.

1. A broad field of mathematics, algebra deals with solving generic (1) … … and manipulating them to arrive at results. 2. A fascinating branch of mathematics, it involves complicated (2) … and formulas to derive answers to the problems posed. 3. The earliest records of advanced, organized (3) … date back to the ancient Mesopotamian country of Babylonia and to the Egypt of the 3rd millennium BC. 4. Ancient mathematics was dominated by arithmetic, with an emphasis on (4) … and calculation in geometry and with no trace of later mathematical concepts such as axioms or proofs. 5. It was in ancient Egypt and Babylon that the history of (5) … began. 6. Egyptian and Babylonian mathematicians learned to solve linear and quadratic equations as well as indeterminate (6) … whereby several unknowns are involved. 7. 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 (7) … to difficult indeterminate equations. 8. 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 9.

Kamil stated and proved (8) … and identities of algebra. By medieval times, Islamic mathematicians had worked out the basic algebra of (9) …. 10. The astronomer and poet Omar Khayyam showed how to express (10) … of cubic equations.

Task 11.

Match the beginnings and the endings of the given sentences.

Beginnings

1. A broad field of mathematics, algebra deals with …. 2. Unknown quantities denoted by alphabets that form a part of an equation are solved for and …. 3. A fascinating branch of mathematics, algebra involves …. 4. The earliest records of advanced, organized mathematics date back …. 5. Ancient mathematics was dominated by arithmetic, with an emphasis on … . 6. Egyptian and Babylonian mathematicians learned to solve linear and quadratic equations as well as …. 7. Diophantus' book Arithmetica gives many … . 8. In the 9th century, the Arab mathematician Al-Khwarizmi wrote … . 9. At the end of the 9th century, the Egyptian mathematician Abu Kamil stated and proved … . 10. By medieval times, Islamic mathematicians had worked out … . 11. The astronomer and poet Omar Khayyam showed how to express … . 12. An important development in algebra in the 16th century was … . 13. Descartes' most significant contribution to mathematics was ... .

Endings

a. his discovery of analytic geometry, which reduces the solution of geometric problems to the solution of algebraic ones. b. solving generic algebraic expressions and manipulating them to arrive at results. c. surprising solutions to difficult indeterminate equations. d. the introduction of symbols for the unknown and for algebraic powers and operations. e. the value of the variable is determined. f. roots of cubic equations. g. complicated solutions and formulas to derive answers to the problems posed. h. the basic algebra of polynomials. i. to the ancient Mesopotamian country of Babylonia and to the Egypt of the 3rd millennium BC. j. measurement and calculation in geometry and with no trace of later mathematical concepts such as axioms or proofs. k. one of the first Arabic algebras. l. the basic laws and identities of algebra. m. indeterminate equations whereby several unknowns are involved.

Task 12.

Retell Text A.

Task 13.

In pairs, take turns to interview your partner about algebra and its history. What questions do you think are the most relevant?

Task 14.

Write a short essay on the suggested topics. The volume of the essay is 200-250 words. Suggest some other relevant essay topics.

1. The Egyptian mathematicians. 2. Abu Kamil. 3. Rene Descartes. 4. The Alexandrian mathematicians. 5. The Arab mathematician Al-Khwarizmi.

Task 15.

Read the words and try to remember the pronunciation.

1. non-Euclidean geometry [nɔn-juːˈklɪdɪən ʤɪˈɒmɪtrɪ] – не-Эвклидова геометрия 2. Gauss [΄gaʊs] – Гаусс 3. Riemann [ˈriːmən] – Риман 4. Kant [kænt] – Кант 5. decade [ˈdekeɪd] – десятилетие 6. obscure [əbˈskjʊə] – малоизвестный, незаметный 7. unique [juːˈniːk] – уникальный 8. plausibility [΄plɔːzəˈbɪlɪtɪ] – очевидность, правдоподобность 9. inherent [ɪnˈhɪərənt] – врождённый, изначальный 10. ingenuity [ɪnʤɪˈnjuːɪtɪ] – оригинальность (мышления), изобретательность 11. convergence [kənˈvɜːʤəns] – сходимость (бесконечного ряда)

Task 16.

Read Text B. Translate it from English into Russian.

Text B

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. 68 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 scientific character, 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.

AFTER TEXT TASK

Task 17.

Answer the questions on Text B.

1. What city 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?

Part 2

WHAT IS ALGEBRA? BASICS, DEFINITION, EXAMPLES

Task 1.

In pairs, discuss the following questions. Try to prove your idea. Express your attitude to the received response, your agreement or disagreement with the partner's opinion. 1. Why do people need algebra? 2. What are the main branches of algebra? 3. Why is understanding algebra as a concept more important than solving equations?

Task 2.

Practise reading the following words.

№ Word Transcription

1 representation [reprɪzenˈteɪʃn] 2 mathematical [mæθɪˈmætɪkəl] 3 variables [ˈveərɪəblz] 4 addition [əˈdɪʃn] 5 subtraction [səbˈtrækʃn] 6 multiplication [mʌltɪplɪˈkeɪʃn] 7 division [dɪˈvɪʒən] 8 trigonometry [trɪgəˈnɒmɪtrɪ] 9 calculus [ˈkælkjʊləs] 10 constant [ˈkɒnstənt]

Task 3. Study and remember the following words and expressions.

№ Word / Expression Transcription

1 simplify [ˈsɪmplɪfaɪ] упрощать 2 numerous [ˈnjuːmərəs] многочисленный 3 complexity [kəmˈpleksɪtɪ] сложность 4 various [ˈve(ə)rɪəs] различный 5 linear equation [ˈlɪnɪə ɪˈkweɪʒ(ə)n] линейное уравнение 6 quadratic equation [kwɒˈdrætɪk ɪˈkweɪʒ(ə)n] квадратное уравнение 7 polynomial pɒlɪˈnəʊmɪəl] многочлен 8 exponent [ɪkˈspəʊnənt] показатель степени 9 logarithm [ˈlɒgərɪðəm] логарифм 10 quantity [ˈkwɒntɪtɪ] величина 70

Task 4.

