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УЧЕБНЫЕ ТЕКСТЫ ПО МАТЕМАТИКЕ
для самостоятельного чтения

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Часть I

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Ex.1. Find in text 1 and memorize the following words:

to count, equal, fraction, to be acquainted with, relation, to consider, property, to satisfy, to deal with, integer, quotient, to contain, isosceles triangle, to assume, decimal

Ex.2. Translate the following international words:

natural, associative, commutative, distributive, system, fundamental, symbol, positive, negative, geometrically, line, direction, plus, minus, mathematician, rational, hypotenuse, irrational, sum, problem

Ex.3. Give Russian equivalents:

invent - invention, success - succession, develop - development, measure - measurement, divide - subdivide - division, exist - existence, direct - direction, recognize - recognition, reason - reasonable, express - expressible, associate - associative, distribute - distributive - distribution, subtract - subtraction, add - addition, equal - equation, possible - impossible

Ex.4. Make sure if you remember the following word-combinations:

a) natural (single, positive, negative, whole, directed or signed, decimal, rational, irrational, real) number;

b) to contain (to represent, to express, to invent, to be acquainted with, to deal with) numbers;

c) the sum of numbers, relation between two numbers, number already in existence, numbers introduced so far, system of numbers.

Ex.5. Translate the sentences paying attention to the underlined words:

1. Zero is <u>neither</u> positive <u>nor</u> negative. 2. The decimal expression for $\sqrt{2}$ can <u>neither</u> terminate <u>nor</u> be periodic. 3. Every real number can be expressed as a decimal <u>either</u> terminating <u>or</u> not and conversly. 4. From the modern point of view a fraction is considered <u>as</u> a single number. 5. Every rational number can be expressed <u>as</u> a quotient or ratio of two numbers. 6. The word "irrational" means not expressible <u>as</u> a ratio of two integers. 7. The idea of a negative number struggled <u>for</u> recognition <u>for</u> centuries. 8. Recall the usual decimal notation <u>for</u> numbers. 9. <u>If</u> a decimal terminates, it represents a rational number, <u>if</u> not - irrational numbers.

Ex.6. Translate into Russian paying attention to the functions of the words "to do" and "one".

1. A fraction does have many important properties in common with natural numbers. 2. The word "rational" does not mean reasonable. 3. C.Cantor and R.Dedekind did it independently of each other. 4. What do we mean by direct numbers? 5. Don't think that these numbers are mystical or unreal. 6. The numbers most probably invented first were one and two. 7. It is impossible to subtract a fraction from a smaller one. 8. This is one essential characteristic of irrational numbers. 9. One must know that the system of fractions is closed under the operations of addition, multiplication and division, but not subtraction. 10. They are merely marks to distinguish one direction from another.

TEXT 1.

The numbers, most probably invented first were one and two. Some primitive races had in their language only three words of number one, two and many.

The invention of the process of counting objects in succession led our ancestors to develop the numbers 1,2,3,4 and so on. These are called the natural numbers. From the experience with counting objects they developed the idea of the sum of two numbers.

Practical problems of measurement involving the division of things into equal parts led to the invention of fractions. The ancient Greeks were acquainted with fractions but regarded a fraction as a relation between two numbers. From the modern point of view, a fraction is considered as a single number because it does have many important properties, such as the associative, commutative and distribute laws. The natural numbers and the fractions satisfied the practical needs of man for many thousands of years and were the only ones dealt with until comparatively modern times.

The system of fractions is closed under the operation of addition, multiplication and division, but not subtraction. It is impossible to subtract a larger fraction from a smaller one, or even a fraction from itself.

Corresponding to each number two new symbols or marks are added + and -. Thus, we speak of positive and negative whole numbers or integers and fractions. Zero is neither positive nor negative. All these new symbols (-3, +1/2) are called directed or signed numbers

because they may be directed geometrically. The plus and minus signs in the symbols (+3, -3) are not intended to indicate the operations of addition and subtraction, but are merely marks to distinguish one direction from another. The idea of a negative number struggled for recognition for centuries and was recieved with great reluctance as late as the early years of the seventeenth century even by mathematicians.

All the numbers introduced so far, namely zero, the positive and negative integers and fractions are called rational numbers. The word "rational" does not mean reasonable. It comes from the word ratio: every rational number can be expressed as a quatient or ratio of two integers.

Our system of rational numbers contains no number which can represent the length of the hypotenuse of an isosceles right triangle whose leg is of a unit length. The word "irrational" means not expressible as a ratio of two integers.

We shall assume that the irrational numbers fill up all the "gaps" left in our straight line, so that every point on the line has a number attached to it. These numbers are called real. Every real number can be expressed as a decimal either terminating or not and conversly. The system of real numbers is subdivided into rational and irrational numbers.

