***Unit 4***

***Reading 1***

***Before you read***

***Discuss these questions with your partner.***

* ***Why do people study maths?***
* ***When do you use it?***

***A. Vocabulary***

***Match these words with their definitions.***

|  |  |
| --- | --- |
| 1. division 2. knot 3. set up 4. numeral 5. symbol 6. tally 7. notation | A a system of figures or symbols representing numbers  B a written sign in maths or music, for example, which represents an operation, an element, relation, etc  C a record of money spent or received  D a separation  E make ready for operation  F a symbol representing a number  G tie, bond |

***B. The words in italics are all in the wrong sentences. Put the words into the correct sentences.***

1. If you have a ***division***, you have a system to note how much has been spent. ………………….

2. The Roman ***knots*** are still used as numbers nowadays. …………………………..

3. There is a ***set up*** between science and art subjects. ………………………….

4. In maths we use ***numerals*** to show what kind of problem we are solving. ……………………..

5. ***Symbols*** in maths are things like numbers. …………………………

6. Some people tie ***notation*** to remember something. ………………………..

7. She ***tally*** an experiment. ……………………………

***Mathematics***

***An introduction***

The English word *mathematics* tells us something about the influence the Ancient Greeks had on our knowledge. The word comes from the Greek for science, learning and knowledge. It is usually shortened to maths in British English and to math in the USA.

Mathematics developed from a series of ideas, each new idea building on earlier ones. Each new idea became more complex as mathematicians tried to explain how things in the world relate to one another. The first idea to have developed was certainly that of number. People needed to count their belongings. As society developed, numbers became more and more important for business dealings and taxation and it became especially important to be able to record numbers. A wide variety of systems for recording numbers developed in different parts of the world. One example is the tallies that were used by the Incas in South America. They used pieces of string of different lengths and by tying knots in different places along the string, they were able to keep tax records and business accounts throughout their land.

With writing, different ways of recording numbers developed in different countries, too. Roman numerals are a well-known example. In this system I is one and X is ten, so IX is one before ten, that is nine, and XI is eleven. It was not until the 16th century that the system of mathematical notation that we use today finally developed. It is a system that uses Arabic numerals (1, 2, 3 and so on) with a set of symbols + (plus), - (minus), = (equals) for example, along with letters, many of which are taken from the Greek alphabet. It is a system which is used by all mathematicians all over the world. In fact, it has been said that mathematics is one of only two genuinely international languages; the other one is music.

Whether or not mathematics is a science is still a matter of opinion in the mathematical community. Some say no, it is not because it does not pass the test of being a pure science. We know that one plus one is two because that is how we count. No one can set up an experiment to prove that one plus one is two without counting. Therefore, because it cannot be proved by experiment, mathematics is not a science. Others say yes, it is, because science is the search for knowledge and that is what mathematics does. Therefore, mathematics is a science.

Whatever your point of view, there is no doubt that mathematics is applied to all sciences. Many of the most important developments in fields such as physics or engineering have led to further developments in mathematics. The argument over whether mathematics is a science or not appears to be unimportant when you realise that it is impossible to separate mathematics from science or science from mathematics. Many universities recognise this. In many places of learning there are divisions of study, often called Mathematics and Science. The unbreakable connection between mathematics and all other sciences is recognised by the very way in which we study them.

***Ex.1. Read the following statements and determine whether they are true or false.***

1. Mathematics is usually shortened to math in British English and to maths in the USA.

2. The word mathematics comes from the Greek language for science, learning and knowledge.

3. In mathematics we nowadays still use Greek numbers and Arabic symbols, like plus or minus.

4. Mathematics is universally admitted by the scientific world not to be pure science.

5. Mathematics is applied in every field of other sciences.

6. We no longer use Roman symbols in numerals today.

7. Mathematics developed in complexity due to a need to understand the relationships between things.

8. The Incas were the first to come up with a number system.

9. Mathematics is an international language because it uses Arabic numerals.

10. Opinions are divided over whether mathematics is truly scientific.

***Ex.2. Make sure you know the meaning and the pronunciation of the following***

1. ***proper names:*** Arab, Arabic, Pythagoras, Euclid, Einstein;
2. ***regular words:*** ancient, knowledge, mathematics - mathematician, tax records, taxation, knot, alphabet, genuinely, engineering, major, quantity, quality, structure, integer, arithmetic - arithmetical, subtraction, multiplication, plus, minus, apply, theorem, a right-angled triangle, square, hypotenuse, equal - equality, algebra - algebraic, originate, trigonometry, satellite, geometry, analyze - analytical - analysts, significant, quantum mechanics, basis, pure, creative, approach, probability, statistics - statistical

***Ex.3. Fill in the gap with a preposition (avoid consulting the text).***

1. The development of maths is dependent … other sciences and vice versa.

2. Each new idea became more complex as mathematicians tried to explain how things in the world relate … one another.

3. It is a system which is used … all mathematicians all … the world.

4. Science is the search … knowledge and that is what mathematics does.

5. No one can set … an experiment to prove that one plus one is two … counting.

6. Therefore, because it cannot be proved … experiment, mathematics is not a science.

7. The argument … whether mathematics is a science is unimportant when you realise that it is impossible to separate mathematics … science or science … mathematics.

8. Many … the most important developments … fields such … physics or engineering have led … developments … mathematics.

9. The unbreakable connection … mathematics and all other sciences is recognised … the very way in which we study them.

10. It is a system that uses Arabic numerals and a set of symbols, … … letters, many … which are taken … the Greek alphabet.

11. Many important developments in fields such … physics or engineering have led … developments in mathematics.

12. The full name is usually shortened … maths.

***Ex.4. Translate the following sentences paying attention to the underlined grammar structures.***

1. The first idea to have developed was certainly that of number.

2. As society developed, numbers became more and more important for business dealings and taxation and it became especially important to be able to record numbers.

3. Mathematics developed, each new idea building on earlier ones.

4. It was not until the 16th century that the system of mathematical notation that we use today finally developed.

5. Whether or not mathematics is a science is still a matter of opinion.

6. Whatever your point of view, there is no doubt that mathematics is applied to all sciences.

7. The argument over whether mathematics is a science or not appears to be unimportant.

***Ex.5. Choose one correct variant (do not consult the text).***

*1. Mathematics developed … , each new idea building on earlier ones.*

a) from a series of ideas c) from a certainly amount of ideas

b) from series of ideas d) from a number of information

*2. The first idea … was certainly … number.*

a) to develop … a one of c) been developed … of

b) to have developed … that of d) developing … the

*3. People needed … their belongings.*

a) count b) to count c) counting d) counting of

*4. … the 16th century … the system of mathematical notation developed.*

a) There was not until … that c) It was not until … that

b) It was not till … where d) There was was only in … - when

*5. In fact, it has been said that mathematics … one of only two genuinely international languages; … is music.*

a) are … the other one c) is … another

b) is … another one d) is … the other one

*6. … is still a matter of opinion in the mathematical community.*

a) Whether the mathematics is a science or not, it

b) Whether or not mathematics is a science

c) Whether or not mathematics is a science, it

d) Whether mathematics it is a science

*7. … say no, … say yes, it is.*

a) Some of people … others people c) Some of the people … the other

b) Some … others d) Some … other

*8. As a field of knowledge math does not … the test of being a pure science.*

a) take b) pass c) fail passing d) succeed to pass

*9. … , there is no doubt … it.*

a) Whichever is your point of view … about

b) Whatever your point of view … about

c) Whatever your point of view is … in

d) Whenever your point of view … of

*10. Whether mathematics is a science ….*

a) appears to be not important c) didn’t appear being important

b) is appeared to be unimportant d) appears to be unimportant

*11. Many important developments in physics or engineering have brought about … developments in mathematics.*

a) farther b) father c) furtherer d) further

*12. In fact, it has been said that mathematics is one of only two … languages; … is music.*

a) genuinely international … the other

b) genuine international … another one

c) genuinely internationally … the other

d) genuinely international … another

***Ex.6. Translate into English:***

Cчета, вести записи о(/б уплате) налогах(/ов), налогообложение, сделки, арабские цифры, имущество (личные вещи), сокращать (укорачивать), действительно интернациональный язык, сдать экзамен, чистая наука, таким образом, доказать экспериментально; какой бы ни была ваша точка зрения, отделить математику от науки, признавать.

***Ex.7. Listening. Listen to an extract from a radio programme about number systems. Then listen again and choose the correct answer.***

*1. The Arabic system*

a) is a decimal system. b) causes difficulties. c) is only for multiplication.

*2. The decimal system*

a) is based only on hundreds. b) can express any figures simply. c) is complicated.

*3. Roman numerals*

a) can be divided easily. b) are useful for complex maths. c) can’t be easily multiplied.

*4. In Roman numerals C means*

a) two hundred. b) fifty. c) one hundred.

***Reading 2***

***Before you read***

***Discuss these questions with your partner.***

* ***Do you know the names of any important people connected with Mathematics in history?***
* ***What types of problems do you do n Mathematics at school?***

1. ***Vocabulary. Match these words and phrases with their definitions.***

|  |  |
| --- | --- |
| 1. natural number 2. integer 3. operation 4. function 5. right angle 6. square 7. sum 8. satellite navigation system 9. theorem 10. axiom | A the proof that something is mathematically true  B a number larger than zero  C any number (positive or negative) or zero  D a way numbers combine together  E the relationship between argument and result in calculus  F the result of combining numbers  G an angle of 90 degrees  H system in orbit around the Earth for directions  I the product of two equal terms  J principle |

***B. Pronunciation guide***

**Pythagoras** [paɪ'θagərəs]

***Mathematics***

What mathematicians study can be summed up as relating to four major fields. They look at quantities - how much or how many. There is also the study of structure - how things are arranged together and the relationship between the parts. Then there is the study of space, where mathematicians are interested in the shape of things. Finally, there is change and how things move, over time or through space.

Quantity is mostly concerned with numbers.. Natural numbers are those which are greater than zero, while integers may be zero itself or more or less than zero. There are four ways these may combine together; these are called operations. In arithmetic, we know the operations as addition (+), subtraction (-), division (:) and multiplication (x). For a fuller, more philosophical understanding of number and the operations that can be applied to them, mathematicians look to Number Theory.

The study of the structure of things is said to have begun with the Greek mathematician, Pythagoras, who lived from 582 to 507 BG. Every mathematician has to learn his most famous theorem. A theorem is a proof of mathematical truth. Pythagoras showed us that in a right-angled triangle, the square of the side of the hypotenuse is equal to the sum of the squares of the other two sides. The hypotenuse is the longest side of such a triangle and that length, multiplied by itself is the same as the length of one side multiplied by itself and added to the other side multiplied by itself. Mathematicians find it easier to write this as: *a2+b2=c2, (a* squared plus *b* squared equals c squared) where c is the hypotenuse. It is Pythagoras' Theorem which gives us algebra, a branch of mathematics that originated in the Arab world.

Another Greek mathematician laid the foundations for our understanding of space. More than 200 years after Pythagoras, Euclid used a small set of axioms to prove more theorems. This, we know today as geometry. He saw the world in three dimensions - height, width and length. Developments in other sciences, most notably in physics, have led mathematicians to add to Euclid's work. Since Einstein, mathematicians have added a fourth dimension, time, to Euclid's three. By combining space with number we have developed the trigonometry used in making maps both on paper and in satellite navigation systems.

From algebra and geometry comes calculus. This is the most important tool that mathematicians have to describe change, for example, if you calculate the speed of a moving car or analyse the way the population of a city changes over time. The most significant area of calculus is function, which is concerned with the relationship between argument and result. Indeed, the field of functional analysis has its most important application in quantum mechanics, which gives us the basis for our study of physics and chemistry today.

There is more to maths than this. For example, pure maths involves a more creative approach to the science. An important field of study is statistics which uses Probability Theory, the mathematical study of chance, to predict results and analyse information. Many statisticians would say that they are not mathematicians, but analysts. However, without maths, statisticians would all agree, there would be no statistics at all.

***Ex.1. Read the text and complete the summary. Use words from the text.***

A. Maths studies four areas: quantities, structure, space and (1) ……………………. .

B. Natural numbers are larger than (2) ……………………….. but (3) …………………… can be zero.

C. (4) ……………………. was a Greek mathematician who made the famous theorem a2+b2=c2 which helps us find the size of a (5) ……………………………. .

D. Algebra came from (6) …………………………… countries.

E. With (7) ………………………….. Euclid helped us understand (8) ……………………….. .

F. Trigonometry combines space with (9) …………………………. .

G. Calculus describes (10) ………………………. and used in quantum mechanics allows us to study physics and (11) ……………………… .

H. Statistics predicts results and analyses (12) ………………………… .

***Ex.2. Translate the following sentences paying attention to the underlined grammar structures.***

1. The study of the structure of things is said to have begun with the Greek mathematician, Pythagoras.
2. It is Pythagoras' Theorem which gives us algebra.

***Ex.3. Choose one correct variant.***

*1. The study of the structure of things … with the Greek mathematician, Pythagoras.*

a) is been said to begin c) is said to have begun

b) was said to be began d) as it is said was began

*2. What are the four operations that … numbers?*

a) can apply with c) are appliable to

b) can be applicable on d) can be applied to

*3. For … of number and the operations mathematicians look to Number Theory.*

a) a fuller, more philosophical understanding

b) the more full and philosophically understanding

c) the fuller and more philosophically view

d) a more philosophical and full information

*4. Every mathematician knows … theorem.*

a) his the most famous c) the most famous Pythagoras’

b) Pythagoras’ most famous d) the most famous of his

*5. Mathematicians … to write this as: a2+b2=c2.*

a) find it easier c) consider easier

b) think that it is more easy d) find it’s more logically

*6. Since Einstein, mathematicians … a fourth dimension, time, to Euclid's three.*

a) had added b) have added c) added d) have been added

*7. The field of functional analysis has … application in quantum mechanics.*

a) it’s most important c) its most important

b) it’s the most important d) the most important its

*8. … Greek mathematician … the foundations for our understanding of space.*

a) Other … layed c) The other … lay

b) Another … laid d) There was an other … who lay

***Ex.4. Fill in the gap with a preposition where necessary (avoid consulting the text).***

1. Quantity is mostly concerned … numbers.

2. Mathematicians are interested … both natural numbers … integers.

3. Euclid used a small set … axioms to prove … more theorems., which we know today … geometry.

4. Developments in other sciences, most notably in physics, have led mathematicians … add … Euclid's work.

5. Its length, multiplied … itself is the same … the length of one side multiplied … itself and added … the other side multiplied … itself.

6. Function is concerned … the relationship … argument and result.

7. … combining space with number we have developed the trigonometry used … making maps both … paper and … satellite navigation systems.