Read and translate Text A using a dictionary if necessary.

Text A

WHAT IS ALGEBRA? BASICS, DEFINITION, EXAMPLES

Algebra helps in the representation of problems or situations as mathematical expressions. It involves variables like x, y, z, and mathematical operations like addition, subtraction, multiplication, and division to form a meaningful mathematical expression. All the branches of mathematics such as trigonometry, calculus, coordinate geometry, involve the use of algebra. One simple example of an expression in algebra is $2x + 4 = 8$. Algebra deals with symbols and these symbols are related to each other with the help of operators. It is not just a mathematical concept, but a skill that all of us use in our daily life without even realizing it. Understanding algebra as a concept is more important than solving equations and finding the right answer, as it is useful in all the other topics of mathematics that you are going to learn in the future or you have already learned in past. What is Algebra? Algebra is a branch of mathematics that deals with symbols and the arithmetic operations across these symbols. These symbols do not have any fixed values and are called variables. In our real-life problems, we often see certain values that keep on changing. But there is a constant need to represent these changing values. Here in algebra, these values are often represented with symbols such as x, y, z, p, or q, and these symbols are called variables. Further, these symbols are manipulated through various arithmetic operations of addition, subtraction, multiplication, and division, with an objective to find the values. The above algebraic expressions are made up of variables, operators, and constants. Here the numbers 4, 28 are constants, x is the variable, and the arithmetic operation of addition is performed. Branches of Algebra The complexity of algebra is simplified by the use of numerous algebraic expressions. Based on the use and the complexity of the expressions, algebra can be classified into various branches that are listed below: • Pre-algebra • Elementary Algebra • Abstract Algebra • Universal Algebra 71 Pre-algebra The basic ways of presenting the unknown values as variables help to create mathematical expressions. It helps in transforming real-life problems into an algebraic expression in mathematics. Forming a mathematical expression of the given problem statement is part of pre-algebra. Elementary Algebra Elementary algebra deals with solving the algebraic expressions for a viable answer. In elementary algebra, simple variables like x, y, are represented in the form of an equation. Based on the degree of the variable, the equations are called linear equations, quadratic equations, polynomials. Linear equations is of the form of ax + b = c, ax + by + c = 0, ax + by + cz + d = 0. Elementary algebra based on the degree of the variables, branches out into quadratic equations and polynomials. A general form of representation of a quadratic equation is ax2 + bx + c = 0, and for a polynomial equation, it is axn + bxn-1+ cxn-2+ .....k = 0. Abstract Algebra Abstract algebra deals with the use of abstract concepts like groups, rings, vectors rather than simple mathematical number systems. Rings are a simple level of abstraction found by writing the addition and multiplication properties together. Group theory and ring theory are two important concepts of abstract algebra. Abstract algebra finds numerous applications in computer sciences, physics, astronomy, and uses vector spaces to represent quantities. Universal Algebra All the other mathematical forms involving trigonometry, calculus, coordinate geometry involving algebraic expressions can be accounted as universal algebra. Across these topics, universal algebra studies mathematical expressions and does not involve the study of models of algebra. All the other branches of algebra can be considered as the subset of universal algebra. Any of the real-life problems can be classified into one of the branches of mathematics and can be solved using abstract algebra. Algebra Topics Algebra is divided into numerous topics to help for a detailed study. Here we have listed below some of the important topics of algebra such as algebraic expressions and equations, sequence and series, exponents, logarithm, and sets. Algebraic Expressions An algebraic expression in algebra is formed using integer constants, variables, and basic arithmetic operations of addition(+), subtraction(-), multiplication(×), and division(/). An example of an algebraic expression is 5x + 6. Here 5 and 6 are fixed numbers and x is a variable. Further, the variables can be simple variables using alphabets like x, y, z or can have complex variables like x2 , x3 , xn , xy, x2y, etc. Algebraic expressions are also known as polynomials. A polynomial is an expression consisting of variables (also called indeterminates), coefficients, and non-negative integer exponents of variables. Example: 5x3 + 4x2 + 7x + 2 = 0. 72 An equation is a mathematical statement with an 'equal to' symbol between two algebraic expressions that have equal values. Given below are the different types of equations, based on the degree of the variable, where we apply the concept of algebra: • Linear Equations: Linear equations help in representing the relationship between variables such as x, y, z, and are expressed in exponents of one degree. In these linear equations, we use algebra, starting from the basics such as the addition and subtraction of algebraic expressions. • Quadratic Equations: A quadratic equation can be written in the standard form as ax 2 + bx + c = 0, where a, b, c are constants and x is the variable. The values of x that satisfy the equation are called solutions of the equation, and a quadratic equation has at most two solutions. • Cubic Equations: The algebraic equations having variables with power 3 are referred to as cubic equations. A generalized form of a cubic equation is ax 3 + bx 2 + cx + d = 0. A cubic equation has numerous applications in calculus and three-dimensional geometry. Sequence and Series A set of numbers having a relationship across the numbers is called a sequence. A sequence is a set of numbers having a common mathematical relationship between the number, and a series is the sum of the terms of a sequence. In mathematics, we have two broad number sequences and series in the form of arithmetic progression and geometric progression. Some of these series are finite and some series are infinite. The two series are also called arithmetic progression and geometric progression and can be represented as follows. Arithmetic Progression: An Arithmetic progression (AP) is a special type of progression in which the difference between two consecutive terms is always a constant. The terms of an arithmetic progression series is a, a+d, a + 2d, a + 3d, a + 4d, a + 5d, ... Geometric Progression: Any progression in which the ratio of adjacent terms is fixed is a Geometric Progression. The general form of representation of a geometric sequence is a, ar, ar 2 , ar 3 , ar 4 , ar 5 , ... 73 Exponents Exponent is a mathematical operation, written as an . Here the expression an involves two numbers, the base a and the exponent or power n. Exponents are used to simplify algebraic expressions. In this section, we are going to learn in detail about exponents including squares, cubes, square root, and cube root. The names are based on the powers of these exponents. The exponents can be represented in the form an = a x a x a x ... n times. Logarithms The logarithm is the inverse function to exponents in algebra. Logarithms are a convenient way to simplify large algebraic expressions. The exponential form represented as ax = n can be transformed into logarithmic form as logaan = x. John Napier discovered the concept of Logarithms in 1614. Logarithms have now become an integral part of modern mathematics. Sets A set is a well-defined collection of distinct objects and is used to represent algebraic variables. The purpose of using sets is to represent the collection of relevant objects in a group. Example: Set A = {2, 4, 6, 8}..........(A set of even numbers), Set B = {a, e, i, o, u}......(A set of vowels). Algebraic Formulas An algebraic identity is an equation that is always true regardless of the values assigned to the variables. Identity means that the left-hand side of the equation is identical to the right-hand side, for all values of the variables. These formulae involve squares and cubes of algebraic expressions and help in solving the algebraic expressions in a few quick steps. The frequently used algebraic formulas are listed below. • (a + b)2 = a2 + 2ab + b2 • (a - b)2 = a2 - 2ab + b2 • (a + b)(a - b) = a2 - b 2 • (x + a)(x + b) = x + (a + b)x + ab • (a + b + c)2 = a2 + b2 + c2 + 2ab + 2bc + 2ca • (a + b)3 = a3 + 3a2b + 3ab2 + b3 • (a - b)3 = a3 - 3a2b + 3ab2 - b 3 Let us see the application of these formulas in algebra using the following example, Example: Using the (a + b)2 formula in algebra, find the value of (101)2 . Solution: Given: (101)2 = (100 + 1)2 Using algebra formula (a + b)2 = a2 + 2ab + b2 , we have, (100 + 1)2 = (100)2 + 2(1)(100) + (1)2 (101)2 = 10201 Algebraic Operations The basic operations covered in algebra are addition, subtraction, multiplication, and division. • Addition: For the addition operation in algebra, two or more expressions are separated by a plus(+) sign between them. 74 • Subtraction: For the subtraction operation in algebra, two or more expressions are separated by a minus(-) sign between them. • Multiplication: For the multiplication operation in algebra, two or more expressions are separated by a multiply(×) sign between them. • Division: For the division operation in algebra, two or more expressions are separated by a "/" sign between them. Basic Rules and Properties of Algebra The basic rules or properties of algebra for variables, algebraic expressions, or real numbers a, b and c are as given below, • Commutative Property of Addition: a + b = b + a • Commutative Property of Multiplication: a × b = b × a • Associative Property of Addition: a + (b + c) = (a + b) + c • Associative Property of Multiplication: a × (b × c) = (a × b) × c • Distributive Property: a × (b + c) = a × b + b × c or a × (b - c) = a × b - a × c • Reciprocal: Reciprocal of a = 1/a • Additive Identity: a + 0 = 0 + a = a • Multiplicative Identity: a × 1 = 1 × a = a • Additive Inverse: a + (-a) = 0