Ex.7. Answer the questions:

1. What were the first numbers? 2. What numbers are called natural? 3. What is a fraction? 4. Why is a fraction considered as a single number? 5. Under what operations is the system of fractions closed? 6. What do we mean by direct numbers? 7. When were negative numbers recognized? 8. What is a rational number? 9. What does the word "rational" mean? 10. What is an irrational number? 11. What is a real number?

Ex.8. Reproduce the sentences from the text where the following word-combinations are used:

That is, to develop the idea, the invention of fractions, point of view, to have in common, to satisfy the needs, to subtract the fraction from itself, to distinguish direction, struggle for recognition, to come from, a ratio of two integers, to represent the length a point on the line, to subdivide into.

Ex.9. Ask your partner whether he knows:

1. ... what three words for numbers some primitive races had. 2. ... if practical problems of measurement led to the invention of fractions. 3. ... why a fraction is considered as a single number. 4. ... under what operations the system of fractions is closed. 5. ... when the idea of a negative number was received? 6. ... what the word "rational" means? 7. ... if our system of rational numbers can represent the length of the hypotenuse of an isosceles right triangle? 8. ... what the meaning of the word "irrational" is. 9. ... how every real number can be expressed. 10. ... what the system of real numbers is subdivided into.

Ex.10. Correct the following wrong statements:

1. The invention of the process of counting objects led to the development of fractions. 2. The ancient Greeks regarded a fraction as a single number. 3. The system of fractions is closed under subtraction. 4. It is possible to subtract a fraction from itself. 5. Zero is a positive number. 6. The plus and minus signs in the symbols +3, -3 indicate the operations of addition and subtraction. 7. Zero, the positive and negative numbers are called irrational numbers. 8. The word "rational" means reasonable. 9. The idea of a negative number was recognized in the 19th century. 10. The word "irrational" means expressible as a ratio of two integers.

Ex.11. Read the text without a dictionary and render it in Russian:

Every fraction must contain two numbers, a denominator and a numerator. The denominator tells into how many equal parts the unit is divided. The numerator shows how many of these parts are taken. The fraction 41/2 is read four and one half.

A decimal fraction is a fraction having a denominator of 10, 100, 1000 or some similar multiple of 10. All figures to the left of the decimal point are whole numbers, everything that comes after the decimal point (to the right of it) is a fraction or part of a unit.

0,2 is read two tenths; 52.23 is read fifty-two and (or point) twenty-three hundredths.

Percentage is a particular kind of a decimal fraction, of which the denominator is always 100. Instead of writing the denominator we use the term "per cent" to indicate that denominator is 100. When we speak of "6 per cent" we mean 6/100 or 0.06.

Ex.12. Speak on the problems presented in the text. The following plan is available:

1. The first numbers.
2. Fractions.
3. Directed numbers.
4. Rational numbers.
5. Irrational numbers.
6. Real numbers.

UNIT 2

Ex.1. Find in text 2 and memorize the following words:

exact, to solve, mystery, prime (even, odd, perfect) number, to involve, conjecture, statement

Ex.2. Translate into Russian:

exact science, mathematical mystery, unsolved problems, infinite number, systematic way, prime pair, true statement, odd perfect number mystery, a number of problems, the sum of two primes, to involve prime numbers, to occur throughout number system, to locate numbers, to make a conjecture, to try even numbers, to be equal to the sum of the divisors

Ex.3. Translate into Russian:

1. There are a number of mathematical problems that are still mysteries to mathematicians. 2. No one has been able to write a formula that will test whether a given number is a prime number. 3. No one has yet been able to find a way of forming prime numbers. 4. There is an infinite number of prime pairs. 5. Prime pairs seem to occur throughout our number system. 6. Nobody could prove that there is a number beyond which there are no prime pairs. 7. He made the conjecture that every even number except 2 was the sum of two primes. 8. This statement was true for every even number he examined. 9. No even number has been found that is not the sum of two primes. 10. The ancient Greeks considered some numbers to be perfect. 11. No one has ever found an odd perfect number.

TEXT 2.

Unsolved Problems of Mathematics
(Part I)

Although we usually think of mathematics as an "exact science" that solves all problems, there are a number of mathematical problems that are still mysteries to mathematicians. A few of them are:

The Prime Number Mysteries. Some of the older unsolved problems involve prime numbers. For example, no one has been able to write a formula or system that will test whether or not a given number is a prime number. There must be some way of forming prime numbers, but no one has yet been able to find a systematic way to do it.