8. It gives us the basis … our study of physics and chemistry today.

9. There is more … maths than this.

10 For example, pure maths involves … a more creative approach … the science.

11. However, … maths, statisticians would all agree, there would be no statistics … all.

***Ex.5. Translate the following definitions and statements into English (do not look up the text).***

1. Предметом изучения математики являются понятия количества, структуры вещей – т.е. как они расположены и каковы отношения между ними, пространства – то есть формы и изменений во времени и в пространстве.
2. Натуральное число – это число больше нуля.
3. В арифметике известны (существует) 4 действия – сложение, вычитание, умножение и деление.
4. Теория чисел – это философский взгляд на числа и арифметические действия.
5. Теорема – это доказательство математической истины.
6. Аксиома – это принцип, подход к доказательству теоремы.
7. Гипотенуза – самая длинная сторона треугольника.
8. Он видел мир в трех измерениях – высота, ширина, длина.
9. Тригонометрия – наука, развившаяся из сочетания чисел и пространства.
10. Теория вероятностей – это математическое изучение случайности (вероятности) с целью анализа информации и предвидения результата.
11. Квадрат гипотенузы равен сумме квадратов катетов.

***Ex.6. Fill in the gap with an appropriate form of one of the verbs:***

*a) RISE/RAISE*

1. The lift was slowly ………………… to the top floor.
2. When the visitor … from the chair I also ………………… to show him out.
3. They were watching the game and their excitement ………………… .
4. When she entered the room he didn’t even ………………… his head and went on working.
5. When the Moon ………………… we can continue our way.
6. Don’t ………………… your voice when speaking to a child.
7. When he was passing by, he ………………… his hat to greet us.
8. This question ………………… at our previous meeting.
9. Sometimes the government has to ………………… prices without ………………… salaries.
10. He ………………… very early in the morning.
11. We managed ………………… enough money.
12. We ………………… the picture an inch higher.
13. ………………… children isn’t as easy as one may think.
14. The car ………………… a lot of dust when it braked so suddenly.

***b) LIE/LAY***

1. He told the dog ………………… down.
2. It’s unfair ………………… all the responsibility on him.
3. She ………………… for an hour before the doctor came
4. The table ………………… for four people.
5. He saw something ………………… on the table, which looked like a letter.
6. Don’t ………………… all the blame on her, we are all responsible.
7. He ………………… traps for foxes the day before.
8. She ………………… motionless for a whole hour, so tired she was after work.

***c) FALL-FEEL, FIND-FOUND***

1. The University ………………… in the previous century.
2. He ………………… sorry for what he had done.
3. She ………………… in love with the city and decided that she should stay a little longer.
4. For a long time he was unable ………………… asleep.
5. He looked for the keys but couldn’t ………………… them anywhere.
6. He ………………… so sleepy that decided to go to bed a bit earlier that day.
7. The company that they ………………… together several years ago was now doing very well.
8. She suddenly ………………… ill and quit the job.
9. The necessary solution ………………… at last.
10. She ………………… slightly unwell and sleepy.

***Ex.7. Listening. Listen to these people talking about mathematics in everyday life. Then listen again and match the activity to the area of mathematics. There is one activity that you do not have to use.***

1. estimating sizes A algebra

2. the arrangement of parts B arithmetic

3. avoiding collisions C geometry

4. paying for goods D Probability Theory

5. calculating wages E trigonometry

6. predicting lottery numbers

***Ex.8. Prepare a short presentation on the four main areas of mathematical study. Copy out all the discourse markers in both texts and use them in your presentation. Talk about:***

1. what the areas are;

2. what they focus on;

3. what mathematical developments are practiced in different areas;

4. how they might be of use in the real world.

***Ex.9. Write a short essay to discuss the topic: ‘Mathematics is a science of numbers’.***

***Unit Review.***

***Ex. 1. Fill in the void boxes with derivatives.***

|  |  |  |  |
| --- | --- | --- | --- |
|  | ***adjective*** *(also with negative affixes)* | ***noun*** | ***verb*** |
| **1** | --- |  | record |
| **2** |  |  | break |
| **3** |  |  | divide |
| **4** |  |  | relate |
| **5** |  |  | predict |
| **6** | short |  |  |
| **7** | high |  |  |
| **8** | wide |  |  |
| **9** | long |  |  |
| **10** | deep |  |  |
| **11** | broad |  |  |
| **12** | sweet | --- |  |

***Ex.2. Fill in the gap with a preposition where necessary. Translate the sentences. Use a dictionary to copy out more examples with the words in italics.***

1. The study examines social change within the city and **relates** it …........... developments in the country as a whole.

2. That sounds rather simple, but …………. ***fact*** it's very difficult.

3. John Major didn't go to university. ………… ***fact*** he left school at 16.

4. It is too early to ***predict*** ……………. a result.

5. The Turkish security forces have started ***searching*** ……….. the missing men.

6. I must ***search*** ………….. the Internet for one of his pictures.

7. 1 liter is roughly ***equal*** ……………. 1 quart.

8. 9 percent interest less 7 percent inflation ***equals*** …………. 2 percent.

9. Only one game ***separates*** us …………… total victory.

10. He summed ……………. his weekend in one word: `Disastrous.'

11. His project ***is concerned*** …………... ***applying*** the technology …………… practical business problems.

12. The ***proof*** ……………… the pudding is in the eating.

***Ex. 3. Open the brackets choosing one correct form and fill in the blanks with prepositions where necessary.***

**Pythagoras of Samos** (570 – 495 BC) was an [Ionian](http://en.wikipedia.org/wiki/Ionians) [Greek](http://en.wikipedia.org/wiki/Ancient_Greeks) [philosopher](http://en.wikipedia.org/wiki/Greek_philosophy), [mathematician](http://en.wikipedia.org/wiki/Mathematician), and founder of the religious movement called [Pythagoreanism](http://en.wikipedia.org/wiki/Pythagoreanism). ***(Most of the, The most of the, Most of)*** information about Pythagoras was written down centuries after he ***(has lived, was living, lived)***, so ***(a little, very little, only little)*** reliable information is known about him. He was born on the island of [Samos](http://en.wikipedia.org/wiki/Samos), and might ***(travel, travelled, have travelled)*** widely in his youth, visiting [Egypt](http://en.wikipedia.org/wiki/Egypt) and other places seeking ………… knowledge. He had a teacher named [Themistoclea](http://en.wikipedia.org/wiki/Themistoclea), who introduced him ……… the principles of [ethics](http://en.wikipedia.org/wiki/Ethics). Around 530 BC, he moved to [Croton](http://en.wikipedia.org/wiki/Crotone), a [Greek colony](http://en.wikipedia.org/wiki/Greek_colony) in ***(the, -)*** [southern Italy](http://en.wikipedia.org/wiki/Magna_Graecia), and there set ………… a religious sect. The society played an active role ………… the politics of Croton, but this eventually led ……… their downfall. The Pythagorean meeting-places ***(were been burnt, were burned, have burnt down)*** and Pythagoras ***(was, -, has been)*** forced to flee the city. He is said to ***(end, have been ended, have ended)*** his days in [Metapontum](http://en.wikipedia.org/wiki/Metapontum).

Pythagoras made influential contributions ……… [philosophy](http://en.wikipedia.org/wiki/Philosophy) and religious teaching in the late 6th century BC. He is often referred ……… as a great [mathematician](http://en.wikipedia.org/wiki/Mathematician), [mystic](http://en.wikipedia.org/wiki/Mysticism) and [scientist](http://en.wikipedia.org/wiki/Scientist), but he is best known ……… the [Pythagorean theorem](http://en.wikipedia.org/wiki/Pythagorean_theorem), which ***(bears, is bearing, has been born)*** his name. However, because legend and time cloud his work even more than with ***(the other, the others, others)*** [pre-Socratic philosophers](http://en.wikipedia.org/wiki/Pre-Socratic_philosophy), some ***(has, have, have been)***, questioned whether he contributed much ……… [mathematics](http://en.wikipedia.org/wiki/Mathematics) and [natural philosophy](http://en.wikipedia.org/wiki/Natural_philosophy). Many ***(of, of the)*** accomplishments credited ……… Pythagoras may actually ***(had been, have been, to have been)*** accomplishments of his colleagues and successors. It was said that he was the first man ***(to call, to be called, been called)*** ***(him, himself, his)*** a philosopher, or lover of wisdom, and Pythagorean ideas exercised a marked influence ……… [Plato](http://en.wikipedia.org/wiki/Plato), and through him, all of [Western philosophy](http://en.wikipedia.org/wiki/Western_philosophy).

***Science Section Vocabulary and Grammar Review***

***Ex. 1. Open the brackets choosing one correct form and fill in the blanks with prepositions where necessary. Retell the texts.***

***Scientific facts***

Although companies spend billions … dollars … research and development, new products sometimes come about just … chance.

**SAFETY GLASS** - The idea of safety glass came to a French scientist, Edouard Benedictus, in 1903. He was working in a laboratory … one night when he suddenly knocked over a glass jar ***(contained, containing)*** celluloid. The glass broke, but did not shatter because it ***(sticked, stuck, stucked)*** to the celluloid, and this ***(lead, led, was lead)*** … the idea of safety glass - two sheets of glass with a central sheet of celluloid.

**TEFLON** - Roy Plunkett made the first batch of Teflon while he ***(has worked, had worked, was working)*** … Du Pont. He was carrying … research into coolant gases when he left one batch in a container overnight. He came back … the next day to find that the gas had turned … Teflon, the slipperiest substance … the world.

**PFIZER'S LUCKY BREAK** - Scientists at Pfizer's laboratory in England were testing a new heart drug ***(calling, being called, called)*** Viagra when they realized that, although it was … ***(a little, little, few)*** use in treating heart problems, it had some unexpected side-effects. The result was a ***(hugely, huge)*** successful new product that has probably done more to save the rhinoceros than anything else in history.

***Unit 5***

***Reading 1***

***Before you read***

***Discuss these questions with your partner.***

* ***What is algebra?***
* ***Can you think of any ways that we use it in our everyday lives?***

1. ***Vocabulary. Match these words and phrases with their definitions.***

|  |  |
| --- | --- |
| 1. linear algebra 2. reunion 3. matrices 4. profit and loss 5. transposing 6. operators 7. input and output | A money gained or lost  B rewriting  C linear equations  D coming back together  E arrangement of mathematical elements  F what goes into something and what comes out  G signs used in maths |

1. ***Match the words to make phrases.***

|  |  |
| --- | --- |
| 1. arithmetical 2. unknown 3. abstract 4. vector | A quantities  B spaces  C system  D algebra |

***C. Pronunciation guide.***

**equation** [ik`wei∫ən]

**linear** [`liniə]

**matrices** [`meitrisi:z]

***Algebra***

Algebra originated in the Middle East. Earlier than 1000 BC, the Babylonians developed an arithmetical system for solving problems that could be written algebraically. This was in advance of other systems, notably that of the Ancient Egyptians, who were able to solve the same problems, but did so by using geometry. The word *algebra* comes from Arabic and translates into English as *reunion.* It describes a system of mathematics which performs calculations by firstly rewriting, that is, transposing them, and then reducing them to their simplest form.

Algebra is the branch of mathematics which studies the structure of things, the relationship between things and quantity. It looks different from arithmetic when it is written. Arithmetic uses numbers and the four operators (plus, minus, multiply and divide). Algebra uses symbols, usually letters, and the operators. Actually, it is not very different from arithmetic; what can be done in algebra can be done in arithmetic. There are good mathematical reasons, however, why algebra is used instead of arithmetic.

Firstly, by not using numbers, mathematicians are able to set out arithmetical laws. In this way they are able to understand the system of numbers more clearly. Secondly, by using algebra, mathematicians are able to perform calculations where unknown quantities are involved. This unknown is usually represented by *x.* Solutions can then be applied not just to the immediate problem, but to all problems of the same nature by the use of a formula. A common algebraic problem to solve in school exams would be, for example: *find x where 3x + 8 = 14.* A third reason for the use of algebra rather than arithmetic is that it allows calculations which involve change in the relationship between what goes into the problem and what comes out of it, that is, between input and output. It is an algebraic formula which allows a business to calculate its potential profit (or loss) over any period of time.

It is possible to classify algebra by dividing it into four areas. Firstly, there is elementary algebra in which symbols (such as x and y, or a and b) are used to denote numbers. In this area, the rules that control the mathematical expressions and equations using these symbols are studied. Then, there is abstract or modern algebra in which mathematical systems consisting of a set of elements and several rules (axioms) for the interaction of the elements and the operations are defined and researched. Thirdly, there is linear algebra (linear equations) in which linear transformations and vector spaces, including matrices, are studied. Finally, there is universal algebra in which the ideas common to all algebraic structures are studied.

Like all branches of mathematics, algebra has developed because we need it to solve our problems. By avoiding the use of numbers we are able to generalize both the problem and the solution.

***Ex. 1. Translate the sentences from the text paying attention to the underlined structures.***

1. This was in advance of other systems, notably that of the Ancient Egyptians, who were able to solve the same problems, but did so by using geometry.
2. A third reason for the use of algebra rather than arithmetic is that it allows calculations which involve change in the relationship between what goes into the problem and what comes out of it.
3. What can be done in algebra can be done in arithmetic.

***Ex. 2. Read the text and decide whether the following statements are true or false.***

1. Algebra originated in ancient Egypt.
2. The word *algebra* comes from Latin*.*
3. Rewriting is an equivalent to transposing in maths.
4. The four operators arithmetic uses are plus, minus, multiply and divide.
5. Algebra the same as arithmetic uses symbols, usually letters, and the operators.
6. Without using numbers, mathematicians cannot set out arithmetical laws.
7. Through application of algebra, mathematicians can perform calculations where unknown quantities are involved. This is one of its advantages over arithmetic.
8. Algebraic formulae are seldom made use of by businesses to calculate a future profit or loss over any period of time. They apply a different methodology.
9. It is possible to classify algebra by dividing it into four areas – elementary, abstract, modern and linear.

***Ex. 3. Answer the following questions.***

1. What does ***algebra*** study?

2. What does ***elementary*** algebra study? What are its methods?

3. What does ***abstract*** algebra study?

4. What does ***linear*** algebra study?

5. What does ***universal*** algebra study?

***Ex. 4. Translate the following sentences into Russian paying attention to the words in italics. Use a dictionary to copy out more examples with them.***

1. Too much protein in the diet may *advance* the ageing process.
2. Medical technology has *advanced* considerably in the recent years.
3. The subject of the talk was announced a week *in advance*.
4. Even his allies *describe* him as forceful, aggressive and determined.
5. What you do in the privacy of your own home is a *different* matter.
6. The number of calories in *different* brands of drinks varies enormously.
7. This is *different* from what he said.
8. Each part of the engine *performs* a *different* function.
9. There is a *reason* for every important thing that happens.
10. He complained about his employee’s laziness and not without *reason*.
11. They allowed him to *develop* their original idea.
12. The disease *originated* in Africa.
13. I seem to have *involved* myself in something I don’t understand.
14. Their boss encourages his employees to think for themselves *rather than* telling then what to think.