AFTER TEXT TASKS

Task 5.

Answer the following questions. 1. What does algebra deal with? 2. What is the complexity of algebra simplified by? 3. What are the basic ways of presenting the unknown values as variables? 4. How are simple variables like x, y represented in elementary algebra? 5. How are the equations based on the degree of the variable called? 6. How can we define rings? 7. How can all the other mathematical forms involving trigonometry, calculus, coordinate geometry involving algebraic expressions be accounted? 8. How is an algebraic expression formed? 9. What should be done for the division operation in algebra?

Task 6.

Look through the text to search for unfamiliar words and try to understand their general meanings.

Task 7.

Write down the transcription and definitions of unfamiliar words, practise reading the words and try to remember them.

Task 8.

Give Russian equivalents to these word combinations.

1. coordinate geometry 2. a viable answer 75 3. the degree of the variables 4. abstract algebra deals with 5. group theory 6. ring theory 7. numerous applications 8. the subset of universal algebra 9. sequence and series 10. integer constants

Task 9.

10. кубы 11. квадратный корень 12. кубический корень

Task 10.

Match the terms with their definitions.

№ Term Defenition

1 An algebraic identity a is a mathematical operation, written as an. 2 A set b is a special type of progression in which the difference between two consecutive terms is always a constant. 3 Identity c is an equation that is always true regardless of the values assigned to the variables. 4 The logarithm d is a set of numbers having a relationship across the numbers. 5 Exponent e is a well-defined collection of distinct objects and is used to represent algebraic variables. 6 An Arithmetic progression (AP) f is a mathematical statement with an 'equal to' symbol between two algebraic expressions that have equal values. 7 A sequence g means that the left-hand side of the equation is identical to the right-hand side, for all values of the

variables. 8 Geometric Progression h are the algebraic equations having variables 76 with power 3. 9 Cubic Equations i is the inverse function to exponents in algebra. 10 An equation j is any progression in which the ratio of adjacent terms is fixed

Task 11.

Match the beginnings and the endings of the given sentences.

Beginnings

1. Algebra is a branch of mathematics that deals with … 2. The complexity of algebra is simplified … . 3. The basic ways of presenting the unknown values as variables help … 4. Elementary algebra deals with … 5. In elementary algebra, simple variables like x, y, are represented … 6. Based on the degree of the variable, the equations are called … 7. Abstract algebra deals with … 8. Rings are a simple level of abstraction found by … 9. All the other mathematical forms involving trigonometry, calculus, coordinate geometry involving algebraic expressions can be accounted as … 10. An algebraic expression in algebra is formed using … 11. For the division operation in algebra, two or more expressions are separated …

Endings

a. integer constants, variables, and basic arithmetic operations of addition, subtraction, multiplication, and division. b. symbols and the arithmetic operations across these symbols. c. universal algebra. d. by the use of numerous algebraic expressions. e. writing the addition and multiplication properties together. f. to create mathematical expressions. g. the use of abstract concepts like groups, rings, vectors rather than simple mathematical number systems. h. solving the algebraic expressions for a viable answer. i. linear equations, quadratic equations, polynomials. j. in the form of an equation. k. by a "/" sign between them.