Another mystery about prime numbers is raised by the question, "Is there an infinite number of prime pairs?" A prime pair is a pair of prime numbers whose difference is 2: for example, (3, 5), (11, 13), (41, 43). These prime pairs seem to occur throughout our number system. No one has been able to find how many there are or discover a formula to locate them. But on the other hand, no one has been able to prove that there is a number beyond which there are no prime pairs.

Goldbach's Conjecture. "Is every even number the sum of two primes?" is still another mathematical mystery. In 1742 the German mathematician C. Goldbach wrote a letter to his friend, the great Swiss mathematician Leonard Euler, in which he made the conjecture that every even number except 2 was the sum of two primes. This was an interesting statement that was true for every even number he examined, but he could not prove that it was a true statement for all even numbers.

If you try some even numbers you will find that it always works: for example, 4 = 2 + 2, 6 = 3 + 3. No even number has been found that is not the sum of two primes. But this is no proof that every even number is the sum of two primes. If you could find one even number that is not the sum of two prime numbers, then the problem would be solved. Since no logical proof had been found for this seemingly simple problem it is still one of the mysteries of mathematics.

The Odd Perfect Number Mystery. The ancient Greeks considered some numbers to be perfect. Perfect numbers are numbers which are equal to the sum of their divisors. The number 6 is such a number because 6 = 1 + 2 + 3. Another perfect number is 28, since 28 = 1 + 2 + + 4 + 7 + 14. The next perfect number after 28 is 496. Others have been found and all of them are even numbers. No one has ever found an odd perfect number. But no one has been able to prove that every perfect number must be even.

Ex.4. Answer the questions:

1. What kind of science is mathematics? 2. What is a prime number? 3. Could mathematicians find a systematic way of forming prime numbers? 4. What is a prime pair? 5. Do mathematicians know a formula to locate prime pairs? 6. How many prime pairs are there in our number system? 7. What conjecture did Goldbach make? 8. Could he prove this statement? 9. When would this problem be solved? 10. Has anyone found an odd perfect number? 11. Can mathematicians prove that every perfect number must be even?

Ex.5. Ask questions for more information:

1. A number of problems are mysteries to mathematicians (how many, what). 2. Mathematicians can't solve all problems (why, what). 3. There are some unsolved problems which involve prime numbers (how many, what). 4. He made the conjecture that every even number except 2 was the sum of two primes (who, when). 5. Goldbach couldn't prove this statement (what). 6. Goldbach's conjecture is still one of the mysteries of mathematics (why). 7. They considered some numbers to be perfect (who). 8. Another perfect number is 28 (why).

Ex.6. Correct the following wrong statements:

1. There are no mysteries in mathematics. 2. Mathematicians can write a formula for testing prime numbers. 3. A prime pair is a pair of prime numbers whose difference is 4. 4. There is a number beyond which there are no prime pairs. 5. Goldbach proved that every even number is the sum of two primes. 6. Mathematicians found a logical proof for Goldbach's conjecture. 7. Perfect numbers are numbers which are equal to the sum of their factors. 8. The number 5 is a perfect number. 9. Mathematicians have found an odd perfect number.

Ex.7. Read the text and render it in Russian:

Mathematics abounds with problems that have remained unsolved for decades and even centuries and yet have stimulated whole new branches of the science. Mathematicians have, for example, developed much of the modern theory of numbers during attempts to check a conjecture of the German mathematician named Goldbach. In 1742 he said that every even number greater than two (2) is the sum of two prime numbers (a prime is a number that is not exactly divisible by any other whole number except one). For instance: 8 is equal to 3 plus 5; 26 is equal to 13 plus 13.

No one has yet found a mathematical proof for Goldbach's assertion, but on the other hand no one has found an exception that would disprove it. In 1931 a Russian mathematician Schnirelmann proved that every positive number is the sum of not more than 300.000 prime numbers. Then another Russian, Vinogradov, showed that every sufficiently large odd number is the sum of not more than three primes. But what is "sufficiently large"? Now it is known that "sufficiently large" means at least 350.000 digits - a number that would fill fifteen to twenty pages. There the question rests.

Ex.8. Speak on the problems presented in the text.