***Ex. 5. Insert prepositions where necessary (avoid consulting the text):***

1. She arrived … advance … everyone else.
2. They paid us … advance.
3. Recent advances … medical science mean that this illness can now be cured.
4. Algebra transposes calculations and then reduces them … their simplest form.
5. By generalizing problems algebraically mathematicians are able to set … arithmetical laws.
6. In algebra the unknown quantity is usually represented … *x.*
7. Such solutions can be applied not just … the immediate problem, but … all problems of the same nature.
8. A third reason … the use of algebra is that it allows … calculations which involve … change.
9. Algebra is divided … four areas.
10. It looks different … arithmetic when it is written.
11. This branch … algebra studies ideas common … all algebraic structures.

***Ex. 6. Practice the pronunciation of the following groups of derivatives (pay attention to the possible shift of stress).***

1. arithmetic – arithmetical
2. mathematics – mathematical
3. algebra – algebraic – algebraically
4. geometry – geometrical – geometrically
5. matrix – matrices

***Ex. 7. Translate the following words and word combinations from the text and write them down in the right-hand column of the table. Recall and reproduce the context in which they were used in the text.***

|  |  |
| --- | --- |
| 1. происходить, возникать 2. разработать арифметическую систему 3. решать проблему, задачу алгебраически 4. область математики 5. отличаться от ч-л 6. четыре действия – сложение, вычитание, деление, умножение 7. разработать, упорядочить законы арифметики 8. понимать систему чисел более ясно, точно 9. непосредственная (данная) задача 10. позволять производить вычисления 11. Во-первых … в конечном итоге 12. общий для всех алгебраических структур 13. обобщать и проблему и решение |  |
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***Ex. 8. Listening. Listen to a teacher talking to a class. Then listen again and complete the sentences.***

1. Algebra is a branch of mathematics that uses mathematical …………………… to describe variables.

2. In a mathematical statement, letters are often used to represent a(n) …………………… which is not fixed.

3. A(n) ………………… is a mathematical statement containing letters or symbols to represent numbers.

4. A term is a number or a(n) ……………………. of a number and one or more variables.

5. An expression is a collection of numbers, variables and ……………………., positive or negative, of operations that make mathematical or logical sense.

***Reading 2***

***Before you read***

***Discuss these questions with your partner.***

* ***What is the job of an engineer?***
* ***Why does an engineer need to know maths?***

***A. Complete the sentences below with words and phrases from the box.***

|  |  |
| --- | --- |
| * accumulation of quantities * methodology * differential calculus * vast * tangent * coordinate * sake | * infinitesimal * integral calculus * vital * latter * chord * distinction |

1. A line segment joining two points on a curve is a ………………………. .

2. A ……………………. is a line or surface that touches another.

3. The area of maths used to determine areas, volumes and lengths is called …………………… .

4. The area of maths relating to changes in variable is called …………………….. .

5. If something is close to zero it is ………………………….. .

6. You need to eat well for the …………………….. of your health.

7. There is a ……………………. amount of knowledge to learn in sciences.

8. There are two theories – one from ancient times and a modern one. The …………………., the modern one, is widely accepted now.

9. She claimed the ………………….. of having solved the equation.

10. A …………………. is a number that identifies a position relative to a straight line.

11. …………………… is the system of methods followed in an area of study.

12. …………………… measures areas under a curve, distance travelled, or volume displaced.

13. If something is ……………………, it is one of the utmost importance.

***B. Pronunciation guide.***

**Gottfried Leibniz** [`gotfri:d `laibnits]

**infinitesimal** [infini`tesiməl]

**plagiarism** [`pleidʒərizəm]

***Gottfried Leibniz***

Gottfried Leibniz was born and lived most of his life in Germany. He made visits to both Paris and London, for the sake of learning and study, but spent the vast majority of his working life as an employee of German royalty, as a philosopher, engineer and mathematician. It is for the latter that he is best remembered. His greatest achievement was as an inventor of calculus, the system of notation which is still in use today. Leibniz is remembered as *an* inventor, not *the* inventor of calculus. In England, Isaac Newton claimed the distinction, and was later to accuse 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. Newton, it must be said, was very protective of his achievements and jealous of others' success. It is important to mention that Leibniz published his writings on calculus three years before Newton published his most important work.

Leibniz was the first to use function to represent geometric concepts. Among other terms, Leibniz used what is now everyday language in mathematics to describe these concepts. Words such as *tangent* and *chord,* were first used by Leibniz. He also saw that linear equations in algebra could be arranged into matrices. It was in this significant piece of work on calculus that he introduced mathematics and the world to the word *coordinate.* He also made important advances in algebra and logic in ways that still today, three hundred years later, have an impact on mathematics.

Leibniz' importance for modern mathematics can be understood through his work. He was especially interested in ***infinitesimal*** calculus. This is an area of calculus developed from geometry and algebra. It is divided into two parts. There is differential calculus, which is concerned with measuring rates of change of quantities. And there is integral calculus, which studies the accumulation of quantities. That is, Leibniz was looking at ways of measuring the speed and the distance travelled, for example. Today, calculations of this type are used not only in mathematics but in every branch of science and in many fields which apply a scientific methodology, such as economics and statistics.

Despite the disagreements between Leibniz and Newton, modern mathematicians recognise each of them as being vital to the development of modern mathematics. Newton was certainly the first to apply calculus to the problems of physics. In mathematics itself, it is to Leibniz that we look for our system of writing equations and for the language we use to refer to the concepts. While both reached their understanding without the benefit of reading each other's work, it remains a fact that Leibniz was first to publish.

***Ex. 1. Translate the sentences from the text paying attention to the underlined structures.***

1. He was a philosopher, engineer and mathematician. It is for the latter that he is best remembered.
2. Tycho Brahe, Galileo, Nicolas Copernicus tried to discover the mysteries the heavens. The latter believed that the Earth was not the centre of the solar system but just another planet revolving around the Sun.
3. In England, Isaac Newton claimed the distinction.
4. Leibniz was the first to use function to represent geometric concepts.
5. It was in this significant piece of work on calculus that he introduced mathematics and the world to the word *coordinate.*
6. In mathematics itself, it is to Leibniz that we look for our system of writing equations and for the language we use to refer to the concepts.
7. It remains a fact that Leibniz was first to publish.
8. Modern-day historians however, regard Leibniz as having arrived at his conclusions independently of Newton.

***Ex. 2. Read the text and decide whether the following statements are true or false.***

1. Gottfried Leibniz was born in *Austria but* lived most of his life in Germany.
2. He spent the vast majority of his working life as an employee of German royalty.
3. Calculus is the system of notation which is still in use today.
4. Plagiarism is applying somebody else's ideas in order to develop your own.
5. Gottfried Leibniz’s greatest achievement was as an inventor of calculus.
6. It was Newton who was the first to use such words as *tangent* and *chord.*
7. Isaac Newton accused Gottfried Leibniz of plagiarism.
8. Having done a lot of investigating and analyzing modern-day historians insist that Gottfried Leibniz was a plagiarist.
9. Leibniz published his writings on calculus three years later than Newton published his most important work.
10. Infinitesimal calculus is an area of calculus developed from geometry and algebra.
11. Infinitesimal calculus is divided into two parts – differential calculus and integral calculus.
12. Differential calculus is concerned with the accumulation of quantities.
13. Integral calculus studies measuring rates of change of quantities.

***Ex. 3. Answer the following questions to the text.***

1. What do the following fields of math study?

1. Infinitesimal calculus.
2. Differential calculus.
3. Integral calculus.

2. For what contribution to mathematics is Leibnitz best remembered?

3. Who was Leibnitz’ main rival? About what did they disagree?

4. What other areas of work also use Leibnitz’ calculus?

5. Which important geometrical terms did Leibnitz invent?

6. Who is considered more important for the development of modern mathematics?

***Ex. 4. Translate the following sentences into Russian paying attention to the words in italics. Use a dictionary to copy out more examples with them.***

1. For the *sake* of historical accuracy, permit us to state the true facts.
2. These methods of making Champagne are still *in* *use* today.
3. The site has been *out of* *use* for many years.
4. When King Richard III died, Henry VII *claimed* the English throne.
5. Her assistant was *accused* of theft and fraud by the police.
6. I *regard* creativity as both a gift and a skill.
7. She started to *arrange* the books in piles.
8. As far as his conduct is *concerned*, it leaves much to be desired.
9. As far as I *am concerned*, feng shui is a load of rubbish.
10. Today’s lesson *is concerned with* punctuation.
11. It’s just that she is *concerned* about her son’s future.
12. This type of bank accounts pays above the average *rate* of interest.
13. The world’s tropical forests are disappearing at an even faster *rate* than experts had thought.
14. We are told the figure could *reach* 100,000 next year.

***Ex. 5. Insert prepositions where necessary (avoid consulting the text):***

1. Their parents only stayed together … the sake … the children.
2. The surgeon was accused … negligence.
3. That is, Leibniz was looking … ways … measuring the speed and the distance travelled.
4. When they arrived … the police station, they were taken … an interview room.
5. When did they arrive … the US?
6. The conclusion that we arrived … previously seems to be wrong.
7. Both scientists made the discovery independently … each other, … roughly the same time.
8. They point … that there are important differences … the writings of both men.
9. Her parents always regarded him … the cleverest … their children.
10. His writings … calculus are still vital … mathematics as well as … many fields which apply a scientific methodology, such … economics and statistics.
11. This is an area of calculus developed … geometry and algebra.
12. I promise … you never to mention … the incident again.
13. She has always been jealous … her sister’s good looks.
14. The anti-smoking campaign has made quite an impact … young people.
15. He was especially interested … infinitesimal calculus.

***Ex. 6. Find synonyms in the right-hand column for the words on the left:***

|  |  |
| --- | --- |
| 1. regard 2. point out 3. infinitesimal 4. arrange 5. be concerned with 6. for the sake of 7. accuse 8. jealous 9. impact 10. concept 11. measure 12. apply | * 1. lay blame on sb   2. deal with   3. tiny, microscopic   4. effect   5. notion, idea   6. organize, put in certain order   7. refer to   8. make use of   9. envious   10. emphasize   11. determine (the dimensions of sth)   12. because of, for the purpose of |

***Ex. 7. Practice the pronunciation of the following groups of derivatives (pay attention to the possible shift of stress):***

1. policy – politics – political – politician – political figure
2. statistics – statistical
3. economics – economy – economic – economical – economist
4. agree – disagree – disagreement
5. history – historic – historical – historically – historian
6. science – scientist – scientific
7. method – methodology
8. apply – application – applicant

***Ex. 8. State what parts of speech the following ic-ending words are:***

Arithmetic, historic, logic, classic, enthusiastic, pathetic, economic, basic, elastic, public, skeptic, anesthetic, narcotic, alcoholic, tragic, magic.

***Ex. 9. With your books closed make a plan-like enumeration of Leibniz’s most important achievements.***

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***Ex. 10. Listening. Listen to the extract from a lecture about matrices. Then listen again and tick the statements which are true.***

|  |  |
| --- | --- |
| 1. A matrix is a table of abstract quantities that can be added or multiplied. |  |
| 2. No form of matrix was used in prehistoric times. |  |
| 3. Matrices can be added, multiplied, and decomposed in different ways. |  |
| 1. The horizontal lines in a matrix are the columns. |  |
| 1. A matrix with ***m*** rows and ***n*** columns is known as an ***m***-by-***n*** matrix. |  |

***Unit Review.***

***Ex.1. Check yourself and see if you remember how to pronounce correctly the following***

***a) proper names:***

Babylonians, Ancient Egyptians, Gottfried Leibniz, Germany, Paris, London;

***b) regular words (also determine their part of speech):***

instead of , however, potential, period, area, abstract, linear, axiom, interaction, royalty, engineer, vast, majority, original, jealous, tangent, chord, coordinate, significant, calculus, infinitesimal, integral, accumulation;

***c) groups of derivatives (pay attention to the possible shift of stress):***

policy – politics – political – politician, economics – economy – economic – economical – economist, agree – disagree – disagreement, history – historic(al) – historically – historian, science – scientist – scientific, method – methodology, apply – application – applicant, symbols – symbolic, classify – classification, element – elementary, to control – control (noun) – control (adjective), philosopher – philosophical, employer – employee – unemployed, system – systematic, plagiarism – plagiarist.

***Ex. 2.***

***a) Write down the plural forms of the following words and pronounce them correctly:***

|  |  |
| --- | --- |
| 1. matrix |  |
| 1. formula |  |
| 1. change |  |
| 1. business |  |
| 1. loss |  |
| 1. equation |  |
| 1. axiom |  |
| 1. space |  |
| 1. employee |  |
| 1. royalty |  |
| 1. difference |  |
| 1. man |  |
| 1. advance |  |
| 1. use |  |
| 1. language |  |
| 1. science |  |
| 1. way |  |
| 1. quantity |  |
| 1. rate |  |
| 1. measure |  |

***b) Write down the degrees of comparison of the following adjectives and adverbs (give variants where possible):***

|  |  |  |
| --- | --- | --- |
| 1. abstract |  |  |
| 1. simple |  |  |
| 1. modern |  |  |
| 1. common |  |  |
| 1. late |  |  |
| 1. good |  |  |
| 1. bad |  |  |
| 1. jealous |  |  |
| 1. important |  |  |
| 1. significant |  |  |
| 1. great |  |  |
| 1. badly |  |  |
| 1. well |  |  |
| 1. clearly |  |  |

***Ex. 3. Fill in the blanks with prepositions where necessary and open the brackets using correct forms of the verbs. Translate the sentences into Russian.***

1. Matters of pollution and the environment concern … us all.

2. The number of people claiming … unemployment benefits (rise) sharply this month.

3. The surgeon (accuse) … negligence and fired. (Use Passive) Thus, since last month the position (be) vacant.

4. Local people (regard) this idea of a motorway through the village … an abuse of their rights.

5. He always (refer) … the house … his refuge.

6. He (have) to refer … history book to find out the dates of the French Revolution.

7. The reader constantly (refer) back … the introduction. (Use Passive)

8. He felt he (grow) jealous … her success and tried to suppress this feeling.

9. … convenience’s sake the tourists (arrange) in five parties. (Use Passive) They were to set out the next morning.

10. I dedicate this book to the memory of my uncle, Arthur S. Link, who (introduce) me … the joys of history at a young age.

11. Their aid always (be) vital … our success and we are going (apply) … them for assistance again.

12. Falling export rates (make) an impact … the country’s economy quite considerably recently.

13. Feminist ideas have influenced … the law-makers.

14. They have enough influence … the Parliament to get the bill (pass).

15. Van Gogh (have) a major influence … the development of modern painting.

16. Don’t touch the machine when it is … use.

17. It's an interesting scientific phenomenon, but … no practical use whatever.

***Science Section Vocabulary and Grammar Review***

***Ex. 1. Choose one correct variant among the forms in brackets.***

***GLOBAL WARMING FAST FACTS***

With the world on the brink of catastrophic climate change, it is time **…** **(to get, getting, for us getting)** **… (serious, seriously, in a serious way)**. Humans are pouring carbon dioxide **… (in, on, into)** the atmosphere **… (more, much, a lot of)** faster **… (as, then, than)** plants and oceans can absorb it. … **(On, In, At)** December 2009, governments of the world will meet in **… (the, -, a city of)** Copenhagen to decide the future of our plan­et. Let's hope they get it right.