Task 12.

Write out key words from the text.

Task 13.

Use the key words of the text to make up the outline of the text.

APPENDIX 1
READING SOME MATHEMATICAL EXPRESSIONS

1. $x > y$ «x is greater than y»
2. $x < y$ «x is less than y»
3. $x = 0$ «x is equal to zero»
4. $x \leq y$ «x is equal or less than y»
5. $x < y < z$ «y is greater than x but less than z»
6. xv «x times or x multiplied by y»
7. $a + b$ «a plus b»
8. $7 + 5 = 12$ «seven plus five equals twelve; seven plus five is equal to twelve;

seven and five is (are) twelve; seven added to five makes twelve»

9. a – b «a minus b»

10. 7 – 5 = 2 «seven minus five equals two; five from seven leaves two; difference between five and seven is two; seven minus five is equal to two»

11. a x b «a multiplied by b»

12. 5 x 2 = 10 «five multiplied by two is equal to ten; five multiplied by two equals ten; five times two is ten»

13. a : b «a divided by b»

14. a/b «a over b, or a divided by b»

15. 10 : 2 =5 «ten divided by two is equal to five; ten divided by two equals five»

16. a = b «a equals b, or a is equal to b»

17. b ≠ 0 «b is not equal to 0»

18. т : ab «т divided by a multiplied by b»

19. $\sqrt{ax}$ «The square root of ax»

20. ½ «one second»

21. ¼ «one quarter»

22. -7/5 «minus seven fifth»

23. a^4 «a fourth, a fourth power or a exponent 4»

24. a^n «a nth, a nth power, or a exponent n»

25. π
e «e to the power π »

26. $\sqrt[n]{b}$ «The nth root of b»

27. $\sqrt[3]{8}$ «The cube root of eight is two»

28. Log_{10} 3 «Logarithm of three to the base of ten»

29. 2 : 50 = 4 : x «two is to fifty as four is to x»

30. 4! «factorial 4»

31. $(a + b)^2 = a^2 + 2ab + b^2$ «The square of the sum of two numbers is equal to the square of the first number, plus twice the product of the first and second, plus the square of the second»

32. $(a-b)^2 =a^2 - 2ab+ b^2$ «The square of the difference of two numbers is equal to the square of the first number minus twice the product of the first and second, plus the square of the second»

33. Δx «Increment of x»

34. Δx →0 «delta x tends to zero»

35. ∑ «Summation of ...»

36. dx «Differential of x»

37. dy/dx «Derivative of y with respect to x»

38. d^2y/dx^2 «Second derivative of y with respect to x»

39. d^ny/dx^n «nth derivative of y with respect to x»
40. dy/dx «Partial derivative of y with respect to x»
41. d^ny/dx^n «nth partial derivative of y with respect to x»
42. ∫ «Integral of ...»
a
43. ∫ «Integral between the limits a and b»
b
44. $\sqrt[5]{d^n}$ «The fifth root of d to the nth power»
45. √a+b/ a – b «The square root of a plus b over a minus b»
46. a^3 = logcd «a cubed is equal to the logarithm of d to the base c»
t
47. ∫ f[S, φ(S)] ds «The integral of f of S and φ of S, with respect to S from
τ τ to t»
tl
48. X a-ь =e «X sub a minus b is equal to e to the power t times l»
49. f (z) = Kab «f of z is equal to К sub ab»
d^2u
50. ——— = 0 «The second partial (derivative) of и with respect to t is
dt^2 equal to zero»

APPENDIX 2

HOW TO WRITE A SUMMARY

What is a summary?

A summary – a short version of a larger reading. To write a summary means to use your own words to express briefly the main idea and relevant details of the piece you have read. The purpose in writing the summary is to give the basic ideas of the original reading. The size of the summary is usually onethird of the original article.

Before writing a summary:

For a text, read, mark, and annotate the original. (For a lecture, work with the notes you took.)

– highlight the topic sentence
– highlight key points/ key words/ phrases
– highlight the concluding sentence
– outline each paragraph in the margin

Take notes on the following:

the source (author-- first/last name, title, date of publication, volume number, place of publication, publisher, URL, etc.)

the main idea of the original (paraphrased)

the major supporting points (in outline form)
major supporting explanations (e.g. reasons/causes or effects).
Remember:
Do not rewrite the original piece.
Keep your summary short.
Use your own wording.
Refer to the central and main ideas of the original piece.
Read with who, what, when, where, why and how questions in mind.
How Should I Organize a Summary?
Like traditional essays, summaries have an introduction, a body, and a conclusion.
What these components look like will vary some based on the purpose of the summary you're writing. The introduction, body, and conclusion of work focused specifically around summarizing something is going to be a little different than in work where summary is not the primary goal.
Introducing a Summary
You will almost always begin a summary with an introduction to the author, article, and publication so the reader knows what we are about to read.
The introduction should accomplish a few things:
- Introduce the name of the author whose work you are summarizing.
- Introduce the title of the text being summarized.
- Introduce where this text was presented.
- State the main ideas of the text you are summarizing—just the big-picture components.
- Give context when necessary. Is this text responding to a current event? That might be important to know.

Presenting the "Meat" (or Body) of a Summary
Depending on the kind of text you are summarizing, you may want to note how the main ideas are supported (although, again, be careful to avoid making your own opinion about those supporting sources known).
When you are summarizing with an end goal that is broader than just summary, the body of your summary will still present the idea from the original text that is relevant to the point you are making (condensed and in your own words).
Concluding a Summary
Now that we've gotten a little more information about the main ideas of this piece,

are there any connections or loose ends to tie up that will help your reader fully understand the points being made in this text. This is the place to put those.