1. The Prime Number Mysteries.
2. Goldbach's Conjecture.
3. The Odd Perfect Number Mystery.

UNIT 3

Ex.1. Memorize the following words:

attempt, circle, volume, angle, expect, surface, to draw, to perform

Ex.2. Translate into Russian:

a) logical (truely wonderful) proof, positive integer, marginal note, the same area, equal angles, round object, best arrangement, first layer;

b) a result of attempts, a pair of compasses and a straight edge, the volume of a given circle, packing of spheres, arrangement for the first layer;

c) to contain a proof, to develop ideas, to propose a problem, to construct a circle, to divide an angle, to find solution, to perform construction, to use the least possible space, to draw a circle, to cover the least surface, to arrange the second layer of spheres

Ex.3. Give Russian equivalents for the following word combinations. Find them in the text:

for example, by the way, on the other hand, actually, as a result, namely, such as, such that, similar to

Ex.4. Translate into Russian:

1. This margin is too small to contain the proof of the theorem. 2. Mathematicians set out to find a proof for Fermat's theorem. 3. All statements that Fermat claimed he could prove have been proved by later mathematicians. 4. We can't construct a cube exactly twice the volume of a given cube. 5. It is impossible to divide an angle into exactly three equal angles. 6. The solutions were not what you might expect. 7. We can't perform these constructions using only a pair of compasses and a straight edge. 9. Spheres should be packed so that they use the least possible space. 10. Nobody has solved the problem of how to arrange the second layer of spheres.

TEXT 3.
Unsolved Problems of Mathematics
(Part II)

Fermat's Last Theorem. Another famous mathematical mystery is called Fermat's Last Theorem. In the margin of a mathematics book Pierre de Fermat (1601 - 1665), a famous French mathematician, wrote:"If n is a number greater than 2, there are no whole numbers a,b,c such that $a^n + b^n = c^n$. I have found a truely wonderful proof which this margin is too small to contain".

It was known long before Fermat's day that when n=2, it is easy to find whole numbers x,y,z, such that $x^2+y^2=z^2$; for example, 3, 4, 5 or 5, 12, 13. (Such numbers, by the way, are called Pythagorian numbers But no one has ever been able to find positive integers x, y, z, such that $x^3+y^3=z^3$ or such that $x^4+y^4=z^4$. What Fermat was saying was that he could prove that no such numbers could be found.

After Fermat's death his marginal note was discovered and mathematicians set out to find a proof for Fermat's theorem. No one has been successful in proving it. But on the other hand, no one has been able to disprove it either. This is strange because all of the other statements that Fermat claimed he could prove have been proved by later mathematicians. Actually Fermat's theorem is of little real importance, but as a result of attempts to prove it, some important ideas in modern mathematics have been developed.

Three Construction Problems. Some of the first unsolved problems in mathematics were these three famous construction problems proposed by the Greeks, to be solved by using only a pair of compasses and a straight edge.

1. Can you construct a circle with the same area as a square?
2. Can you construct a cube exactly twice the volume of a given cube?
3. Can you divide an angle into exactly three equal angles?

Mathematicians worked on these problems for many years before they found the solutions. However, the solutions were not what you might expect. The solution for each of these problems is the same: namely, that it is impossible to perform these constructions using only a pair of compasses and a straight edge.

How to Pack Spheres. A geometry problem that is still unsolved involves the packing of spheres such as ping-pong balls. How should spheres be packed in a box so that they use the least possible space? This is similar to a problem of drawing circles. How should circles be drawn or round objects like pennies be packed to cover the least surface? The arrangement for the circles on a surface has been found to be the following pattern:(See fig. 1)

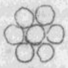


Fig. 1.

In packing spheres, this is also the best arrangement for first layer. But nobody has solved the problem of how to arrange the second layer of spheres.

Ex.5. Answer the questions:

1. What statement could Fermat prove? 2. What was known long before Fermat's day? 3. Could anyone prove Fermat's statement? 4. What are the famous construction problems proposed by the Greeks? 5. What instruments can be used in performing these constructions? 6. What solution have mathematicians found for these three problems? 7. How should round objects be packed to cover the least space? 8. Has anyone solved the problem of how to arrange the second layer of spheres?

Ex.6. Say whether the following statements are true or false:

1. Fermat was a famous English mathematician. 2. Mathematicians found positive integers x, y, z such that $x^3+y^3=z^3$ or such that $x^4+y^4=z^4$. 3. After Fermat's death mathematicians set out to find a proof for his theorem. 4. Mathematicians have been successful in disproving Fermat's theorem. 5. Fermat's theorem is of great importance. 6. Three famous construction problems were proposed by the Greeks. 7. Compass and a straight edge are the simplest instruments for drawing. 8. It is impossible to divide an angle into exactly three equal angles with ruler and compass only. 9. Mathematicians can't construct a cube exactly twice the volume of a given cube with ruler and compass. 10. The problem of packing spheres is similar to the problem of drawing circles. 11. Mathematicians have solved the problem of how to arrange the second layer of spheres.

Ex.7. Insert prepositions:

1. Mathematicians set ... to find a proof ... Fermat's theorem. 2. All statements Fermat claimed he could prove have been proved ... later mathematicians. 3. Fermat's theorem is ... little real importance. 4. Can you divide an angle ... three equal parts? 5. Mathematicians worked ... these problems for many years. 6. The solution ... each problem is the same. 7. The problem of packing spheres is similar ... a problem of drawing circles. 8. But ... other hand nobody could disprove Fermat's theorem.

