МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЖИТОМИРСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ ІМЕНІ ІВАНА ФРАНКА

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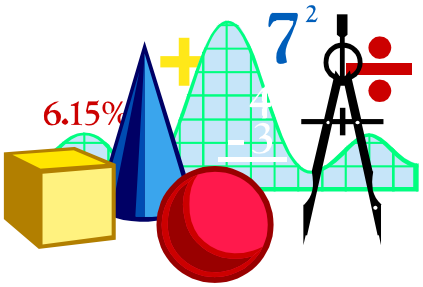
MATHEMATICS

Практикум з англійської мови для студентів фізико-математичного факультету спеціальностей: «Інформатика», «Математика та інформатика», «Фізика та інформатика»



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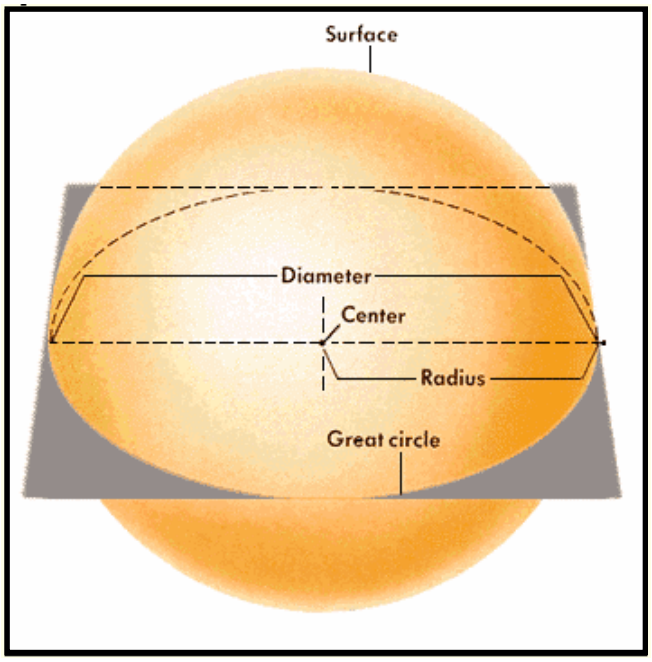
Практикум складається з 10 розділів, 2 розділів для самостійного опрацювання, текстів для додаткового читання та додатків. Тексти підібрані з оригінальної науково-технічної літератури та містять необхідну термінологію зі спеціальності. Кожен розділ включає текст, лексичний мінімум, систему прав лексико-граматичного характеру. Вправи та тести побудовано на мовному матеріалі, який використовується в текстах розділів. Додається підсумковий тест для перевірки знань всього курсу та глосарій.

Зміст

$$\frac{f(10) - f(2)}{10 - 2} = \frac{672}{8} = 84$$

$$\frac{5b^2c + 2d}{15b^2c + 6bd^2}$$

$$\int_a^b f(x)dx$$



$$\lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

$$\frac{5b^2c + 2d}{15b^2c + 6bd^2}$$

Introduction

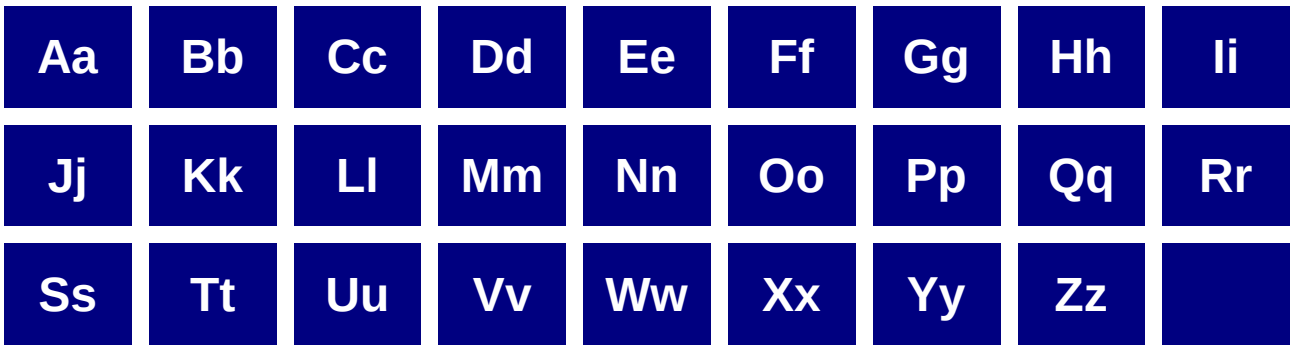
Вступ

Сучасне суспільство висуває нові вимоги до професійної підготовки фахівця. Автори посібника намагались надати підібраному матеріалу не тільки інформативну, але й професійну спрямованість. Посібник-практикум складений відповідно до вимог Програми з англійської мови для університетів (5-річний курс навчання): Проект. (Київ, 2001р.) та рекомендацій Ради Європи щодо вивчення іноземних мов.