Discuss the summary you've just presented. How does it support, illustrate, or give new information about the point you are making in your writing? Connect it to your own main point for that paragraph so readers understand clearly why it deserves the space it takes up in your work.

Useful phrases for writing a summary

In "… (Title, source and date of piece)", the author shows that … (central idea of the piece). The author supports the main idea by using …. and showing that….

The text (story, article, poem, excerpt…) is about…

deals with…

presents…

describes…

In the text (story, article, poem, excerpt…) the reader gets to know…

the reader is confronted with…

the reader is told about…

The author (the narrator) says, states, points out that…

claims, believes, thinks that…

describes, explains, makes clear that…

uses example to confirm, prove that…

agrees/disagrees with the view /thesis…

contradicts the view…

criticises, analyses, comments on…

tries to express…

argues that…

suggests that…

compares X to Y…

emphasises his thesis by saying that…

doubts that…

tries to convince the readers that…

concludes that…

About the structure of the text:

The text consists of/ may be divided into…

In the first paragraph/ exposition the author introduces…

In the second paragraph of the text / paragraph the author introduces…

Another example can be found in…

As a result…

The climax/ turning point is reached when…

To sum up / to conclude…
In the conclusion/ starting from line…, the author sums up the main idea/ thesis…
In his last remark/ with his last remark / statement the author concludes that…

APPENDIX 3
ENGLISH-RUSSIAN DICTIONARY OF MATHEMATICAL TERMS

A

abscissa - абсцисса
absolute - абсолютный
absolute extremum - абсолютный экстремум
absolute value - абсолютная величина, модуль
absolute value of a complex
number - абсолютная величина комплексного числа
accuracy - точность
acnode - изолированная точка
acute angle - острый угол
acute triangle - остроугольный треугольник
add - прибавлять, суммировать
addend - слагаемое
addition - суммирование
addition sign - знак сложения
adjacent angle - соседний (прилежащий, смежный) угол
adjacent side - прилежащая сторона
adjacent supplementary angles - смежные углы
adjoint - сопряженный
admissible - допустимый
admissible solution - допустимое решение
affine coordinates - аффинные координаты
algebra - алгебра
algebraic equation - алгебраическое уравнение
algebraic expression - алгебраическое выражение
algorithm - алгоритм
algorithm for division - алгоритм деления
alternance - чередование
alteration - изменение
alternate angles - накрест лежащие углы
alternate exterior angles - внешние накрест лежащие углы
alternate interior angles - внутренние накрест лежащие углы
altitude of a triangle - высота треугольника
amplitude - амплитуда

analogous - аналогичный
analogical - аналогичный
analogy - аналогия
analysis - анализ
analyze - анализировать
angle - угол
anticosine - арккосинус
antisine - аксинус
applicate - аппликата
approximate solution - приближенное решение
arbitrary - произвольный
arc - дуга
arccosine - арккосинус
arc-length - длина дуги
arcsine - арксинус
arctangent - арктангенс
area - площадь
argument - аргумент
argument of a function - аргумент функции
arithmetic mean - среднее арифметическое
arithmetic progression - арифметическая прогрессия
associative law - сочетательный (ассоциативный)
закон
associative property - сочетательное (ассоциативное) свойство
assumption - предположение
asymmetric(al) - асимметричный
asymmetry - асимметрия
asymptote - асимптота
asymptotes of a hyperbola - асимптоты гиперболы
average - среднее значение
average value - усреднение, среднее значение
axiom
B
- аксиома
back-substitution - обратная подстановка
bar - дробная черта, черта
base - база, базис
base angle {of a triangle} - угол при основании треуольника
base vector - базисный вектор
basis - база, базис
billion - биллион
binary - бинарный
binomial - двучлен (бином)
binomial coefficient - биноминальный коэффициент

binomial expansion - разложение
binomial formula - формула бинома
biquadratic equation - биквадратное уравнение
bisector - биссектриса (более частотный
термин)
bisectrix - биссектриса
bounded interval - ограниченный интервал
braces - фигурные скобки
brackets - квадратные скобки
branch - ветвь
bridging
C
- перенос
calculus - математический анализ, исчисление
cancel - сокращать
canonical - канонический
Cartesian coordinate system - декартова система координат
Cartesian coordinates - декартовы координаты
central angle - центральный угол
central conic - центральное коническое сечение
central symmetry - центральная симметрия
centre - центр
centre of the escribed circle - центр вневписанной окружности
center - центр
change of variable - замена переменной
chord - хорда
circle - окружность, круг
circumcenter - центр описанной окружности
circumscribed figure - описанная фигура
closed - замкнутый
closed interval - замкнутый интервал
coefficient - коэффициент
coincident - совпадающий
collinearity - коллинеарность
combination - комбинация
combine similar terms - приведение подобных членов
common denominator - общий знаменатель
common difference - разность арифметической прогрессии
common divisor - общий делитель
common factor - общий делитель
common fraction - арифметическая (простая) дробь
common logs - десятичный логарифм
common multiple - общее кратное
common ratio - частное геометрической прогрессии