Ex.8. Read the text and render it in Russian:

Of all construction problems, that of constructing with ruler and compass a regular polygon of n sides has perhaps the greatest interest. For certain values of n - e.g. n=3,4,5,6 - the solution has been known since antiquity. But for the regular heptagon (n=7) the construction has been proved impossible. There are three other classical Greek problems for which a solution has been sought in vain: to trisect an arbitrary given angle, to double a given cube (to find the edge of a cube whose volume shall be twice that of a cube with a given segment as its edge) and to square the circle (to construct a square having the same area as a given circle). In all these problems ruler and compass are the only instruments permitted.

Ex.9. Speak on the problems presented in the text:

1. Fermat's Last Theorem.
2. Three classical Greek constructions problems.
3. The Packing of Spheres.

UNIT 4

Ex.1. Find in text 4 and memorize the following words:

contribution, essential, concept, to represent, multiple, value, to employ, denote, spread, require, appear, origin, resistance, benefit

Ex.2. Translate into Russian:

a) an essential contribution, numerical system, man's intellectual achievement, various people, a more limited number of integers, considerable resistance, a vacant space, incalculable benefits;

b) the concept of representing "nothing", system of counting, different letters of alphabet, the multiple of 10, the sum of the values of several symbols, the concept of the zero, the rest of our "Arabic" numbers;

c) throughout the world, to a greater degree, in space and time, for about a thousand years, about 500 A.D.,because of the strong tradition of Roman numbers;

d) the system of counting, to use different letters of alphabet, to denote numbers, to represent a number by a single letter symbol, to employ the additive principle, to be widely separated in space and time, to be in possession of smth, to be more advanced, to derive incalculable benefits.

Ex.3. Translate the sentences into Russian:

1. The introduction of the zero was anessential contribution to modern technological development. 2. The Greeks used different letters of their alphabet to denote numbers from 1 to 10 and each of the multiples of 10. 3. The Romans used fewer symbols to represent a more limited number of integers. 4. The concept of zero appears to have been independently arrived at in three great cultures of the past. 5. There was considerable resistance to the adoption of the zero because of the strong tradition of Roman numbers. 6. In writing this number nine individual symbols were required. 7. Some numbers could not be represented by a single letter symbol. 8. These numbers were

expressed by the sum of the values of several symbols. 9. The Mayas have been in possession of the zero for about a thousand years longer than their conquerors. 10. Modern civilization derives incalculable benefits from the use of zero.

Ex.4. Read the text and find the sentences connected with:

a) the importance of introduction the zero;
b) the representation of numbers by the Greeks;
c) the additive principle used by the Romans

TEXT 4.
Digit That Means Nothing

The introduction of the zero to the European mathematics was an essential contribution to modern technological development. The concept of symbolically representing "nothing" in a numerical system is considered to be one of man's greatest intellectual achievements.

Various people throughout the world have used systems of counting without having the zero. The classical Greeks used different letters of their alphabet to denote numbers from 1 to 10 and each of the multiples of 10. Any number not represented by a single letter symbol was expressed by the sum of the values of several symbols. For example, the number 238 was indicated by writing the letter symbols for 200, 30 and 8 adjacent to each other.

The Romans used fewer symbols to represent a more limited number of integers such as 1, 5, 10, 50, 100, 500, 1000 and employed the additive principle to a greater degree. Thus, in writing the number 238 nine individual symbols were required: CCXXXVIII.

The zero of modern civilization had its origin in India about 500 A.D. By 800 A.D. its use had been introduced to Baghdad, from where it was spread throughout the Moslem world. The zero, along with the rest of our "Arabic" numbers was known in Europe by the year 1000 A.D., but because of the strong tradition of Roman numerals, there was considerable resistance to its adoption. It was not until the late 14th century that the zero was in general use in Western Europe.

Including the Hindu it appears that the concept of the zero, with its idea of positional value, was independently arrived at in three cultures which were widely separated in space and time. About

500 B.C., the Babylonians began to use a symbol to represent a vacant space in their positional-value numbers. However, before the idea could be disseminated to other areas, its use apparently died out about 2,000 years ago along with the culture that gave it birth.

The Mayas of Central America began using a zero about the beginning of the Christian era. Having been in possession of the zero for more than a millenium longer than the Spaniards, in many aspects of mathematics the Mayas were further advanced than were their conquerors.

Modern civilization derives incalculable practical and theoretical benefits from the use of zero.