***What is global warming?***

Carbon dioxide and **… (another, other, others)** gases warm the surface of the planet **…** **(natural, naturally, in a naturally way)** by trapping heat from the sun in our atmosphere. This is a good thing because it keeps our planet habitable. However, by burning fos­sil fuels such **… (like, as, how)** coal, gas and oil and cutting down forests we have dramatically increased the **… (number, amount, quality)** of carbon dioxide in the Earth's atmosphere and tem­peratures are **… (raising, risen, rising)**  **… (fast, fastly, rapid)**!

**Is global warming dangerous?**

Most scientists agree that global warming is **… (much, very, such)** dangerous. We **… (might, can, able to)** already see **… (many, much, a little)** changes:

* Average temperatures around the world **… (are rising, rise, raise, are raising)** especially in **… (the, -)** eastern Russia, **… (the, -)** western Canada and **… (the, -)** American Alaska.
* Arctic ice is quickly disappearing. Polar bears and **… (other, another, the others, others)** animals are already suffering from the loss of sea ice.
* Glaciers and mountain snows are quickly melting. The flow of ice from glaciers in **… (the, -)** Greenland **… (has, had,-)** more than doubled over the past decade.
* The **… (number, amount, quality)** of strong hurricanes over the ocean **… (has almost doubled, almost doubled, had almost doubled)** in the last 30 years.
* The **… (number, amount, quality)** of heat waves, droughts and wild­ fires is increasing.
* At least 279 kinds of plants and animals are already responding **… (for, in, to)** global warming, **… (moved, having moving, moving)** **… (closer, more closely, more closer)** to the poles.

**What will happen if our planet continues to get warmer?**

* Sea levels will rise and cities on coasts will disap­pear under the water.
* Polar bears and **… (many other, a lot of others, the other many)** animals will die **… (out, off, in).**
* **… (It, There, -)** will be more floods, especially **… (nearly, near, closely)** coasts and rivers.
* Places that usually get lots of rain and snowfall will get **… (more hotly and dryly, hotlier and drilier, hotter and drier).**
* Many lakes and rivers will dry up.
* **… (It, There, -)** will be more heat waves, droughts and wildfires.
* Hurricanes, tornadoes and **…** **(others, the others, other)** storms will become **… (more commonly, more common, much more commoner)**.

**What can you do?**

There are **… ( a lot of, lots, much of)** things you can **… (do make, do to make, be doing making)** sure you aren't causing **… (as much , so many, so a lot of)** harm to our planet. Small changes to your daily life can really help to stop global warming.

* Use energy**-… (saved, saving)** light bulbs.
* Put **… (on, up, off)** a sweater when you are cold **… (instead, instead of, instead for)** turning up the heater.
* Use your washing machine or dishwasher only when they are full.
* Take a shower  **… (instead, instead of, instead for)** a bath.
* When **… (shop, to shop, shopping)**, use a reusable bag **… (instead, instead of, instead for)** buy­ing a plastic one in each shop.
* Remember that walking, cycling or taking a bus is less **… (harmful, harmfully, harmlessly)** for our planet than travelling by car.
* If you have a garden, put your organic waste in a compost heap.
* Plant a tree. A single tree will absorb one ton of carbon dioxide over its lifetime.

***Ex.2. Complete the passage using the words in brackets in the appropriate form or adding prepositions to fill in the gaps. Retell the passage.***

***Scientific facts***

Hydrogen is the (***simple)*** and ***(common)*** element in the universe, and has a very high energy ***(content, contents)*** per gram. As it is so lightweight, rockets and space shuttles use hydrogen ……… a power source. Hydrogen ***(seldomly, rarely, rare)*** stands alone as a gas because it is ***(chemical, chemically)*** active and ***(usual, usually)*** combines ……… other elements to form different compounds.

When an electric current passes through water, the water splits up ……… two gases - hydrogen and oxygen. When hydrogen burns, it turns back ……… water.

This process doesn’t cause pollution, and this means that hydrogen could be a useful fuel ……… the cars of the future. ……… the moment, it takes a lot of electricity to produce hydrogen from water, but some researchers believe that new production methods will ***(find)***.

***UNIT 6***

***Reading 1***

***Before you read***

***Discuss these questions with your partner.***

* ***What do you think the word geometry means?***
* ***Do you know any other words associated with geometry?***
* ***What are some ways geometry is used every day?***
* ***What do you know about Euclid?***

***A. Vocabulary***

***Match these words with their definitions.***

|  |  |
| --- | --- |
| 1 spatial  2 roots  3 perspective  4 concentric  5 intersect  6 deduction  7 finite  8 radius  9 plane | A a way of drawing things so that they look real  B relating to physical space  C beginning  D with a common centre  E limited  F a conclusion  G to cut across  H a free two-dimensional shape  I a straight line from the centre to the edge of a circle |

***B. Pronunciation guide.***

**Omar Khayyam** ['əʊmɑː kaɪ'ɑːm]

**Rene Descartes** [re`ne 'deɪkɑːt ]

**Pierre de Fermat** [`piə də 'fəːmɑː ]

**Girard Desargues** [ʒi`ra:r  de`za:rg]

**Hellenistic** [hele`nistik]

***Geometry***

Geometry (from the Greek *geometria, the Earth's measure)* has its roots in the ancient world, where people used basic techniques to solve everyday problems involving measurement and spatial relationships. The Indus Valley Civilisation, for example, had an advanced level of geometrical knowledge - they had weights in definite geometrical shapes and they made carvings with concentric and intersecting circles and triangles. Gradually, over the centuries, geometrical concepts became more generalised and people began to use geometry to solve more difficult, abstract problems.

However, even though people in those times knew that certain relationships existed between things, they did not have a scientific means of proving how or why. That changed during the Classical Period of the ancient Greek civilisation (490 BC-323 BC). Because the ancient Greeks were interested in philosophy and wanted to understand the world around them, they developed a system of logical thinking (or *deduction)* to help them discover the truth. This methodology resulted in the discovery of many important geometrical theorems and principles and in the proving of other geometrical principles that had been known by earlier civilisations. For example, the Greek mathematician Pythagoras was the first person that we know of to have proved the theorem a2 + b2 = c2.

Some of the most significant Greek contributions occurred later, during the Hellenistic Period (323 BC-31 BC). Euclid, a Greek living in Egypt, wrote *Elements,* in which, among other things, he defined basic geometrical terms and stated five basic axioms which could be deduced by logical reasoning. These axioms or postulates, were: 1. Two points determine a straight line. 2. A line segment extended infinitely in both directions produces a straight line. 3. A circle is determined by a centre and distance. 4. All right angles are equal to one another. 5. If a straight line intersecting two straight lines forms interior angles on the same side and those angles combined are less than 180 degrees, the two straight lines if continued, will intersect each other on that side. This is also referred to as the parallel postulate. The type of geometry based on his ideas is called Euclidean geometry, a type that we still know, use and study today.

With the decline of Greek civilisation, there was little interest in geometry until the 7th century AD, when Islamic mathematicians were active in the field. Ibrahim ibn Sinah and Abu Sahl al-Quhi continued the work of the Greeks, while others used geometry to solve problems in other fields, such as optics, astronomy, timekeeping and map-making. Omar Khayyam's comments on problems in Euclid's work eventually led to the development of non-Euclidean geometry in the 19th century.

During the 17th and 18th centuries, Europeans once again began to take an interest in geometry. They studied Greek and Islamic texts which had been forgotten about, and this led to important developments. Rene Descartes and Pierre de Fermat, each working alone, created analytic geometry, which made it possible to measure curved lines. Girard Desargues created projective geometry, a system used by artists to plan the perspective of a painting. In the 19th century, Carl Friedrich Gauss, Janos Bolyai and Nikolai Ivanovich Lobachevsky, each working alone, created non-Euclidean geometry. Their work influenced later researchers, including Albert Einstein.

***Ex. 1. Look through the text again and choose the correct answer.***

*1. Geometry was first used to solve*

a) common problems.

b) abstract problems.

*2. During the Classical Period of Greek civilization,*

a) the way problems were solved changed.

b) people were only interested in geometry.

*3. The Greeks made important advances in geometry*

a) only during the Classical Period.

b) during both the Classical and Hellenistic Periods.

*4. After the decline of Greek civilization,*

a) mathematicians used geometry to solve other kinds of problems.

b) nothing new was discovered.

*5. Between the 17th and 19th centuries, European thinkers*

a) ignored the Greeks’ ideas about geometry.

b) created new types of geometry.

***Ex. 2. Learn to pronounce the following***

1. ***proper nouns:***

Euclidean, Egypt – Egyptian, Pierre de Fermat;

1. ***regular nouns and adjectives:***

civilisation, circle, triangle, perspective, principle, concept, postulate, theorem, axiom, segment, ancient, curved, concentric, intersecting, straight, interior, definite, infinitely, logical, knowledge, weight, deduction, geometry, geometrical, measure, occur, comment, angle, analytic, astronomy, Islamic.

***Ex. 3. Translate the following sentences paying attention to the underlined structures.***

1. The Greek mathematician Pythagoras was the first person that we know of to have proved the theorem a2 + b2 = c2.
2. Euclid, a Greek living in Egypt, wrote *Elements,* in which he defined basic geometrical terms and stated five basic axioms.
3. Rene Descartes and Pierre de Fermat, each working alone, created analytic geometry, which made it possible to measure curved lines.
4. They did not have a scientific means of proving how or why.
5. The two straight lines if continued, will intersect each other on that side.

***Ex. 4. Translate the following sentences into Russian paying attention to the words in italics. Use a dictionary to copy out more examples with them.***

1. This part of the book *interests* me in particular.
2. Investors can borrow an amount *equal to* the property’s purchase price.
3. The investigation will *determine* what really happened.
4. Our personal space *extends* about 12 to 18 inches around us.
5. If headaches only *occur* at night, lack of fresh air and oxygen is often the cause.
6. The US *is contributing* $4 billion in loans, credits and grants.
7. In his speech he *referred to* his recent trip to Canada.
8. Equal and unique are adjectives which *refer to* a logical or mathematical absolute.
9. She *refers to* him *as* a dear friend.
10. The term electronics *refers to* electrically-induced action.
11. Stratford police refuse to *comment on* whether anyone has been arrested.

***Ex. 5. Insert prepositions where necessary (avoid consulting the text).***

1. People used basic techniques to solve … everyday problems involving … measurement and spatial relationships.
2. People … those times knew that certain relationships existed … things, they did not have a scientific means … proving how or why.
3. This methodology resulted … the discovery of many important geometrical theorems,
4. Other geometrical principles had been known … earlier civilizations.
5. Two points determine … a straight line.
6. A line segment extended infinitely … both directions produces … a straight line.
7. All right angles are equal … one another.
8. If a straight line intersecting … two straight lines forms interior angles … the same side and those angles combined are less than 180 degrees, the two straight lines if continued, will intersect … each other … that side.
9. This is also referred … … the parallel postulate.
10. The type … geometry based … his ideas is called Euclidean geometry.
11. The ancient Greeks were interested … philosophy.
12. 's comments … problems in Euclid's work eventually led … the development of non-Euclidean geometry in the 19th century.
13. … the 17th and 18th centuries, Europeans once again began to take an interest … geometry.
14. Projective geometry is a system used … artists to plan … the perspective … a painting.

***Ex. 6. Find synonyms in the right-hand column for the words on the left:***

|  |  |
| --- | --- |
| 1. determine 2. definite 3. infinitely 4. reasoning 5. occur 6. result in 7. result from 8. technique 9. concept 10. measurement 11. influence | 1. method, procedure 2. affect 3. notion, idea 4. considerably, substantially 5. logic, way of thinking 6. dimension 7. happen, come about 8. discover, confirm 9. bring about 10. specific, distinct, exact 11. be caused by, rise from |

***Ex. 7. Find antonyms in the right-hand column for the words on the left:***

|  |  |
| --- | --- |
| 1. significant 2. decline 3. basic 4. gradually 5. definite 6. infinite | 1. rise, increase 2. rapidly, in a hurry 3. vague, confused 4. limited, restricted 5. secondary, minor 6. unimportant, irrelevant |

***Ex. 8. Listening. Listen to a conversation between two friends. Then complete the sentences with a word or short phrase.***

1. The boy is learning about ……………………… geometry.

2. Artists paint on a flat, one- …………………….. surface.

3. Objects that are nearer to us look ……………………. than objects that are further away.

4. Desargues invented a way to understand ……………………. .

5. Desargues’ theorem said when two triangles are in perspective the corresponding sides lie on the same ……………………… .

***Reading 2***

***Before you read***

***Discuss these questions with your partner.***

* ***What developments in geometry do you know about that occurred during the Renaissance (15th-17th centuries AD)?***
* ***What differences and what similarities can you think of between maths and philosophy?***

***A. Vocabulary***

***Find a synonym in the box for the words or phrases in italics in the sentences. Check your answers in the text.***

|  |
| --- |
| * knowledgeable * prosperity * goal * on the continent * harsh * tutor * synthetic geometry * advance * analytic geometry |

1. The country was going through a time of *successfulness*. ………………………….

2. The climate was *very cold and unpleasant*. …………………………..

3. Her *aim* in life was to become a philosopher. ………………………….

4. He lived *in Europe, not Britain*. …………………………

5. She studied *a kind of geometry that used theorems and observations to reach conclusions*. ………………………….

6. He taught *a kind of geometry involving curves and understanding them*. ………………………..

7. She is very *well-educated*; she always beats me at Trivial Pursuit. ………………………….

8. Computer technology is expected to *develop* immensely in the next couple of years. …………………..

9. She wants to find a Maths teacher to *teach* her children at home. ……………………….

***B. Pronunciation guide.***

**Poitiers** [`pwa:tiei]

**Renaissance** [ri`neisəns]

**Aquinas** [ə`kwainəs]

**Cartesian** [ka:`tiziən]

**Constantinople** [kon`stᵆntinəʊpl]

**Jesuit** [`dƷezjuit]

***Reading 2***

***Rene Descartes***

Rene Descartes was born in France on 31st March, 1596, at a time of major change in the world. The great wars which had been going on throughout Europe had finally ended, creating an atmosphere of peace and stability which encouraged creative thinking, experimentation and the questioning of old beliefs and ways. After the fall of Constantinople in 1453, Greek and Islamic texts had been rediscovered and read by learned men around Europe. Ideas of the great Renaissance artists and thinkers had quickly spread across the continent. What is more, with the discovery of the New World by Columbus in 1492, a period of exploration, expansion and prosperity had begun.