commutative law - переместительный (коммутативный) закон
comparison - сравнение
complementary angle - дополнительный угол {до 90 о}
Complete induction - полная индукция
complete solution - полное решение
complex number - комплексное число
computable - вычислимый
computation - вычисление
concave - вогнутый
concave curve - вогнутая кривая
concave function - вогнутая функция
concentric circles - концентрические окружности
condition - условие
cone - конус
congruence - конгруэнтность
congruent angles - равные углы
congruent figures - равные фигуры
congruent polygons - равные многоугольники
congruent segments - равные отрезки
conic - коническое сечение
conic section - коническое сечение
conjugate - сопряженный
conjugate angle - дополнительный угол до 360о
conjugate roots - сопряженные корни
consecutive integers - последовательные целые числа
constant - константа
continuity - непрерывность
continuous function - непрерывная функция
convex - выпуклый
convex curve - выпуклая кривая
convex polygon - выпуклый многоугольник
convexity - выпуклость
coordinate - координата
coordinate axis - координатная ось
coordinate system - система координат
coplanar - компланарный
coplanar vector - компланарный вектор
coprime numbers - взаимно простые числа
corollary - следствие
corresponding angles - соответственные углы
count - подсчитать, считать
criterion - критерий
criterion for divisibility - признак делимости
cross-product - векторное (внешнее) произведение

cube - куб
cubic - кубическая кривая
cubic curve - кубическая кривая
curve - кривая
cut - сечение
cylinder
D
- цилиндр
data - данные
decimal - десятичный
decimal fraction - десятичная дробь
decimal number - десятичное число
decision - решение
decomposition - разложение
decomposition of a fraction - разложение дроби
decrease - убывать
decreasing function - убывающая функция
deduction - дедукция
define - определять
definition - определение
degenerate - вырожденный
degenerate conic - вырожденное коническое сечение
degree - степень
degree of a polynomial - степень многочлена
denominator - знаменатель
dependent - зависимый
derivative - производная
derivative at a point - производная в точке
determinant - определитель
determine - определять
deviation - отклонение
diagonal - диагональ
diagonal element - диагональный элемент
diagonal matrix - диагональная матрица
diameter - диаметр
diametrically opposite point - диаметрально противоположная точка
difference - разность
differentiability - дифференцируемость
differentiable function - дифференцируемая функция
differential of area - элемент площади
digit - цифра
dihedral angle - двугранный угол
dilatation - растяжение
dimension - размерность

direction - направление
direction cosine - направляющий косинус
directly proportional - прямо пропорциональный
discontinuous - разрывный
discontinuous function - разрывная функция
discriminant - дискриминант
disposition - расположение
distance - расстояние
distinct - различный
distributive law - распределительный (дистибутивный) закон
dividend - делимое
divisible {by} - делимый
division - деление
division algorithm - алгоритм деления
divisor - делитель
domain - область; источник
domain of definition - область определения
dot - точка
dot product - скалярное произведение
dotted line - пунктирная линия
double root - двойной корень
dual - двойственный (дуальный)
duality principle - принцип двойственности
E
edge - ребро
element - элемент
element of area - элемент площади
elimination - исключение
elimination by substitution - исключение посредством подстановки
elimination method - метод исключения
ellipse - эллипс
empty set - пустое множество
equation - уравнение
equation of a straight line - уравнение прямой
equilateral - равносторонний
equilateral polygon - правильный многоугольник
equilateral triangle - равносторонний треугольник
equivalent - равносильный (эквивалентный)
equivalent figure - конгруэнтная фигура
error - ошибка
enscribed - описанный, вневписанный
essential - существенный
estimation - оценка
Euclidean algorithm - алгоритм Евклида

Euclidean geometry - евклидова геометрия
Euclidean space - евклидово пространство
evaluation - вычисление
evaluation of determinant - вычисление определителя
even - четный
even function - четная функция
even number - четное число
everywhere defined - всюду определенный
exact - точный
exact division - деление без остатка
exact solution - точное решение
example - пример
excentre - центр вневписанной окружности
exclusion - исключение
existential quantifier - квантор существования
expansion - разложение
expansion of a determinant - разложение определителя
explementary angle - дополнительный угол до 360o
exponent - показатель, экспонент
exponential - показательный, экспоненциальныйы
exponential equation - показательное уравнение
expression - выражение
exterior angle {of a triangle} - внешний угол {треугольника}
extremal - экстремальный
F
factor - множитель
factor theorem - теорема Безу
factoring - разложение
factorization - разложение на множители
family - семейство
field - поле
first derivative - первая производная
first-order equation - уравнение первого порядка
flow chart - блок-схема
flux - поток
focal point - фокальная точка
focus - фокус
foot {of a perpendicular} - основание {перпендикуляра}
formula - формула
fraction - дробь
function - функция
function of a complex variable - функция комплексной переменной
function of a single variable - функция одной переменной

function of several variables - функция несколько независимых переменных
fundamental - основной
fundamental theorem of arithmetic - основная теорема арифметики
G
general - общий
general form - общий вид
general solution - общее решение
general term - общий член
geometric average - среднее геометрическое
geometric locus - геометрическое место точки
geometric mean - среднее геометрическое
geometric progression - геометрическая прогрессия
geometry - геометрия
grade - степень
greatest common divisor - наибольший общий делитель
greatest common factor - наименьшее общее кратное
H
half-angle formulas - формулы половинного угла
halve - делить пополам
height - высота
hemisphere - полусефра, полушар
hexagon - шестиугольник
hexaeder - гексаэдр, шестигранник
hexahedron - гексаэдр, шестигранник
hill climbing - поиск экстремума
homogeneous - однородный
homogeneous equation - однородное уравнение
homogeneous system - однородная система
horizontal - горизонтальный
horizontal axis - горизонтальная ось
Horner's scheme - схема Горнера
hyperbola - гипербола
hyperbolic - гиперболический
hypotenuse - гипотенуза
hypothesis - гипотеза
I
identity - тождество
if and only if - тогда и только тогда
image - образ
implication - импликация
improper fraction - неправильная дробь
incenter - центр вписанной окружности
incircle - вписанная окружность