Ex.5. Answer the questions:

1. What was the essential contribution to modern technological development? 2. Were there any ancient systems of counting without zero? 3. How did the Greeks denote numbers from 1 to 10 and each of the multiple of 10? 4. How was any number not represented by a single letter symbol expressed? 5. What integers were represented by individual symbols in the Roman system of counting? 6. Where did the zero of modern civilization have its origin? 7. When was the concept of zero introduced to Baghdad? 8. Was the zero readily adopted by the Europeans? If not, why? 9. When did the zero become generally used in Western Europe? 10. What people first arrived at the concept of zero with its idea of positional value? 11. When and by what people did the zero begin to be used in Central America?

Ex.6. Say whether the statements are right or wrong. Use the phrases:
Yes, you are right; I am afraid you are mistaken; You are wrong.

1. The introduction of the zero to mathematics was an essential contribution to modern civilization. 2. Ancient people all over the world used systems of counting with the zero. 3. The Greeks used special signs to represent each number from 1 to 10. 4. The Romans used much more symbols than the Greeks to represent numbers! 5. Written numerals were used by the ancient people for computation. 6. The zero had its origin in Europe about 500 A.D. 7. The zero was in general use in Western Europe in the 16th century. 8. The concept of the zero was used at the same time by the Hindu, the Babylonians and the Mayas. 9. In Western Europe the strong tradition of Roman numbers caused considerable resistance to the adoption of the zero.

Ex.7. Insert prepositions or adverbs where necessary:

1. ...the past there were systems ... counting ... the zero. 2. The number not represented ... a single letter symbol, was expressed ... the sum ... the values ... several symbols. 3. The Romans employed the additive principle ... a greater degree. 4. The zero had its origin ... India ... 500 A.D. 6. ... 800 A.D. its use had been introduced ... Baghdad, ... where it spread ... the Moslem world. 7. The zero ... ... the rest ... our "Arabic" numbers was known ... Europe the year of 1000 A.D. 8. ... ... the strong tradition ... Roman numbers there was considerable resistance ... the adoption ... the zero. 9. The concept ... zero was independently arrived ... ... three great cultures ... the past. 10. The Mayas have been ... possession ... the zero ... ... a thousand years longer than the Spaniards.

Ex.8. Open the brackets:

1. The Romans employed the (to add) principle to a greater degree. 2. In Europe there was (to consider) resistance to the (to adopt) of our "Arabic" numbers. 3. About 500 B.C. the Babylonians began to use a symbol to represent a vacant space in their (position) value numbers. 4. The concept of (symbol) representing "nothing" is one of man's greatest intellectual achievements. 5. The zero of modern system of counting had its (to originate) in India about 500 A.D. 6. Modern civilization derives (calculation) practical and theoretical benefits from the use of zero. 7. Classical Greeks denoted the number 238 by (to write) three letter symbols adjacent to each other.

Ex.9. Read the text without the dictionary and render it in Russian:

One can imagine that there must have been difficulties when the Babylonians, wishing to express the result of subtracting a number from itself, introduced a symbol for zero and began to treat it as though zero were one of the whole numbers. Zero seems like an emptiness, like nothing. Later people came to realize that zero is just for "counting" the number of beasts in an empty field or the number of kings during the republican era.

The Pythagoreans attached very interesting interpretations to other numbers. The number one they identified with reason; two was identified with opinion; four - with justice because it is the first number which is the product of equals; five signified marriage because it was the union of the first odd and first even number; seven was identified with health and eight - with love and friendship.

UNIT 5

Ex.1. Find in text 5 and memorize the following words:

device, variable, binary, digit, to store - storage, input, output, punched-card, sequence, memory, to consist, to compare

Ex.2. Give Russian equivalents to the following words without using a dictionary:

modern, electronic, transistor, type, analogue, voltage, automatic, radar, alphabetic, functional, aspect, bit, section, magnetic, nerve, final, list, manipulation, interpret, analyse, calculation

Ex.3. Translate into Russian:

a) electronic device, various calculations, analogue (digital) computer, coded character, adding machine, binary digits, external world, initial data, intermediate results, appropriate manipulation, actual solution;

b) the method of representing numbers, a list of instructions, a sequence of operations, changes of voltage, problems of a much more complex nature, the use of binary digits, language intelligible to the machine;

c) to perform required calculations, relate physical changes, to deal with numbers, to provide information, to store data, to accept results, to determine the operation, to call for a number, to move from memory.