Основна мета посібника – послідовно провести студентів по розділам спеціальної лексики та граматики, на сучасних, професійно-спрямованих текстах ввести інформацію з вивчення математики та сформувати навички роботи з літературою по спеціальності під час перекладу на українську мову.

Практикум складається з десяти розділів, двох розділів для самостійного опрацювання та текстів для додаткового читання. Тексти підібрані з оригінальної науково-технічної літератури та містять необхідну термінологію за спеціальністю. Кожний розділ включає набір лексико-граматичних та комунікативних вправ. Вправи та тести побудовано на мовному матеріалі, який використовується в текстах розділів. Підсумковий тест може бути використаний як для самоконтролю, так і для контрольної роботи. Спеціальна термінологія представлена в глосарії.

Практикум призначений для студентів неспеціальних факультетів денної, заочної та дистанційної форми навчання, які вивчають математику, а також для всіх тих, хто бажає поглибити свої знання з англійської мови.



Unit One

Task 1. Discuss the following questions:

- You are a student of the Department of Physics and Mathematics. Why did you choose this department? Give your motives.
- Do you like mathematics? Was it your favorite subject at school?
- Are you good at mathematics now?
- Do you consider mathematics to be important? Give your reasons.
- Can you give us the names of some famous mathematicians?

Task 2. Read the phonetic transcription. Practise your pronunciation:

[ˌmæθɪ'mætɪks] [ˌmæθɪ'mætɪkəl] [ˌmæθɪmətɪʃən] ['saɪəns] ['saɪəntɪst] ['kwɔntɪtɪ] ['fɔ:mjulə] ['fɪgə] [ə'plaɪd,mæθɪ'mætɪks] [pjuə,mæθɪ'mætɪks] [ɪ'kweɪʃən] [dɪ'faɪn] [kən'klu:ʒən] ['nɔlɪdʒ] ['sɪstɪm] [dɪ'zaɪn] ['neɪtʃə] ['ældʒɪbrə] [dʒɪ'ɔmɪtrɪ] [rɪ'sə:tʃ] ['wɪdθ] ['haɪt] ['leŋθ]

Task 3. Practise saying the following words and word-combinations. Pay attention to the pronunciation:

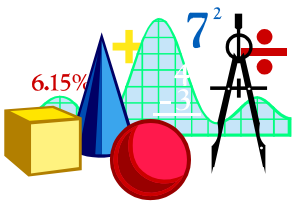
mathematics, knowledge, quantity, figure, sets of formulas, pure mathematics, applied mathematics, transactions, astronomy, chemistry, physics, economics, psychology, sociology, to define, to analyze, for example, length, width, depth, insurance, conclusion, techniques, purchase, relationship, to make predictions.

Task 4. Read the following international words and guess their meaning:

number ['nʌmbə] *n*, mathematics [ˌmæθɪ'mætɪks] *n*, system ['sɪstɪm] *n*, logic ['lɔdʒɪk] *n*, analysis [ə'næləsɪs] *n*, practical ['præktɪkəl] *adj*, complex ['kɔmpleks] *adj*, project ['prɔdʒekt] *n*, absolutely ['æbsəlu:tlɪ] *adv*, parabola [pæ'rəbələ] *n*, per cent[pə'sent] *n*, component [kəm'pəunənt] *n*

Task 5. Read the text and find some information about the importance and usage of mathematics in everyday life:

Mathematics



Mathematics is one of the most useful and fascinating divisions of human knowledge. It includes many topics of study. It comes from a Greek word meaning "inclined to learn."

Most of the basic mathematics taught in school involves the study of number, quantity, form, and relations. Arithmetic, for example, concerns problems with numbers. Algebra involves solving equations (mathematical statements of equality) in which letters represent unknown quantities. Geometry concerns the properties and relationships of figures in space.