After completing his education at the Jesuit College and the University of Poitiers, both in France, Descartes began to work on his goal of presenting a new way of looking at philosophy and mathematics. Although his first essays were probably written earlier than 1628, the year he moved to Holland, he was not well known until 1637, when a collection of his essays appeared and attracted the interest of the scientific world.

His great work *Discourse on the Method* was one of the essays included in this collection.

Descartes was knowledgeable about the work of Plato and Aristotle, as well as that of earlier European philosophers like Augustine and Aquinas. Descartes' goal was to reach true knowledge about things by applying mathematical methodology to find answers to philosophical questions. Starting with the principle that the only thing he could be sure of was that he himself existed *(Cogito, ergo sum* meaning, *I* *think, therefore I am),* he reached his own conclusions about God and the physical world. Because his ideas were very different from traditional ideas of his time, he was often criticised by religious leaders. His work had a great influence on later philosophers, including Benedict de Spinoza, Blaise Pascal, John Locke and Immanuel Kant.

Another of his goals was to advance the field of mathematics, particularly geometry. Until that time, Euclidean geometry was the type most well known. Also known as synthetic geometry, Euclidean geometry uses theorems and observations to reach conclusions.

Building on the work of the ancient Greek, Apollonius of Perga (262-190 BG), Descartes realised that it would be useful and important to be able to measure curved lines in addition to straight ones. This led to his invention of the Cartesian coordinate system, a way of algebraically measuring curves and understanding things about them. This was the start of analytic geometry (also called *coordinate geometry* and *Cartesian geometry)* and eventually led to the invention of calculus. In addition to his work in philosophy and geometry, Descartes contributed to algebra, optics and even physiology and psychology.

Descartes became one of the most important figures of his time. Queen Christina of Sweden invited Descartes to tutor her, which he did. However, he became ill in Sweden, possibly because he was not used to the cold, harsh climate, and died on 11th February, 1650. To honour him for his many contributions, people call him the 'Founder of Modern Philosophy' and the 'Father of Modern Mathematics'.

***Ex. 1. Read the text and decide whether the following statements are true or false.***

1. Descartes’ time was one of major changes.

2. Descartes aimed to invent a new branch of mathematics and philosophy.

3. Descartes hadn’t been influenced by earlier philosophers.

4. Descartes’ ideas often did not meet with the approval of church authorities.

5. Descartes’ major contribution was to calculus.

***Ex. 2. Read the following***

1. ***proper nouns:***

Jesuit, Renaissance, Columbus, Poitiers, Holland,Constantinople, Plato, Aristotle, Augustine, Aquinas, Sweden;

1. ***regular words and word combinations:***

major, atmosphere, stable – stability, encourage, creative, experimentation, rediscover, learned, spread, exploration, prosperity, influence, synthetic, curved, knowledgeable, optics, psychology, physiology, honour, discourse.

***Ex. 3. Insert prepositions where necessary (avoid consulting the text).***

1. 1596 was a time of major change … the situation in the world.
2. Before 1596 great wars had been going … … Europe.
3. Peace and stability encouraged … creative thinking.
4. People started questioning … old beliefs and ways.
5. Ideas of the great Renaissance artists and thinkers had quickly spread … the continent.
6. After completing his education … the Jesuit College and the University of Poitiers, Descartes began to work … his goal of presenting a new way … looking … philosophy and mathematics.
7. … 1628 he moved … Holland.
8. His great work *Discourse … the Method* was one of the essays included … this collection.
9. Descartes was knowledgeable … the work of Plato and Aristotle.
10. Descartes’ goal was to reach … true knowledge … things … applying mathematical methodology … ways of looking for answers … philosophical questions.
11. Starting … the principle that the only thing he could be sure … was that he himself existed he reached his own conclusions … God and the physical world.
12. His ideas were very different … traditional ideas of his time.
13. He was often criticized … religious leaders.
14. His work had a great influence … later philosophers.
15. Another … his goals was to advance … the field of mathematics.
16. Also known … synthetic geometry, Euclidean geometry uses theorems and observations to reach … conclusions.
17. This led … his invention … the Cartesian coordinate system.
18. … addition … his work in philosophy and geometry, Descartes contributed … algebra, optics and even physiology and psychology.
19. Queen Christina … Sweden invited Descartes to tutor her.
20. He was not used … the cold, harsh climate, and died on 11th February.
21. People honour him … his many contributions.

***Ex. 4. Find synonyms in the right-hand column for the words on the left:***

|  |  |
| --- | --- |
| 1. learned 2. creative 3. encourage 4. major 5. rediscover 6. expansion 7. prosperity | 1. main, chief 2. wealth, affluence 3. persuade, give confidence 4. educated, cultured, well-read 5. find or experience again 6. inventive, resourceful 7. development, increase, growth |

***Ex. 5. Find antonyms in the right-hand column for the words on the left:***

|  |  |
| --- | --- |
| 1. learned 2. harsh 3. curved 4. addition 5. different 6. criticize 7. attract | 1. repel, repulse 2. exception, exclusion 3. praise, compliment 4. straight 5. similar 6. uneducated 7. mild, soft |

***Ex. 6. Listening. You will hear part of a talk about the history of mathematics. Listen and choose the correct answer.***

*1. The ancient Egyptians*

a) didn’t know a lot about geometry.

b) built small structures.

c) were quite knowledgeable regarding geometrical ideas.

*2. The Chinese*

a) may have had geometrical measurement systems.

b) certainly didn’t have geometrical measurement systems.

c) had advanced measurement systems.

*3. A recovered object ancients used for measuring*

a) was probably worn on the hand. b) was found in the sea. c) may have been a kind of compass.

*4. Ancient people from India may have*

a) known a lot about astronomy. b) taught the Greeks astronomy. c) measured the seas.

*5. Most ancient civilizations used geometry*

a) in their architecture. b) in some way. c) to plan their cities.

***Unit Review***

***Ex. 1.Fill in the gaps in the table with the derivatives. Some of the gaps may remain void.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***VERB*** | ***NOUN*** | ***ADJECTIVE*** | ***NEGATIVE ADJECTIVE*** |
| 1 | learn |  |  |  |
| 2 | 1.discover  2*. \_\_\_\_\_\_\_\_\_\_\_*  *(a verb showing a repeated action)* |  |  |  |
| 3 |  |  | equal |  |
| 4 | analyze | 1.  2. |  |  |
| 5 | encourage |  |  |  |
| 6 |  | 1.architecture  2. |  |  |
| 7 |  |  | 1.civil  2. |  |
| 8 |  | prosperity |  |  |
| 9 |  | expansion |  |  |
| 10 | explore | 1.  2. |  |  |
| 11 |  | knowledge |  |  |
| 12 |  |  |  | indifferent |
| 13 |  |  | inclusive | exclusive |
| 14 | advance |  |  |  |
| 15 |  | religion |  |  |
| 16 | use |  |  |  |
| 17 | found | 1.  2. |  |  |
| 18 | apply | 1.  2.  3. |  |  |
| 19 |  | honour |  |  |
| 20 |  |  |  | unbelievable |
|  |  | 1.  2.  3.  4. | creative |  |
| 21 | refer |  |  |  |
| 22 |  | space | 1.  2. |  |
| 23 | define |  |  |  |
| 24 | deduce |  |  |  |
| 25 |  |  | stable |  |

***Ex. 2. Insert prepositions where necessary.***

1. He developed an interest … art.

2. There’s been a lot of comment lately … miscarriages in justice.

3. The total debits should be equal … the total credits.

4. Four plus six divided by two equals … five.

5. This style of music is generally referred … the 18th century.

6. Closing the plant will lead … 300 job losses.

7. `Educational toys' are designed to promote the development of, … example, children's spatial ability.

8. We began at eight o’clock and went … working till half-past one.

9. The government imposed a tax on fuels which contributed … global warming.

10. Do you think you are more knowledgeable … life than your parents were at your age?

11. It is the self-assurance of the new generation which makes them sure … their success.

12. The car's different … anything else on the market.

13. Too much protein in the diet may advance … the ageing process.

14. This is a fine book; a worthy addition … the Cambridge Encyclopedia series.

***Ex. 3. Read the following text, open the brackets supplying the appropriate form of the word and insert prepositions where necessary.***

***The Renaissance* (**[ri`neisens, rene`sa:ns], a renewal of interest … some particular kind of art, literature, etc) **-** the period in Europe from about *1400*to about *1600*, when art, literature, and ideas of the ancient world, especially ancient Greece, began to ***(study)*** again, causing … new interest and new activity in all these subjects. The Renaissance affected … most of Western Europe but it ***(connect)*** especially … Italy, and generally ***(regard)*** as beginning in Florence, where there was a revival of interest … classical antiquity. Important early figures are the writers Petrarch, Dante, Boccaccio and the painter Giotto. Music flourished, from madrigals to the polyphonic masses of Palestrina, with a wide variety of instruments such … viols and lutes. The period from the end of the 15th century has become known … the High Renaissance, when Venice and Rome began to share Florence's importance and Raphael, Leonardo da Vinci, and Michelangelo were active. Renaissance thinking spread … the rest … Europe from the early 16th century, and ***(be)*** influential for the next hundred years. The beginning of the Renaissance led … the end of the period ***(call)*** the 'Middle Ages'.

***Ex. 4. Choose one correct variant.***

*1. The demand generated by one factory required the construction of … .*

a) other b) another c) other one d) a more large factory

*2. An applied mathematician is supposed to possess … .*

a) a wide range of various knowledges c) a whole number of knowledge

b) vast knowledge in a variety of fields d) an extensive information in more than one field

*3. They will have to learn to deal with … . They are so different.*

a) one another b) each another c) one the other d) themselves

*4. He just wanted the war …, the same … everyone around.*

a) to end … as c) ending … how

b) ended … like d) be finished … as

*5. There’s … that a diet high in fibre is more … .*

a) a little doubt … satisfied c) few doubts … enjoyable

b) little doubt … satisfying d) a few doubts … enjoyed

*6. This is … !*

a) very efficient means c) very efficiently means

b) a very efficient mean d) a very efficient means

*7. They helped … the necessary sum.*

a) us to rise b) us raise c) us to be risen d) us raising

*8. Maths … me more than ….*

a) is interested … any another subject c) is interesting to … many another subjects

b) interest … some other subjects d) interests … any other subject

***Ex. 5. Choose one correct variant. Pay attention to the structures with the verb form ‘use(d)’.***

*1. We … to school and got very tired, but now we get there by bus.*

a) used to walk c) got used to walking

b) are used to walk d) are used to walking

*2. What - at night before TV was invented?*

a) were people used to do c) did people use to do

b) had people used to do d) used people do

*3. He … really shy, but he's much more confident now.*

a) was used to being c) had to get used to be

b) used to be d) got used to be

*4. My daughter was born 3 months ago but I can't … a mother yet.*

a) use to be c) get used to being

b) use to being d) have got used to be

*5. I … all day alone but I have to.*

a) used to spend c) am not used to spend

b) am not used to spending d) use to spend

*6. We never cooked this soup in my house and I … to it.*

a) am not used c) used to eat

b) haven't used d) used eating

*7. Susan has changed a lot. She … like that.*

a) used to look c) used not to look

b) got used to look d) didn't use to looking

*8. I was impatient at first, but soon … to the delays.*

a) got used b) used to c) had to using d) used

*9. He used … dinner at five o'clock.*

a) to having big b) having a big c) to have a d) to have had

*10. I … bacon and eggs every morning,*

a) am used to eat c) am used to eating

b) used to eating d) use to eat

***Ex. 6. Writing***

***Write a short essay on ‘The history of geometry’. Use these notes to help you.***

***Paragraph 1***

Introduction: one/two sentences to say what you are writing about.

Write about the long history if geometry dating back to ancient times, how much has changed since then.

***Paragraph 2:*** ancient world, contribution of the Greeks, Euclidean geometry.

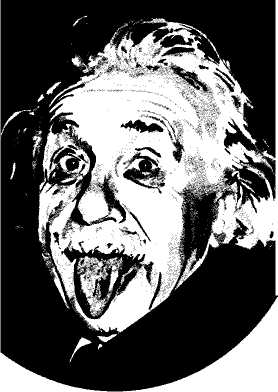
***Paragraph 3***: geometry after the Greeks - Islamic mathematicians, developments in Europe.

***Paragraph 4***: conclusion.

Write 200-250 words.

***Science Section Vocabulary and Grammar Review***

***Ex.1. Choose the correct word and insert prepositions where necessary:***

**Albert Einstein: *the greatest scientist of the 20 th century***

Not many people really deserve the title 'genius' but Albert Einstein was one of them. His discover­ies have changed the way we understand our world today. But he was also an activist for world peace and believed scientists had a duty to protect the world. Read some ***(little, a little, few)*** known facts from the life of the great scientist.

**Slow Learner**

Albert Einstein was born in Germany in 1879. He was a very ***(slowly, slow, slower)*** learner **…** first. He even had trouble learning to speak! His par­ents were really worried.

**The Compass**

Albert learned maths from his uncle, how **(to play, playing, play)** … the violin from his mother and his father gave … him his first compass. Albert, who was five years old … that time, wondered why the compass needle always swung northwards and became inter­ested … the natu­ral world.

**School**

***(Like, As, When was)*** a boy, Albert Einstein was very unhappy … school. His teachers treated him ***(badly, bad, in a badly way)*** because they thought he wasn't very clever. His marks were ***(usual bad, usually badly, usually bad)***.

**University**

In 1896 Albert went … Zurich to study … one … the best technical universities. There his abilities … mathematics and physics began to show.

**Love and Marriage**

Einstein fell … love … Mileva Marie, a Hungarian student … his uni­versity. After he graduated … 1902, Einstein took a ***(work, job)*** at the Swiss Patent Office and married … Mileva … the next year. They had chil­dren, but ***(latter, in few years, later)*** divorced. He then married … his cousin, Elsa.

**Miracle Year**

1905 is known ***(like, as)*** his 'Miracle Year', ***(as, because of, due to)*** he published … three important essays including one … the Special Theory of Relativity. Later Einstein would write the Theory of Gravity and the General Theory of Relativity. He soon would become a world-***(wide, widely, famously)*** celebrity.

**Back to Berlin**

In 1914 Einstein moved back … Berlin. It was not long before the Nazis came … power … Germany.

**Nobel Prize**

In 1921, Einstein was awarded … the Nobel Prize for Physics, and ***(modest, modestly, in a modestly way)*** traveled third class … Stockholm to receive it. He used his influence to lecture around Europe and the USA to promote world peace.

**Off to America**

***(Despite, In spite, Although)*** Albert Einstein was world-famous, he suffered a lot of abuse because he was Jewish. Eventually he had had enough, and he decided to leave Germany. In 1933 he went … America where he lived … the rest of his life.