Ex.4. Translate into Russian:

1. In modern electronic computer its components are arranged so as to perform various calculations. 2. An analogue computer relates physical changes and variables in the form of mathematical equations. 3. The digital computer performs required calculations with numbers or coded alphabetic characters. 4. The method of representing numbers and other information is based on the use of binary digits. 5. In one direction the input-output section processes information in a language intelligible to the machine. 6. In the opposite direction it provides information in a form that is intelligible to the operator. 7. Initial data, intermediate results and

final results are stored in memory. 8. Control causes the other parts to perform the appropriate functions at the appropriate time. 9. Let's follow the sequence of operations of a digital computer which has been given to add two numbers.

Text 5.

Computers.

A modern electronic computer is a device in which electronic components such as transistors are arranged so as to perform various calculations.

There are two general types of computers: analogue and digital. An analogue computer relates physical changes and variables such as changes of voltage in the form of mathematical equations. It is used in industrial automatic processes, radar and in various other systems.

The digital computer deals with numbers or coded alphabetic characters, and performs with them required calculations. The electronic digital computer can be compared to the adding machine in its functional aspect, except that the electronic device will solve problems of a much more complex nature than the desk-type adding machine. In the digital computer the method of representing numbers and all other information is based on the use of binary digits (abbreviated as "bits") which are represented by electronic signals.

A typical electronic computer consists of: the input-output section, the storage section, the arithmetic section and the control section.

The input-output section is the transducer through which the system communicates with the external world. In one direction it processes some physical medium, such as paper or magnetic tape, punched cards, which has been prepared in a language intelligible to the machine. In the opposite direction it provides information which has been prepared in a form that is intelligible to the operator.

Storage or memory is the nerve centre of the machine. It is the section in which initial data, intermediate results, final results and the statement of the problem are stored. The latter appears as a list of instructions which make the system perform the appropriate manipulations of the data it has been given. It also accepts the results that have been computed by the arithmetic section.

The function of the arithmetic section is to perform such operations as addition, subtraction, multiplication, division, square rooting etc. as well as certain logical operations. It is there that the actual solution of the problem is done.

Control is the section that interprets the instructions, the machine has been given and causes the other parts to perform the appropriate functions at the appropriate time.

Let's follow the sequence of operations of a digital computer which has been given to add two numbers. The first coded instruction moves from the memory to the control unit which analyses it to determine what operation is called for and where in memory to locate the first number. Then the control unit sends our signals to the appropriate units and causes the specific number to move to one of the arithmetic registers in preparation for the operation. The second instruction is similarly interpreted and the control unit calls for the second number to move from the memory to the arithmetic unit and be added to the first number. The third instruction sends the sum back to memory, etc. This goes on until the problem is solved. Finally the sum is written on an output device.

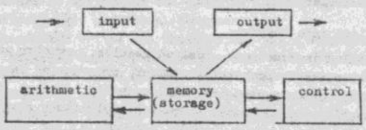
Ex.5. Answer the following questions:

1. What are the general types of computers? 2. In what form does the analogue computer relate physical changes and variables? 3. What data does the digital computer deal with? 4. What is known as "bit"? 4. What are the four sections of a typical computer? 5. What is the function of the input-output section of a computer? 6. What is the sequence of operations of the input-output section? 7. Which section is known as the nerve centre of the computer? 8. What is stored in the memory section? 9. In what way is the statement of the problem represented in the system? 10. What is the function of the arithmetic section? 11. In what section is the actual solution of the problem done? 12. What are the functions of the control section?

Ex.6. Substitute the infinitive in brackets by the appropriate form of the verb:

1. In the electronics laboratory we were shown the sequence of operations of a digital computer which (to give) to add two numbers. 2. We could see how the first coded instruction (to move) from the memory to the control unit. 3. When the control unit (to determine) what operation was called for, it (to send out) signals to the appropriate units and (to cause) the specific numbers to move to one of the arithmetic registers. 4. Then the second instruction (to interprete) in the same way and the second number (to move) from the memory to the arithmetic unit and was added to the first number. 5. The third instruction (to send) the sum back to the memory. 6. This went on until proper solution of the problem (to find). 7. As soon as the problem (to solve) the sum was written on the output device.

Ex.7. Describe the sequence of operations of a digital computer:



Ex.8. Read the text and render it in Russian:

A computer consists of input and output devices, arithmetic and control circuits and a memory. Equally essential to the complete portrait is the program of instructions that puts the system to work. The computer accepts information from the environment through its input devices: it combines this information according to the rules of the program stored in its memory with information that is also stored in its memory, and it sends information back to its environment through its output devices.

The computer is a universal information processing machine. Any calculations that can be done by any machine can be done by a computer, provided that the computer has a program describing the calculation. A scientific problem that took an hour on a big 1950 machine at 1,000 operations per second can be solved by the fastest contemporary computers in less than half a second. This reflects the impressive progress in the design and manufacture of computers.