The most important skills in mathematics are careful analysis and clear reasoning. These skills can help us solve some of the deepest puzzles we must face. Mathematics is based upon logic. Starting from widely accepted statements, mathematicians use logic to draw conclusions and develop mathematical systems.

The work of mathematicians may be divided into pure mathematics and applied mathematics. Pure mathematics seeks to advance mathematical knowledge for its own sake rather than for any immediate practical use. For example, a mathematician may create a system of geometry for an imaginary world where objects have more dimensions than just length, width, and depth. Applied mathematics seeks to develop mathematical techniques for use in science and other fields.

The boundary between pure and applied mathematics is not always clear. Ideas developed in pure mathematics often have practical applications, and work in applied mathematics frequently leads to research in pure mathematics.

Nearly every part of our lives involves mathematics. It has played an essential role in the development of modern technology – the tools, materials, techniques, and sources of power that make our lives and work easier.

In everyday life, we use mathematics for such simple tasks as telling time from a clock or counting our change after making a purchase. We also use mathematics for such complex tasks as making up a household budget or figuring our income tax. Cooking, driving, gardening, sewing, and many other common activities involve mathematical calculations. Mathematics is also part of many games, hobbies, and sports.

Mathematics is an essential part of nearly all scientific study. It helps scientists design experiments and analyze data. Scientists use mathematical formulas to express their findings precisely and to make predictions based on these findings.

The physical sciences, such as astronomy, chemistry, and physics, rely heavily on mathematics. Such social sciences as economics, psychology, and sociology also depend greatly on statistics and other kinds of mathematics. For example, some economists create mathematical models of economic systems. These models are sets of formulas used to predict how a change in one part of the economy might affect other parts.

Mathematics helps industries design, develop, and test products and manufacturing processes. Mathematics is necessary in designing bridges, buildings, dams, highways, tunnels, and other architectural and engineering projects.

In business, mathematics is used in transactions that involve buying and selling. Businesses need mathematics to keep records of such things as inventory and employees' hours and wages. Bankers use mathematics to handle and invest funds. Mathematics helps insurance companies calculate risks and compute the rates charged for insurance coverage.

Glossary:

mathematics [ˌmæθɪ'mætɪks] *n* – математика
quantity ['kwɔntɪtɪ] *n* – кількість
formula ['fɔ:mjulə] *n* – формула
pure mathematics [pjuəˌmæθɪ'mætɪks] *n* – елементарна математика
applied mathematics [ə'plaɪdˌmæθɪ'mætɪks] *n* – теоретична математика
data ['deɪtə] *n* – дані, інформація
equation [ɪ'kweɪʃən] *n* – рівняння
define [dɪ'faɪn] *v* – визначати, давати визначення
conclusion [kən'klu:ʒən] *n* – висновок, умовивід, результат
knowledge [n'ɔlɪdʒ] *n* – знання
length ['leŋθ] *n* – довжина
width ['wɪdθ] *n* – ширина
height ['haɪt] *n* – висота
figure ['fɪgə] *n* – цифра, ілюстрація, малюнок

- Write down the new words and learn them.

Exercises

1. Explain the meanings of the following words and expressions from the text. Make sentences with each of them:

- mathematics;
- dimensions;
- astronomy, chemistry, physics;
- scientific study.

_____
_____
_____
_____
_____
_____

2. Discuss in pairs. Are the following statements True (v) or False (x)? Correct the false ones.

	T	F
Mathematics is an essential part of nearly all scientific study.		
The physical sciences, such as astronomy, chemistry, and physics, rely heavily on philosophy.		
Applied mathematics seeks to develop mathematical techniques for use in science and other fields.		
The term mathematics comes from a Latin word meaning "inclined to learn."		
Mathematics is based upon logic.		
Arithmetic, for example, concerns problems with letters.		
The work of mathematicians may be divided into pure mathematics and applied mathematics.		