**Einstein’s legacy**

Einstein achieved so much … his life­time. He was even asked to be the second president … Israel and ***(rose, raised, had risen)*** six ***(millions of, millions, million)*** dol­lars for anti-war efforts when he wrote one of his ***(the most famous, famousest, most famous)*** papers and sold it … auction. He died … April 18th, 1955 … New Jersey, leav­ing behind a new way … us to look … the world. Without his theories lasers, computers, space travel and many other things that are familiar today would never have developed.

***EX. 2. Here are some quotations of Albert Einstein’s sayings. Choose one you like best and write a short essay on it.***

1. Small is the number of people who see with their eyes and think with their minds.
2. Education is what remains after one has forgot­ten everything he learned at school.
3. I never think of the future - it comes soon enough.
4. Sometimes one pays most for the things one gets for nothing.
5. Nothing will end war unless the people them­selves refuse to go to war.
6. I know not with what weapons World War III will be fought, but World War IV will be fought with sticks and stones.
7. Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning.
8. Only a life lived for others is a life worthwhile.
9. There are two ways to live: you can live as if nothing is a miracle; you can live as if everything is a miracle.
10. I want to know God's thoughts; the rest are details.
11. Not everything that counts can be counted, and not everything that can be counted counts.

***REVIEW OF UNITS 4-6***

1. ***REVISE the vocabulary of units 4-6 and TRANSLATE the following sentences into English. Avoid consulting the texts when doing the translation.***

1. Является математика наукой или нет, обсуждалось в течение многих лет.

2. Линейная алгебра изучает линейные преобразования, включая матрицы.

3. Работа Лейбница в области бесконечно малых величин имеет огромное значение.

4. Эвклид, греческий математик, живший в Египте, определил базовые геометрические понятия и пять основных аксиом. Так зародилась Эвклидова геометрия.

5. Религиозные лидеры критиковали Декарта за его идеи, которые сильно отличались от традиционных для того времени идей.

6. Теория относительности – это математическое изучение случайности; она используется для предсказания результатов и анализа информации.

7. Доказательство математической истины называется теоремой.

8. Древние греки хотели найти истину о мире вокруг себя и создали дедукцию – систему логического мышления.

9. Несколько систем записи чисел было разработано в разных частях света. Примером является цивилизация инков, которые завязывали узелки для того, чтобы вести учет (запись) налогов.

10. Используя алгебру, люди могут производить вычисления неизвестных величин (количеств).

11. Хорошо известным фактом является то, что можно объединить любые две точки в прямую линию.

12. Декарт понимал значение измерения кривой и создал систему координат.

13. Преимущество неиспользования чисел – это возможность обобщения и проблемы, и её решения.

14. Говорят, что Лейбниц является человеком, который изобрел вычислительную математику.

15. Область математики, которая зародилась в арабском мире, - это алгебра.

16. В середине 15 века идеи великих греческих и исламских мыслителей распространились по всей Европе.

***B) DISCUSSION***

***Go over the texts of units 4, 5 and 6 and get ready to answer the following questions in class. They are not listed in the order of appearance in the texts. So if you happen to forget the answer to a certain question, you will have to do a certain amount of scan work at home to find it.***

1. What are the four basic fields that mathematicians study? Which of them is mostly connected with numbers?
2. What field of maths is used to describe change? What is its most significant area?
3. How did the idea of number develop? What examples of number-recording systems can you give?
4. Why is maths considered to be a genuinely international language?
5. What is a natural number?
6. What important geometrical terms did Leibniz invent? What other areas of work also use Leibniz’s calculus?
7. What is Pythagoras famous for? When did he live?
8. What are the four basic arithmetical operations?
9. What is non-Euclidean geometry and when was it developed?
10. Where did algebra originate?
11. For what contribution to maths is Leibniz best remembered? Who was Leibniz’s main rival? About what did they disagree?
12. Is maths a science or not? State the problem as it was viewed in the text and give your own arguments.
13. What is algebra? What does it study? How is it different from arithmetic?
14. What is the Number Theory used for?
15. What is the origin of the word mathematics? How is it abbreviated nowadays?
16. What is hypotenuse? Give the definition.
17. What is Euclid famous for? When did he live? What branch of maths did he lay foundations of?
18. When did the modern system of mathematical notation develop? What is the origin of letters, symbols and numbers used in modern-day maths?
19. What were Rene Descartes’ goals in philosophy? How knowledgeable was he about it? Why were his ideas criticized by religious leaders? What was the philosophical principle he proceeded from?
20. How many dimensions did Euclid use? What are they? What fourth dimension was added later? What science did its discovery bring about? Where is this science applied?
21. What field of maths helps scientists develop quantum mechanics and chemistry?
22. Where is Probability theory applied?
23. What is integer?
24. What do we call Euclidean geometry? About what did Euclid write in his *ELEMENTS*? Give examples of postulates that he formulated there.
25. What other fields besides geometry and philosophy did Rene Descartes contribute to?
26. Why does often algebra and not arithmetic need to be applied?
27. What does the word *GEOMETRY* mean? Did ancient people know geometry?
28. Where does the word *ALGEBRA* come from?
29. When did geometry start to develop as a science and not as an empirical practical set of rules?
30. Describe the time when Rene Descartes was born and worked. When was he born and where?
31. What were Rene Descartes’ goals in the field of geometry? What is Cartesian geometry and how was Cartesian coordinate system developed?
32. Into what areas is algebra classified? What do these fields study?

***UNIT 7***

***Before you read***

***Discuss these questions with your partner.***

* ***What do you know about calculus?***
* ***Can you think of a problem calculus could be used to solve?***

***A. Vocabulary***

***Complete the definitions below with words from the box.***

|  |
| --- |
| slope, embrace, diverse, sphere, rectangle, approximation, acceleration, indispensable, cube |

1. If something is a(n) …………………., it isn’t exact.

2. An increase in speed is called …………………….. .

3. If something is ………………………, you can’t manage without it.

4. If you ……………………….. an idea, you accept it.

5. A ………………….. is a three-dimensional, square shape.

6. Something which is ………………………….. is different or of many kinds.

7. If you place two squares side by side, you form a(n) ……………………….. .

8. A …………………… is a three-dimensional surface, all the points of which are the same distance from a fixed point.

9. A …………………….. is also known as a fall.

***B. Pronunciation guide.***

**Archimedes** [a:ki`mi:di:z]

**Eudoxus** [ju`doksəs]

***Reading 1***

***Calculus***

Calculus is the branch of mathematics that deals with the rates of change of quantities as well as the length, area and volume of objects. It grew out of geometry and algebra. There are two divisions of calculus - differential calculus and integral calculus. Differential calculus is the form concerned with the rate of change of quantities. This can be illustrated by slopes of curves. Integral calculus is used to study length, area and volume.

The earliest examples of a form of calculus date back to the ancient Greeks, with Eudoxus developing a mathematical method to work out area and volume. Other important contributions were made by the famous scientist and mathematician, Archimedes. In India, over the course of many years - from 500 AD to the 14th century - calculus was studied by a number of mathematicians. In fact, the first text on calculus was written in India. However, it was not until the end of the 1600s that calculus was taken up in Europe. There was much scientific activity at the time, and calculus was able to answer many questions, particularly in the field of physics. Many great mathematicians of the time embraced calculus and furthered its development, including Rene Descartes and Pierre de Fermat, but the most important contributions were made by Gottfried Leibniz and Isaac Newton. Newton was the first to use calculus in his studies of physics and Leibniz developed many of the symbols that we use in calculus.

The starting point of calculus is the idea that you can use an approximation and keep increasing the accuracy until an exact answer is found. An example of this would be to calculate the volume or area of a sphere by using shapes such as rectangles or cubes that become increasingly smaller until the exact volume or area is determined. In calculus, this final result is called a limit.

Differential calculus describes processes that are *influx —* which means they are constantly changing. Examples of this are temperature variations or the speed of a moving object. By using differential calculus, it is possible to determine the rate at which the temperature changes and the rate of acceleration of the moving body. Integral calculus begins with a known rate of change and, working backwards, finds certain values. For example, if you know the rate of acceleration of a car, you can find out its speed at a given point.

Today, both forms are used in every area of science and knowledge. Fields as diverse as engineering, medicine, business and economics make use of calculus. Calculus is such an indispensable tool that it is applied whenever we have a problem that can be solved by mathematics.

***Ex. 1. Read the text and decide if the following statements are true or false.***

1. Calculus and geometry led to the development of algebra.

2. India was using calculus before Europe.

3. In the 17th century, calculus was applied to physics.

4. Integral calculus can calculate the rate at which a population increases.

5. Differential calculus has to do with systems that are undergoing change.

***Ex. 2. Translate the following sentences paying attention to the underlined structures.***

1. The earliest examples of a form of calculus date back to the ancient Greeks, with Eudoxus developing a mathematical method to work out area and volume.
2. Calculus is such an indispensable tool that it is applied whenever we have a problem that can be solved by mathematics.

***Ex. 3. Choose one correct variant.***

1. *… important contributions*

A) others B) another C) other

1. *… mathematicians*

A) a certain amount of B) a number of C) a lot

*3. This can … slopes of curves.*

A) be illustrated by B) illustrate by C) be illustrated with

*4. a … method*

A) mathematically B) mathematic C) mathematical

*5. the … example*

A) most early B) earliest C) more early

*6. … much scientific activity at the time.*

A) It was B) There was C) There has been

*7. The substance kept … in volume.*

A) to increase B) increasing C) on to increase

*8. We’ll increase the accuracy until an exact answer … .*

A) will be found B) isn’t found C) is found

*9. Rectangles or cubes become … .*

A) increasing small B) increased and smaller C) increasingly smaller

*10. In calculus, this final result is called a … .*

A) limit B) influx C) rate

***Ex. 4. Insert prepositions where necessary (do not consult the text).***

1. Calculus grew … … geometry and algebra.
2. Calculus is the branch of mathematics that deals … the rates of change of quantities.
3. Differential calculus is the form concerned … the rate of change of quantities.
4. The earliest examples of a form of calculus date … … the ancient Greeks, with Eudoxus developing a mathematical method to work … area and volume.
5. In India, over the course of many years - … 500 AD … the 14th century - calculus was studied … mathematicians.
6. … fact, the first text … calculus was written … India.
7. Is it possible to determine the rate … which the temperature changes?
8. Integral calculus begins … a known rate of change.
9. … example, if you know the rate of acceleration of a car, you can find out its speed … a given point.
10. Fields as diverse as engineering, medicine, business and economics make use … calculus.
11. Calculus is such an indispensable tool that it is applied whenever we have a problem that can be solved … mathematics.

***Ex. 5. Match the words in the left-hand column with their synonyms in the right-hand column.***

|  |  |
| --- | --- |
| 1. slope 2. curve 3. contribution 4. further 5. embrace 6. determine 7. develop 8. approximation 9. accuracy 10. rectangle 11. increasingly 12. diverse 13. indispensable 14. tool 15. branch 16. rate | * 1. define   2. four-sided figure   3. pace, speed   4. develop, continue   5. support, accept   6. extend, increase   7. subdivision   8. rough calculation   9. necessary, obligatory   10. correctness, precision   11. hill, angle   12. gradually more   13. varied, different   14. arc, bend   15. donation, role   16. instrument, device |

***Ex.6. Listening. Listen to a teacher and students discussing some of the history of calculus. Then answer the following questions.***

1. What was the original meaning of the word *calculus*?

2. Who named the branch of mathematics known as *calculus*?

3. Why did Newton name it *the science of fluxions*?

4. What did Newton accuse Leibnitz of doing?

5. Leibnitz and Newton had different starting points in their work on calculus – what were they?

***Reading 2***

***Before you read***

***Discuss these questions with your partner.***

* ***Who do you think were the greatest mathematicians in history?***
* ***Which kinds of mathematics were they involved in?***
* ***What do you know about Pierre de Fermat?***

***A. Vocabulary***

***Match these words with their definitions.***

|  |  |
| --- | --- |
| 1. devotion 2. astounding 3. councilor 4. fellow 5. neglect 6. chief magistrate | 1. don’t pay attention to 2. somebody working in the same field 3. top judge 4. amazing 5. commitment 6. member of an administrative body |

***B. Complete the sentences below with words from the box.***

|  |
| --- |
| devotion, fellow, councilor, astounding, neglect |

1. She shows great ……………………… to her family.

2. Please don’t ……………………….. to pay the phone bill.

3. Meet Peter. He is a(n) ……………………… film enthusiast.

4. What a(n) …………………………… speech he gave at the conference. It was amazing!

5. He’s been a town ………………………. for over five years now.

***C. Match the words to make phrases.***

|  |  |
| --- | --- |
| 1. practice  2. criminal  3. remarkable  4. number  5. probability  6. Cartesian  7. analytic  8. receive | A theory  B coordinates  C law  D geometry  E achievements  F court  G recognition  H theory |

***D. Pronunciation guide.***

**Orleans** [o:`li ənz]

**Toulouse** [tu:`lu:z]

***Pierre de Fermat***

Pierre de Fermat was born in Toulouse, France on 17th August, 1601, and died on 12th January, 1665. He came from a wealthy family, and he studied law in Orleans. After graduating, he began to practise law and later he became a councilor in parliament. By 1652, he had become the chief magistrate of the criminal court - a very important and highly respected position.

In 17th century France, magistrates spent large amounts of time on their own. It was during this time that de Fermat worked in the field of mathematics. In fact, his devotion to this science was so great that he spent as much free time as he could working on mathematical problems and solutions. Although de Fermat published very little in his lifetime, he is still considered to be one of the greatest mathematicians of all time. His achievements in mathematics are quite astounding. De Fermat's most important work was done in the development of modern number theory, which was one of his favourite areas of mathematics, and which had an important impact on the study of calculus. Sir Isaac Newton said that his own invention of calculus - differential calculus in particular - was based in large part on the work of de Fermat, who had done his studies on calculus well before Isaac Newton and Gottfried Leibniz were born. In 1654, Blaise Pascal wrote a letter to de Fermat asking about the latter's views on probability. Thus began a correspondence that became the foundation of Probability Theory, with de Fermat and Pascal considered to be the founders of this theory. Rene Descartes is famous for his invention of Cartesian coordinates and his important work *La Geometrie.* De Fermat had independently come up with his own three-dimensional analytic geometry, which was more complicated and advanced than Descartes'; Descartes' work became more popular, however, because its notation was more convenient. Today, both scientists are seen as the fathers of analytic geometry.

De Fermat also made contributions in the field of optics, formulating a law on the way light travels. His methods were so advanced that many of his results were not proved for a century after his death, and de Fermat's Last Theorem took more than three hundred years to prove. De Fermat rarely provided his proofs, that is, evidence or procedures for reaching conclusions, to explain how he got his answers. In his letters to fellow mathematicians, he stated theorems but neglected the proofs, which was very annoying for them. Since he never wanted anything to be published (as he considered mathematics to be his hobby), there was nowhere for scholars to check his claims and consequently during his lifetime, he received very little recognition as a mathematician. If the people he wrote to had not saved his papers and letters, we may never have heard of de Fermat and his remarkable achievements.