The basic unit of information with which these machines work is the bit. Any device that can be in either of two states can store one bit. Two such devices can store two bits, three can store three bits and so on. Consider a five-bit register made of five one-bit devices. Since each device has two states, represented say by 0 and 1, the five together have 2^5 or 32 states. The combinations from 00000 to 11111 can be taken to represent the binary numbers from 0 to 31. They can also be used to encode the 26 letters of the alphabet.

UNIT 6

Ex.1. Find in text 6 and memorize the following words:

sequence, to deliver, to refer to, software, hardware, high-level(low-level) language, to require, to suit, to represent, sign, compiler, assembler

Ex.2. Translate into Russian:

a) detailed instructions, desired results, computer scientists, electronic circuits, peripheral equipment, programming languages, business data, commonly used language, assembly language, binary digits, operation codes, memory addresses, relatively simple programs;

b) sequence of operations, job to be done, program written in a high-level language, language composed of binary digits, rules for combining elements;

c) to perform the sequence of operations, to deliver results, to apply the term hardware, to resemble the language of mathematics, to involve processing business data, to suit for writing programs

Ex.3. Translate the sentences into Russian:

1. These instructions tell what sequence of operations to perform with the data. 2. Computer scientists called programmers write the instructions. 3. The term hardware is applied to the computer itself. 4. Some programming languages enable programmers to write instructions in simple, everyday expressions. 5. The language that a programmer uses depends largely on the job to be done. 6. However, preparing a computer to solve complicated scientific problems might require the use of ALGOL. 7. BASIC is well suited for writing relatively simple programs. 8. This kind of language is harder to use than a high-level language because it involves symbols as well as words. 9. The instructions have to be translated into a machine language composed of binary digits that represent operation codes,

memory addresses and various symbols.

TEXT 6

Programming involves the preparation and writing of detailed instructions for a computer. These instructions tell a computer exactly what data to use and what sequence of operations to perform with the data. Without such programs, a computer could not solve problems or deliver any other desired results.

In most cases, computer scientists and other computer specialists called programmers write the instructions. They refer to programs as software because the instructions have no physical parts. The term hardware is applied to the computer itself, including its electronic circuits and peripheral equipment.

A programmer writes the instructions for a computer in a programming language. Such a language consists of letters, words, and symbols as well as rules for combining those elements. Some programming languages closely resemble the language of mathematics. Others enable programmers to write instructions in simple, everyday expressions, such as "Read", "Add", and "Stop". Programming languages of this kind are called high-level languages.

The language that a programmer uses depends largely on the job to be done. If a task involves processing business data, the programmer would most likely use COBOL (Common Business Oriented Language). However, preparing a computer to solve complicated scientific problems might require the use of ALGOL (ALGOrithmic Language), which is a mathematically oriented programming language.

Some high-level languages can be used for business, technical, or scientific programming. Such languages include FORTRAN (FORmula TRANslation); APL (A Programming Language); and PL/1 (Programming Language One).

Another commonly used programming language is BASIC (Beginner's All-purpose Symbolic Instruction Code). BASIC is well suited for writing relatively simple programs for minicomputers and microcomputers.

Some computer programs may be written in an assembly language. This kind of language is harder to use than a high-level language because it involves symbols as well as words. For example, an assembly language might use the symbols AD for add and S for subtract.

Acomputer cannot work directly with a program written in a high-level or assembly language. The instructions have to be translated into a machine language composed of binary digits that represent operation codes, memory addresses, and various symbols, such as plus and minus signs. Machine language is also known as low.level language. Special programs called compilers and assemblers translate high-level and assembly languages into machine language.

Ex.4. Answer the following questions:

1. What does programming involve? 2. What do the instructions tell? 3. Who writes the instructions? 4. What is the term hardware applied to? 5. What does a programming language consist of? 6. What programming languages do you know? 7. What does the language that a programmer uses depend on? 8. Why is an assembly language harder to use than a high-level language? 9. What is a machine language composed of ? 10. What programs translate high-level and assembly languages into machine language?

Ex.5. Say whether the statements are right or wrong:

1. Programming involves the preparation and writing of detailed instructions for a computer. 2. A computer can solve problems and deliver desired results without a program. 3. The term hardware is applied to programs. 4. A programmer writes the instructions for a computer in a machine language. 5. Some programming languages closely resemble the language of mathematics. 6. If a task involves processing business data, the programmer would use ALGOL. 7. COBOL is a mathematically oriented language. 8. BASIC can be used for scientific programming. 9. Some computer programs may be written in an assembly language. 10. A computer work directly with a program written in a high-level or assembly language. 11. A machine language is composed of letters, words and symbols as well as rules for combining those elements.

Ex.6. Speak about high-level and low-level languages.

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