include - включать
inclusion - включение, вложение
inconsistent - несовместимый, противоречивый
incorrect - ошибочный, неточный
increase - расти
increment - приращение
indefinite - неопределенный
independent - независимый
independent variable - независимая переменная
indeterminancy - неопределенность
induction - индукция
inequality - неравенство
infinite - бесконечный
infinite decimal fraction - бесконечная десятичная дробь
inflexion - перегиб
inhomogeneous - неоднородный
initial - начальный
initial condition - начальное условие
initial value - начальное значение
inscribe - вписать
inscribed angle - вписанный угол
inscribed circle - вписанная окружность
inscribed polygon - вписанный многоугольник
integer number - целое число
integral - интеграл
integral curve - интегральная кривая
integrand - подинтегральное выражение
integration by parts - интегрирование по частям
integration constant - постоянная интегрирования
inter-stage function - ступенчатая функция
intercept - отрезок; отрезок отсекаемый с оси
intercept theorem - теорема Фалеса
interdependency - взаимозависимость
interior angle - внутренний угол
intersection - пересечение
interval - интервал
inverse - обратно
inversely proportional - обратно пропорциональный
irrational number - иррациональное число
irreductibility - неприводимость
isosceles triangle - равнобедренный треугольник
J
jump - скачок
jump function - ступенчатая функция

K
kilogram(me) - килограмм
kilometre - километр
known - известный
L
law - закон
law of composition - закон композиции
law of sines - теорема синусов
law of the excluded middle - закон исключенного третьего
least common denominator - наименьший общий делитель
least common multiple - наименьшее общее кратное
leg - боковая сторона
Leibniz rule - формула Лейбница
lemma - лемма
length - длина
like denominators - одинаковые знаменатели
like signs - одинаковые знаки
limit - предел
limit value - предельное значение
limits of integration - пределы интегрирования
line - прямая
line segment - отрезок
linear - линейный
linear equation - линейное уравнение
linear function - линейная функция
linear independency - линейная независимость
linearity - линейность
local - локальный
logarithm - логарифм
lower limit - нижний предел
lowest common denominator - наименьший общий знаменатель
lowest common multiple - наименьшее общее кратное
lozenge - ромб
M
magnitude - величина
main diagonal - главная диагональ
major axis - главная ось
many-variable system - система с несколькими переменными
map - отображение
mapping - отображение
meter - метр
mathematical induction - математическая (полная) индукция
mathematics - математика

matrix - матрица
matrix of the transformation - матрица преобразования
maximum - максимум
mean - среднее арифметическое
mean proportional - среднее геометрическое
measurable - измеримый
measure - мера
median {of a triangle} - медиана
member {of a set} - элемент {множества}
minimum - минимум
minuend - уменьшаемое
minus {sign} - знак минус
module - модуль
monom - одночлен (моном)
monotone decreasing function - монотонно убывающая функция
monotone increasing function - монотонно возрастающая функция
monotonic function - монотонная функция
monotonous - монотонный
multiple - многократный; кратное
multiplex - многократный
multiplicand - множимое
multiplication - умножение
multiplier - множитель
multiply - множить
mutually - взаимно
N
natural logarithm - натуральный логарифм
natural number - натуральное число
necessary and sufficient condition - необходимое и достаточное условие
negative - отрицательный
negligible - пренебрегаемый
node - узел
non-decreasing - неуменьшающийся
non-degnerate - невырожденный
non-degenerate conic - невырожденное коническое сечение
non-degenerate conic section - невырожденное коническое сечение
non-linear - нелинейный
non-linear equation - нелинейное уравнение
non-orthogonal coordinate system - неортогональная координатная система
non-periodic - непериодический
non-symmetric - несимметричный
non-terminating decimal - бесконечная десятичная дробь
non-trivial solution - нетривиальное (ненулевое) решение

non-zero solution - нетривиальное (ненулевое) решение
normal - нормаль
normal to the surface - нормаль к поверхности
normal vector - вектор нормали
null-vector - нулевой вектор
null-matrix - нулевая матрица
null-set - нуль-множество, пустое множество
number - число
number line - числовая прямая
O
oblique - oblic
obtuse angle - тупой угол
obtuse triangle - тупоугольный треугольник
octagon - восьмиугольник
odd - нечетный
odd-function - нечетная функция
one-to-one - взаимно-однозначный
open interval - открытый интервал
opposite interior angles - внутренние накрест лежащие углы
order - порядок
order of derivative - порядок производной
order of equation - порядок уравнения
ordered pair - упорядоченная пара
ordinal number - порядковый номер
ordinate - ордината
origin {of coordinates} - начало {координат}
orthogonal base - ортогональный базис
orthogonal coordnate system - ортогональная система координат
orthonormal basis - ортонормированный базис
oval - овал
P
pair - пара
parabola - парабола
parabolic - параболический
parallel - параллельный
parallelepiped - параллелепипед
parallelogram - параллелограмм
parallelogram law - закон параллелограмма
parallelogram rule - закон параллелограмма
parameter - параметр
parametric form - параметрическая форма
parentheses - круглые скобки
partial fraction - элементарная дробь
partial-fraction expansion - разложение правильной дроби на

простейшие дроби
pencil - пучок
pencil of lines - пучок прямых
pentagon - пятиугольник
per cent - процент
perimeter - периметр
period - период
periodic decimal fraction - периодическая десятичная дробь
periodic function - периодическая функция
periodic solution - периодическое решение
permissible solution - допустимое решение
perpendicular - перпендикуляр
pivot - ось вращения, центр вращения
plane - плоскость
plane geometry - планиметрия
planimetry - планиметрия
plus sign - знак плюс
point - точка
point of discontinuity - точка разрыва
point of inflexion - точка перегиба
polygon - многоугольник
polyhedron - многогранник
polynomial - многочлен
positive - положительный
possibility - возможность
power - показатель степени
pre-image - прообраз
preceding - предыдущий
prime factorization - разложение на простые множители
prime number - простое число
primitive - первообразная функция
principal - главный
principal axis - главная ось
principal diagonal - главная диагональ
principle of complete induction - метод полной индукции
prism - призма
product - произведение
progression - прогрессия
projection - проекция
proof - доказательство
proper factor - собственный делитель
proper fraction - дробь
property - свойство
proportion - пропорция