***Ex. 1. Read the text and choose the correct answer.***

*1. Despite having little of his work published while alive, de Fermat*

a) had a successful career in law.

b) is seen as a great mathematician.

c) held an important position.

*2. De Fermat’s work on modern numbers*

a) was influenced by Newton’s work.

b) helped him develop a branch of calculus.

c) had an effect on calculus.

*3. Pascal and de Fermat*

a) are recognized as the fathers of Probability Theory.

b) communicated about analytical geometry.

c) produced work more advanced than Descartes’.

*4. De Fermat’s methods and results*

a) were never proven in his lifetime.

b) were ahead of their time.

c) suffered as he never provided proof.

*5. We know about de Fermat’s work nowadays because*

a) his work was published.

b) learned people researched his claims.

c) he left behind a correspondence.

***Ex. 2.Translate the following sentences paying attention to the underlined structures.***

1. He is still considered to be one of the greatest mathematicians of all time.
2. Thus began a correspondence that became the foundation of Probability Theory, with de Fermat and Pascal considered to be the founders of this theory.
3. If the people he wrote to had not saved his papers and letters, we may never have heard of de Fermat and his remarkable achievements.
4. He considered mathematics to be his hobby.
5. De Fermat published little in his lifetime.
6. It was during this time that de Fermat worked in the field of mathematics.

***Ex. 3. Insert prepositions where necessary (avoid consulting the text).***

1. He came … a wealthy family.
2. … fact, his devotion … this science was great.
3. Magistrates spent large amounts of time … their own.
4. Modern number theory had an important impact … the study of calculus.
5. Sir Isaac Newton’s own invention of calculus - differential calculus … particular - was based … large part … the work of de Fermat.
6. … 1654, Blaise Pascal wrote a letter … de Fermat asking … the latter's views … probability.
7. Rene Descartes is famous … his invention of Cartesian coordinates.
8. De Fermat had independently come … … his own three-dimensional analytic geometry.

***Ex. 4. Match the words in the left-hand column with their synonyms in the right-hand column.***

|  |  |
| --- | --- |
| 1. complicated 2. advanced 3. convenient 4. rarely 5. evidence 6. procedure 7. neglect 8. fellow 9. solution 10. dimension 11. probability 12. astounding 13. achievement 14. foundation 15. correspondence | 1. process, course of action 2. associate, colleague 3. accomplishment, triumph 4. hardly ever, seldom 5. communication (by mail) 6. complex, sophisticated 7. suitable, handy 8. amazing, astonishing 9. basis 10. way out, result 11. measurement 12. ignore, overlook 13. likelihood, chance 14. highly developed 15. proof |

***Ex. 5. Listening. Listen to a teacher talking to a class about Fermat’s Last Theorem. Then complete the sentences below.***

1. Fermat’s Last Theorem was the world’s most puzzling ………………………. problem.

2. Fermat left no ……………………………. of the proof he had found.

3. Fermat claimed there was no solution for any equation beyond the ……………………….. .

4. Proof is a line of reasoning that consists of many ………………….. .

5. Andrew Wiles published a proof to the Last Theorem in ………………………. .

***Ex. 6. Choose the correct variant.***

*1. He studied … Orleans.*

A) the law in the B) law in C) the law in

*2. It was a very important and … position.*

A) highly B) very respecting C) highly respected

*3. He spent a lot of time … various mathematical problems.*

A) on working at B) working on C) for working on

*4. His achievements in mathematics are quite … .*

A) astounding B) astounded C) amazed

*5. … in the development of modern number theory.*

A) De Fermat's most important work was done

B) The most important De Fermat's work was done

C) De Fermat's most important work was made

*6. De Fermat … his studies on calculus well before Isaac Newton and Gottfried Leibniz were born.*

A) had done B) has done C) had made D) has made

*7. His methods were … advanced that many of his results were not proved for a century after his death.*

A) so B) such C) as

*8. He … the same conclusions.*

A) reached at B) arrived to C) reached

*9. In his letters to fellow mathematicians, he stated theorems but neglected the proofs, which was very …*

*for them.*

A) annoyed B) irritable C) annoying

*10. He never wanted anything … .*

A) being published B) to publish C) to be published

***UNIT REVIEW***

***Ex. 1. Discuss these questions with your partner.***

* Is calculus only useful in mathematics and sciences such as physics?
* How can calculus be used in other branches of knowledge?

***Ex. 2. Prepare a short presentation to answer the question: ‘What is calculus?’***

***Ex. 3. Write an essay on the topic: ‘The greatest mathematical puzzle of them all’.***

***Science Section Vocabulary and Grammar Review***

***Ex.1 Complete the passage using the words in brackets in the appropriate form or adding prepositions to fill in the gaps.***

***The Chocolate Revolution***

After ***(achieving, reaching, arriving to)*** Europe with Columbus in 1502, chocolate ***(rapid, rapidly)*** became popular ***(like, as)*** a drink that people took to improve ***(their, theirs)*** health. Eating solid chocolate, however, was unpopular; it was ***(dark and bitter, dark and bitterly),*** and manufacturers did not know how to mix it with milk or cream to make it ***(taste, to taste)*** better. The discovery of milk chocolate was made in 1876 … Daniel Peter in Switzerland. After trying ***(unsuccessfully, unsuccessful)*** for eight years to mix milk and dark chocolate, Peter began working with his neighbour, the chemist Henri Nestle. Nestle ***(has, had)*** developed a new product to ***(fed, feed)*** babies; in the process, he ***(has, had)*** discovered how to make ***(condensing, condensed)*** milk, which Peter tried instead of using ordinary milk. The result ***(had, was)*** an ***(instant, instantly)*** success, and the two men joined forces to manufacture milk chocolate for a ***(grateful, gratefully, ungratefully)*** world.

***UNIT 8***

***Before you read***

***Discuss these questions with your partner.***

* ***In what fields do you think mathematics is useful?***
* ***How many kinds of mathematics can you think of?***

***A. Vocabulary***

***Match these words with their definitions.***

|  |  |
| --- | --- |
| 1. enable 2. arise 3. refine 4. exclude 5. simplify 6. adjustments 7. comprehensible | 1. to make something easier to do or understand 2. to make better 3. to allow 4. to occur 5. to leave out 6. understandable 7. small changes |

***B. Match these words to make phrases.***

|  |  |
| --- | --- |
| 1. applied 2. branch 3. mathematical 4. final 5. second 6. knowledgeable 7. real 8. major 9. mathematical 10. wide | 1. of mathematics 2. developments 3. variety 4. mathematics 5. terms 6. model 7. solution 8. stage 9. life 10. mathematician |

***Reading 1***

***Applied mathematics***

Most of the major developments in mathematics were the result of trying to solve a particular problem. When faced with a problem, people would ask themselves 'How can we do this?' 'What's the best way of doing that?' Thus, mathematics arose. Today, we have many different branches of mathematics, all of which can be used to answer questions like the ones above.

When mathematics is used to solve problems in other related areas of life, it is known as applied mathematics. Mathematics is *applied,* that is, used, to provide us with answers and solutions. It is used in numerous ways. A few examples are numerical analysis, engineering and programming. In these and other areas, applied mathematics takes problems from real life, and gives us successful and creative tools for solving them. Often, the first step when using applied mathematics is to create a mathematical model. This is a description of the problem in mathematical terms. This model is then studied to obtain exact or approximate solutions. If the solution is exact, the model is applied to the problem; if it is approximate, the model is refined until it is exact. Then, the conclusions are interpreted and explained in comprehensible terms. Often the model is changed to be more realistic or to include more features of the problem. Thus, the modelling process may involve many adjustments. The second stage is the final solution to the problems mathematically formulated in the first stage. Mathematics is used or *applied* to other fields to solve problems in these fields.

It is often not clear which mathematical tools will be useful in the study of a new problem, for example, algebra or differential calculus. For this reason, applied mathematicians need to be well trained in a range of mathematical areas so they will have a wide variety of mathematical tools available to them. They must not only be skilled mathematicians but must also be knowledgeable in the specific area to which mathematics is being applied. For example, in dealing with business and industry, a knowledge of economics is necessary. In this way, a good applied mathematician can then create and interpret appropriate models. A good applied mathematician must therefore be knowledgeable in both mathematics and the field of application in order to successfully deal with a problem.

When it comes to creating models, the mathematician will make choices about which factors to include and which to exclude. The goal is to produce a model that is realistic enough to reflect the main aspects of the problem being studied, but simple enough to be treated mathematically.

Sometimes the mathematician has to either simplify this model so it can be analysed, or devise new mathematical methods that will allow the model to be analysed. The modelling process may involve a sequence of models of increasing complexity. Problems sometimes lead to new mathematical methods, and existing mathematical methods often lead to a new understanding of the problems.

Mathematics in its most useful, practical form becomes a tool with which we can improve our world. That is exactly what applied mathematics is and what it does.

***Ex. 1.Read the text. Then put the events (A-F) below in the correct order, from first to last, to show the***

***procedure for using applied mathematics.***

|  |  |
| --- | --- |
| EVENT 1 ………………………………  EVENT 2 ………………………………  EVENT 3 ………………………………  EVENT 4 ………………………………  EVENT 5 ………………………………  EVENT 6 ……………………………… | A The revised model is applied.  B The model is adjusted.  C A mathematical model is created.  D A problem arises.  E A solution is found.  F Approximate solutions are obtained. |

***Ex. 2. Complete the table. Some boxes may remain void.***

|  |  |  |  |
| --- | --- | --- | --- |
| ***verb*** | ***noun*** | ***adjective*** | ***adverb*** |
| 1. approximate |  |  |  |
| 2. number | 1  2  3 | 1  2  3 |  |
| 3. create | 1  2  3  4 |  |  |
| 4. apply | 1  2 | 1  2 |  |
| 5. comprehend |  | 1  2 | 1  2 |
| 6. | 1  2 | 1 real  2 | 1  2 |
| 7. describe |  |  |  |
| 8. vary | 1  2 | 1  2  3 |  |
| 9. know |  |  |  |
| 10. succeed | 1  2 | 1  2 |  |
| 11. choose |  |  |  |
| 12. analyze |  |  |  |
| 13. |  | simple |  |
| 14. exist |  |  |  |

***Ex. 3. Match the words in the left-hand column with their synonyms in the right-hand column***

|  |  |
| --- | --- |
| 1. arise 2. refine 3. interpret 4. comprehensible 5. applied 6. adjustment 7. formulate 8. range 9. feature 10. simplify 11. sequence 12. related | * 1. practical, functional   2. make easier or more straightforward   3. succession, series   4. improve   5. understand and rephrase   6. concerned, involved   7. modification, fine-tuning   8. understandable   9. word   10. variety   11. characteristic, trait   12. occur |

***Ex. 4. Match the words in the left-hand column with their antonyms in the right-hand column.***

|  |  |
| --- | --- |
| 1. approximate 2. simplicity 3. knowledgeable 4. different 5. specific 6. comprehensible 7. indispensable 8. final | * 1. ignorant, uneducated   2. initial   3. general   4. similar   5. exact   6. complexity   7. unclear   8. unnecessary |

***Ex. 5.Add negative affixes to the following words and translate them.***

Realistic, skilled, understanding, useful, different, exact, interpret, helpful, comprehensible, clear, certain, reasonable, appropriate, necessary, practical, lead, available, use, real, sensible.

***un- in- mis- -less***

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

***Ex. 6. Listening. Listen to a course director giving some information to a group of potential maths students. Then decide whether the following statements are true or false.***

1. Mathematics is an expanding area with good job prospects.

2. The difference between pure and applied mathematics lies in the content of the studies.

3. An applied mathematician finds answers to questions raised by mathematics.

4. A pure mathematician’s answers take the form of general propositions with exact, formal proof.

5. The two kinds of mathematics can come to the same conclusions.

***Reading 2***

***Before you read***

***Discuss these questions with your partner.***

* ***Do you think a scientist should have an all-round education?***
* ***What benefits could scientists derive from involvement in other fields apart from science?***

***A. Vocabulary***

***Complete the definitions below with words from the box.***

|  |  |
| --- | --- |
| * cybernetics * insight * draw on * via * imitate | * collaborative * tend * elect * established * aspect |

1. A feature or a side of something is a(n) …………………………… .

2. To ……………………. means to copy.

3. The field of ………………………… studies people and machines’ practices and procedures to understand where they differ.

4. If work is …………………… , it is done by cooperating.

5. …………………………… means by the use of.

6. If you have ………………………… into something, you have special understanding.

7. To ………………………… means to choose, perhaps for a position of responsibility.

8. If you …………………….. something, you make use of a resource.

9. When you …………………………. to do something, it is a habit you have.

10.If something is ……………………….., it is made certain.

***Reading 2***

***Norbert Wiener***

Norbert Wiener, the famous applied mathematician, was born in 1894 in the USA and died in Stockholm, Sweden, in 1964. His father was a professor of Slavonic languages at Harvard. Norbert was a very intelligent child and his father was determined to make him a famous scholar. This is indeed what he became, being awarded a PhD by Harvard at the age of 18. He also studied Philosophy, Logic and Mathematics at Cambridge and Gottingen.

His first important position was that of Instructor of Mathematics at MIT (Massachusetts Institute of Technology) in 1919, followed by that of Assistant Professor in 1929 and of Professor in 1931. Two years later, in 1933, he was elected to the National Academy of Sciences (USA), from which he resigned in 1941. In 1940 he started to work on a research project at MIT on anti-aircraft devices, a project which played an important part in his development of the science of cybernetics.

The idea of cybernetics came to Wiener when he began to consider the ways in which machines and human minds work. This led to the development of the idea of cybernetics, which is the study of the ways humans and machines process information, in order to understand their differences. It often refers to machines that imitate human behaviour. The term was coined from the Greek *kubernetike* which means *the art of the steersman* (the skill of a captain when controlling the ship). This idea made it possible to turn early computers into machines that imitate human ways of thinking, particularly in terms of control (via negative feedback) and communication (via the transmission of information).

Norbert Wiener was also deeply attracted to mathematical physics. This interest originated in the collaborative work that he did with Max Born in 1926 on quantum mechanics. But Wiener's interests were not limited to logic, mathematics, cybernetics or mathematical physics alone, as he was also familiar with every aspect of philosophy. In fact, he was awarded his doctorate for a study on mathematical logic that was based on his studies in philosophy. In addition to that, in a very different field, he wrote two short stories and a novel. Wiener also published an autobiography in two parts: *Ex-Prodigy: My Childhood and Youth* and *I Am a Mathematician.*

Norbert Wiener was an amazing mathematician, who was gifted with philosophical insight. In an age when scientists tended, and still tend, to specialise in their own very specific fields, this man was interested and involved in many different disciplines. Due to this, he was able to draw on many resources in his varied research, thus making him an incredibly successful *applied* scientist. Wiener was one of the most original and significant contemporary scientists and his reputation was securely established in the new sciences such as cybernetics, theory of information and biophysics.