proposition - предложение
prove - доказывать
pyramid - пирамида
Pythagorean theorem - теорема Пифагора
Q
quadrate - квадрат
quadratic - квадратный
quadratic equation - квадратное уравнение
quadratic formula - формула корней квадратного уравнения
quantifier - квантор
quotient - частное
R
radian - радиан
radical - радикал, знак корня
radical sign - радикал, знак корня
radius - радиус
radius vector - радиус-вектор
raise to a power - возводить в степень
range - область, множество значений
rank of a matrix - ранг матрицы
ratio - частное, отношение
rational - рациональный
rational function - рациональная функция
rational number - рациональное число
ray - полуось
real - действительный, вещественный
real number - действительное (вещественное) число
reciprocal matrix - обратная матрица
rectangle - прямоугольник
rectangular coordinate system - {декартова} прямоугольная система координат
reduce - приводить, сокращать
reducible - приводимый
regular polygon - правильный многоугольник
relation - отношение
relative - относительный
relatively prime numbers - взаимно простые числа
remainder - остаток
repeated root - кратный корень
replace - подставлять, заменять
represent - представлять
rest - остаток
restriction - ограничение, рестрикция
rhomb - ромб

rhombus - ромб
right angle - прямой угол
right triangle - прямоугольный треугольник
root - корень
rotation - вращение
round - округлять
rounding error - ошибка округления
rule - правило
S
satisfy - удовлетворять
scalar - скаляр
scalene triangle - разносторонний треугольник
secant - секущая
sector of a circle - сектор круга
segment - отрезок, сегмент
semi-circle - полукруг
semiclosed interval - полузамкнутый интервал
set - множество
set theory - теория множеств
side {of an angle} - сторона {угла}
sign - знак
signum function - сигнум-функция
similar fractions - дроби с равными знаменателями
similar polygons - подобные многоугольники
similar terms - подобные члены
similar triangle - подобный треугольник
similarity - подобие
similitude - подобие
simple - простой
simple root - простой (однократный) корень
simplification - упрощение
sine curve - синусоида
sine rule - теорема синусов
single - один, отдельный, единственный
single root - простой (однократный) корень
skew lines - скрещивающиеся прямые
slope - наклон; угловой коэффициент
slope angle - угол наклона
slope formula - формула углового коэффициента
slope-intercept form of a
straight line equation - уравнение прямой с угловым коэффициентом
solution {of a problem} - решение {задачи}
solution set - множество решений
solve - решать

space - пространство
speed - скорость
sphere - сфера, шар
square - квадрат; возводить в квадрат
square brackets - квадратные скобки
square root - квадратный корень
standard form - общий вид, стандартная форма, нормальная форма
statement - утверждение, высказывание
step function - ступенчатая функция
straight - прямой, правый
straight angle - развернутый угол
straight-line - прямая линия
straight-line segment - отрезок прямой, отрезок
stretching - растяжение
strict - строгий
strongly monotonic - строго монотонный
subset - подмножество
substitution - подстановка
subtraction - вычитание
subtrahend - вычитаемое
sum - сумма
summand - слагаемое
supplementary angles - дополнительные углы
surface - поверхность
surface area - площадь поверхности
surface element - элемент площади {поверхности}
surface of revolution - поверхность вращения
symbol - символ
symmetric - симметричный
symmetric function - симметричная (четная) функция
synthetic division - схема Горнера
system - система
T
tangent - касательная; тангенс, функция тангенс
tangent line - касательная
tangent plane - касательная плоскость
term - член
term of a fraction - числитель дроби
terminating decimal
fraction - конечная десятичная дробь
tetragon - четырехугольник
tetrahedron - четырехгранник, тетраэдр
theorem - теорема

theory - теория
transcendental number - трансцендентное число
transform - преобразовать
transform of coordinates - преобразование координат
transitivity - транзитивность
translation - трансляция
trapezium - трапеция
trapezoid - трапеция
triangle - треугольник
triangular - треугольный
trigonometric - тригонометрический
trigonometric function - тригонометрическая функция
trigonometry - тригонометрия
trisection of the angle - трисекция угла
truth - истинность
U
unambiguous - недвусмысленный, однозначный
unbounded - неограниченный
uncertainty - недостоверность, неопределенность
undefined - неопределенный (недефинированный)
undetermined - неопределенный
unequal - неравный
union - объединение
unique solution - единственное решение
uniqueness - единственность
unit - единица
unit circle - единичная окружность
unit tangent vector - касательный единичный вектор
unit vector - единичный вектор
universal quantifier - квантор общности
universal set - универсальное множество
unknown - неизвестное
unlike denominators - неодинаковые знаменатели
unsymmetric - несимметричный
V
valid - справедливый
value - величина, стоимость
vanish - исчезать, обратиться в нуль
variable - переменная
vector - вектор
vector product - векторное (внешнее) произведение
velocity - скорость
verify - проверять
vertex - вершина

vertex angles - вертикальные углы
vertical - вертикаль; вертикальный
vertical axis - вертикальная ось
vice versa - наоборот, обратно
vinculum - дробная черта
volume - объем
W
way - путь
well-defined - вполне определенный;
однозначно
определенный
whole - целый
X
x-axis - ось x
x-intercept - отрезок на оси x
xy-plane - плоскость xy
Y
y-axis - ось y
Z
z-axis - ось z
zero - нуль
zero
solution - нулевое решение

ХАРАТОКОВА Марьят Губедовна

ENGLISH FOR STUDENTS OF MATHEMATICS

Учебное пособие

Корректор Чагова О.Х.
Редактор Чагова О.Х.

Сдано в набор 20.06.2023 г.
Формат 60х84/16
Бумага офсетная
Усл.печ.л .5,58
Заказ № 4729
Тираж 100 экз.

Оригинал-макет подготовлен
в Библиотечно-издательском центре СКГА
369000, г. Черкесск, ул. Ставропольская,36