***Ex. 1. Read the text and choose the correct answer.***

*1. Norbert Wiener’s father*

a) was awarded a PhD. b) taught intelligent children. c) was a language instructor.

*2. Norbert Wiener began to think seriously about cybernetics*

a) when he was at MIT. b) when he was a science instructor. c) after he resigned.

*3. An example of cybernetics in action would be*

a) a television b) a computer c) a ship

*4. Norbert Wiener wrote a book about*

a) himself b) childhood c) philosophy

*5. According to the text most scientists*

a) know a lot about many different subjects.

b) are familiar with applied science.

c) deal with certain fields only.

***Ex. 2. Pronounce correctly.***

Slavonic, scholar, technology, philosophy - philosophical, philology, logic, cybernetics, resign-resignation, to process – process, prodigy, autobiography, insight, disciplines, significant, contemporary, biophysics, collaborative.

***Ex. 3. Match the words in the left-hand column with their synonyms in the right-hand column.***

|  |  |
| --- | --- |
| 1. intelligent 2. determined 3. famous 4. scholar 5. resign 6. award 7. imitate 8. via 9. feedback 10. originate 11. collaboration 12. insight 13. amazing 14. contemporary | * 1. intuition, awareness   2. decorate   3. reaction, response   4. gifted, intellectual   5. go, date back to   6. resolute, firm   7. celebrated   8. researcher   9. current, existing   10. copy, replicate   11. astonishing   12. by means of   13. teamwork, group effort   14. quit |

***Ex. 4.*** ***Match the words in the left-hand column with their antonyms in the right-hand column.***

|  |  |
| --- | --- |
| 1. determined 2. significant 3. contemporary 4. possible 5. familiar with 6. gifted 7. addition 8. logical 9. deeply | 1. hardly probable 2. superficially 3. unaware 4. unreasonable, irrational 5. minor, unimportant 6. dated, nonexistent 7. undecided 8. subtraction 9. incapable, unskilled |

***Ex.5. Listening. Listen to a teacher talking about a famous mathematician. Then listen again and correct the statements if they are wrong.***

1. Norbert Wiener enjoyed the fine arts.

2. Norbert Wiener was only ever taught at home.

3. Norbert Wiener got his undergraduate degree at the age of 18.

4. Norbert Wiener’s working life was 50 years long.

5. Only a few cyber terms have been coined.

***UNIT REVIEW***

***Ex. 1. Choose one correct variant.***

*1. We … a problem.*

a) were faced b) were facing with c) faced d) faced with

*2. Most … major developments in mathematics resulted … trying to solve a particular problem.*

a) of the … in b) in the … from c) - … to d) of the … from

*3. Mathematics in … useful, practical form becomes a tool with which we can improve our world.*

a) it’s the most b) it’s most c) its most d) her most

*4. When it comes to … , the mathematician will have to make choices.*

a) creation models b) a creation of the models c) create models d) creating models

***Ex. 2.Translate the following sentences paying attention to the underlined structures.***

1. When faced with a problem, people would ask themselves 'How can we do this?' '
2. The goal is to produce a model that is realistic enough to reflect the main aspects of the problem being studied, but simple enough to be treated mathematically.
3. That is exactly what applied mathematics is and what it does.
4. This is indeed what he became, being awarded a PhD by Harvard at the age of 18.
5. His first important position was that of Instructor of Mathematics.
6. This idea made it possible to turn early computers into machines that imitate human ways of thinking.

***Ex. 3. Insert prepositions where necessary (avoid consulting the texts).***

1. Mathematics is used or *applied* … other fields to solve problems … these fields.

2. … this reason, applied mathematicians need to be well trained … a range of mathematical areas.

3. Today, we have many different branches … mathematics, all of which can be used to answer questions … the ones above.

4. The second stage is the final solution … the problems mathematically formulated in the first stage.

5. Thus, they will have a wide variety … mathematical tools available … them.

6. A good applied mathematician must therefore be knowledgeable … both mathematics … the field of application in order to successfully deal … a problem.

7 When it comes … creating models, the mathematician will make choices about which factors to include and which to exclude.

8. … the age of 10 years old he was already a Doctor of Philology.

9. This project played an important part … his development … the science of cybernetics.

10. The idea … cybernetics came … Wiener when he began to consider … the ways … which machines and human minds work.

11. This led … the development … the idea of cybernetics.

12. It often refers … machines that imitate …human behaviour.

13. … addition … that, in a very different field, he wrote two short stories and a novel.

14. His work … mathematical logic was based … his studies in philosophy.

15. Wiener's interests were not limited … logic or cybernetics alone, as he was also familiar … every aspect … philosophy.

16. This interest originated … the collaborative work that he did with Max Born in 1926 … quantum mechanics.

17. Norbert Wiener was also deeply attracted … mathematical physics.

18. Due … such a wide range of his interests he was able to draw … many resources in his varied research, which made him an incredibly successful *applied* scientist.

***Ex. 4. Translate into English using the words in brackets.***

1. Когда мы сталкиваемся с проблемой, мы спрашиваем себя, как ее решить (face, solve a problem).

2. Если модель точная, она применяется к проблеме. Если она приблизительная, то ее усовершенствуют, пока она не становится точной, тогда применяют (exact, approximate, apply).

3. Часто модель меняют, чтобы она стала более реалистичной (change).

4. По этой причине математик должен хорошо разбираться в обеих этих областях – как в экономике, так и в математике (be knowledgeable).

5. Знания экономики необходимы, когда приходится иметь дело с проблемами в области предпринимательства и промышленности (indispensable, deal with).

6. Идея создания кибернетики как науки пришла к Винеру, когда он стал задумываться над тем, как работает машина и человеческий мозг (begin to consider, the way how).

7. В возрасте 18 лет он получил диплом филолога в Гарварде, а затем учил математику, логику и философию в Оксфорде (to be awarded PhD, study).

8. Кибернетика – это наука о том, как мозг и машина обрабатывает информацию (process).

9. Греческое слово «кибернетика» означает «искусство штурмана» (steerman).

***Ex.5. Make a dialogue or a short monologue to discuss one of the following topics. Use the vocabulary of the unit.***

1. Advantages computers offer (work, entertainment, everyday life).

2. Disadvantages of having/using a computer.

3. When you think of a scientist, what image comes to your mind? Would you agree that scientists are special people? In what way are they different?

4. Speak about a scientist you admire. Account for your choice. Also speak about his\her achievements.

***Science Section Vocabulary and Grammar Review***

***Complete the passage using the words in brackets in the appropriate form or adding prepositions to fill in the gaps.***

In the 1830s the use of opium was becoming more and more widespread in China. The British East India Company, ***(what, which, who)*** grew opium in India, regularly sailed to Canton to sell the drug. The Chinese authorities, who were concerned … the ***(grown, growing) (amount, number)*** of addicts, wanted to stop the opium trade.

In 1839 Lin Tse-hsu ***(appointed, was appointed, has been appointed)*** Imperial Commissioner at Canton,which was at the centre of the opium trade. One of his first ***(act, acts) (were, was)*** to seize and destroy thousands … chests of opium ***(belonged, belonging)*** … the East India Company and other British traders. The traders, who had powerful allies in London, persuaded the British government ***(go, going, to go)*** to war to protect 'free trade'. ***(Heavy, Heavily)*** armed warships ***(were been sent, were send, were sent)*** … Canton and ***(the, - )*** Chinese, ***(whose, which, who’s)*** weapons were all old and outdated, stood almost no chance. The First Opium War,which ended in 1842, resulted ***(in, from)*** the complete defeat of China. Under the Treaty of Nanking, which was signed … the following year, ***(- , the)*** Chinese agreed to pay a large fine, to give Hong Kong to ***(- , the)*** British and to open up five more ports for trade. The Second Opium War, which broke out in 1856, ended with a second defeat for China. This time ***(-, the)*** British, who ***(was, were, have been)*** assisted … ( -, the) French, gained control of more Chinese ports. Under the terms of the Treaty of Tientsin, which ***(has been, was)*** signed in 1858, the opium trade became ***(complete legally, completely legally, completely legal)***, with disastrous consequences for the Chinese society for the rest of the century.

***REVIEW OF UNITS 7-8***

***A) Complete the sentences with prepositions where necessary.***

1. Pierre de Fermat came …1…. a wealthy family and was a person greatly devoted …2… science. …3… fact, when he became the chief magistrate, he was no longer faced …4… the problem of free time. He had a chance to spend a lot of time …5… his own.

2. Euclid, a Greek mathematician, used a set of axioms, one of which was: all right angles are equal …6… one another. Another of his axioms is referred …7… …8… the parallel postulate. The type of geometry based …9… Euclid’s ideas are known today …10… Euclidean geometry. Since then mathematicians have added a fourth dimension, time, …11… Euclid's three. Omar Khayyam's comments …12… problems in Euclid's work eventually led …13… the development of non-Euclidean geometry.

3. Rene Descartes was knowledgeable …14… the work of Plato and Aristotle. He made attempts to find solutions …15… some philosophical problems describing them …16… mathematical terms. Proceeding from the principle that the only thing he could be sure …17… was that he himself existed, he reached …18… his own conclusions about God and the world. …19…addition to his work in philosophy and geometry, Descartes contributed …20… algebra, optics, physiology and psychology.

***B) Complete the text with the words and word combinations from below.***

As it often happens in the world of science, … 1 … about genuineness of a scientist’s authorship and possible … 2 … … 3 … in heated arguments. For example, some mathematicians and historians have wrongfully … 4 … that Lobachevsky in his studies in … 5 … was … 6 … by Gauss, which is untrue. Gauss himself … 7 … on Lobachevsky's published works and … 8 … that the … 9… to be the first to clearly … 10 … and publish certain ideas rightfully belongs to Lobachevsky, and that they had never had personal … 11 … between them prior to the publication. … 12 … three people can be credited with the … 13 … of hyperbolic geometry - Gauss, Lobachevsky and Bolyai.

Lobachevsky's main … 14 … is the development (… 15 … of [János Bolyai](http://en.wikipedia.org/wiki/J%C3%A1nos_Bolyai)) of a [non-Euclidean geometry](http://en.wikipedia.org/wiki/Non-Euclidean_geometry), also …16 … to as hyperbolic, or Lobachevskian geometry. Before him, mathematicians were trying to … 17 … [Euclid](http://en.wikipedia.org/wiki/Euclid)'s [fifth postulate](http://en.wikipedia.org/wiki/Fifth_postulate) from other … 18 …. Another of Lobachevsky's achievements was developing a method for the … 19 … of the [roots](http://en.wikipedia.org/wiki/Root_of_a_function) of [algebraic … 20 …](http://en.wikipedia.org/wiki/Algebraic_equation).

|  |  |  |  |
| --- | --- | --- | --- |
| * claimed * equations * recognized * plagiarism * independently * influenced | * result * formulate * [axioms](http://en.wikipedia.org/wiki/Axiom) * correspondence * [approximation](http://en.wikipedia.org/wiki/Approximation) * deduce | * in fact * non-Euclidean geometry * referred * achievement * disagreements | * distinction * commented * discovery |

***C) TRANSLATE the following sentences into English. Avoid consulting the texts when doing the translation.***

1. Вычислительная математика оказалась незаменимым научным и прикладным инструментом в медицине, машиностроении (инженерном деле), экономике и предпринимательстве.
2. В 40-х годах Винер занимался вопросами, связанными с противосамолетными устройствами, что сыграло важную роль в развитии кибернетики.
3. Математическая модель должна быть достаточно реалистичной, чтобы отражать основные аспекты изучаемой проблемы, и, вместе с тем, достаточно простой, чтобы можно было подойти к ее решению математически.
4. Ферма сформулировал закон о движении света, тем самым сделав важный вклад в область оптики.
5. Одним из наиболее выдающихся достижений было создание такой области, как прикладная математика, которая дает нам ответы на многие вопросы и обеспечивает решением (является источником для решения) многих задач.
6. Работы Винера связаны в основном с проблемами в области логики и математики, философии и кибернетики.
7. Можно использовать дифференциальные вычисления для того, чтобы посчитать температурные изменения и скорость движения тела.
8. Чтобы успешно справляться с такими задачами, прикладной математик должен иметь математическое образование, а также быть осведомленным (знающим) и в области применения своих математических знаний.
9. В результате того, что Винер имел широкий круг научных интересов в разных дисциплинах, он имел возможность воспользоваться многими ресурсами в своих исследованиях, что сделало его очень успешным прикладным математиком.
10. Ферма независимо от других ученых предложил идею трехмерной аналитической геометрии, системы, которая была более сложной, чем система Картезианских координат Декарта.
11. Кибернетика – это наука о том, как живые организмы и машины обрабатывают информацию.

***D) DISCUSSION***

***Go over the texts of units 7 and 8 and get ready to answer the following questions in class. They are not listed in the order of appearance in the texts. So if you happen to forget the answer to any of the questions, you will have to do a certain amount of scan work at home to find it.***

1. Owing to what did most of the major developments in maths occur?
2. What other fields (besides applied maths) was Norbert Wiener involved in? Speak about his major scientific interests and any other interests beyond sciences.
3. What did Isaac Newton say about Pierre de Fermat’s contribution to maths?
4. Did Pierre de Fermat publish a lot in his lifetime? How do we get to know about his work and the discoveries he made?
5. Enumerate the steps that can be distinguished in the process of application of mathematical methods to a particular task (modeling).
6. What can you say about Pierre de Fermat’s theorems? Did he supply ample proof to the hypotheses he came up with?
7. What are the earliest examples of (applying) calculus?
8. What processes does differential calculus describe? Give examples.
9. In what fields is calculus applied?
10. What do you know about Pierre de Fermat? When was he born? What do you know about his family background and education?
11. What enabled Pierre de Fermat to work intensively in the field of maths although he occupied a very important and highly respected position?
12. In what field did Pierre de Fermat do work that is considered nowadays to be the most important?
13. How did the idea of cybernetics come to Norbert Wiener? What is cybernetics? What is the origin of the term itself?
14. Who is considered to be the founders of the Probability Theory? How did this collaboration begin?
15. What is Pierre de Fermat’s contribution to geometry? Compare it with that of Descartes’.
16. In what other fields (besides maths) did Pierre de Fermat work?
17. What idea is the starting point of calculus? What is the final result called in calculus?
18. What do we learn from the text about Norbert Wiener’s career? Which part of his professional career had the greatest impact on his career as a scientist?
19. When was calculus taken up in Europe? What names of scientists is it associated with?
20. What is the definition of applied maths? What are the examples of practical application of maths?
21. What does the modeling process require from a mathematician?
22. What do you know about Norbert Wiener, his family background and education?
23. What does calculus deal with? What field of maths did it grow out of? What are the two divisions of it? What are they concerned with?
24. Why should a mathematician working in the field of application of maths be trained in a whole range of mathematical areas and also be knowledgeable in certain other fields?
25. Did Pierre de Fermat receive any recognition during his lifetime?
26. How is integral calculus applied?