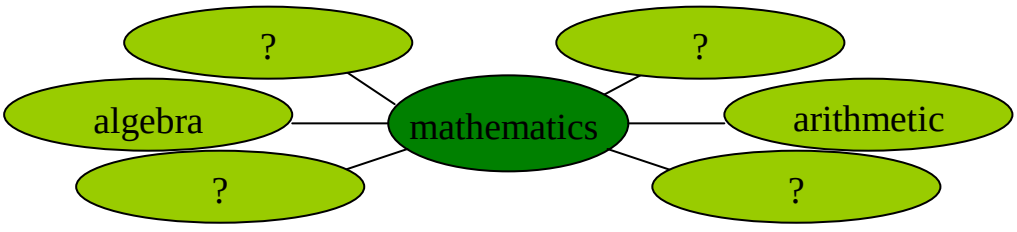
3. Give English equivalents of:

величина**,** рівняння, кількість, запис, цифра, дані, формула, математичні обчислення, знання, визначати, аналізувати, рівність, рівняння, арифметика, елементарна математика, теоретична математика.

Compare your answers.

_____
_____
_____
_____
_____

4. Complete the diagram trying to recall as much as possible about "Mathematics":



5. Make up 2 sentences of your own using the words and expressions given below:
arithmetic, mathematical knowledge, science, mathematical calculations, logic
Discuss the following sentences together, then tell others in your group what you think.

_____
_____
_____
_____

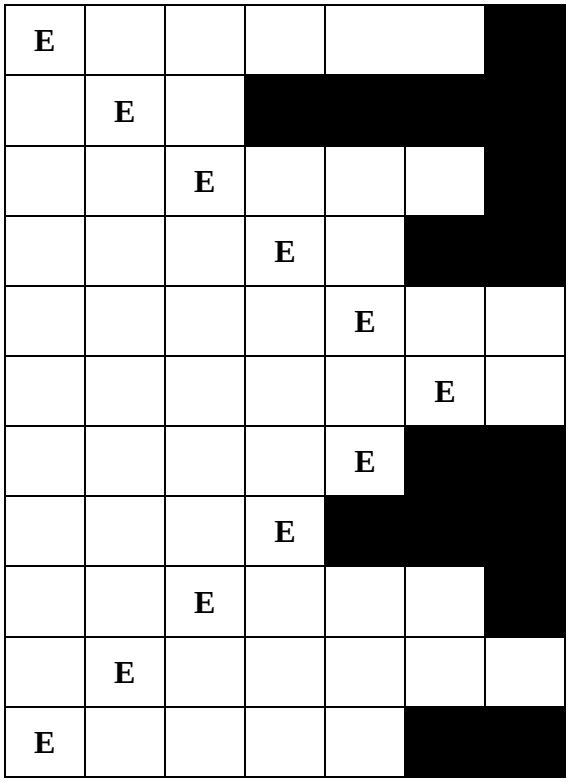
6. Fill in the blanks with the necessary words in brackets and discuss the sentences in pairs:

1. Geometry concerns the properties and relationships of figures in _____ (memory, square, space).
2. Mathematics is an essential part of nearly all _____ study (scientific, social, psychology).
3. The most_____ skills in mathematics are careful analysis and clear reasoning (simple, important, usual).
4. _____is also part of many games, hobbies, and sports (geography, language, mathematics).

7. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. The physical sciences, such as astronomy, chemistry, and physics, rely heavily on mathematics.
2. Mathematics is one of the most useful and fascinating divisions of human knowledge.
3. The boundary between pure and applied mathematics is always clear.
4. In the Hindu – Arabic system we use nine digits.
5. We get the sum as a result of subtraction.

8. Complete each word to give the correct number. Compare your answers in groups.



9. Translate into Ukrainian. Compare your translation in groups.

1. Euclid, one of the foremost Greek mathematicians, wrote the Elements about 300 B.C. In this book, Euclid constructs an entire system of geometry by means of abstract definitions and logical deductions.
2. During the 200's B.C., the Greek mathematician Archimedes extended the method of exhaustion. Using a 96-sided figure to approximate a circle, he calculated a highly accurate value for pi (the ratio of a circle's circumference to its diameter).
3. Ptolemy, an astronomer in Alexandria, Egypt, applied geometry and trigonometry to astronomy about A.D. 150 in a 13-part work on planetary motions.

10. What numbers are these? Fill in the missing letters. Compare your lists.

_	**E**	_	**E**	_	_	_
_	**E**	_	**E**	_		
_	_	**I**	_	_	**Y**	
_	_	_	**E**	**E**		
_	**I**	_	_	_		
_	**I**	_				
_	**I**	_	_	_		
_	**I**	_	**E**			

11. Read the following quotations and translate them:

"Give me a place to stand, and I will move the earth."
"Eureka, eureka!"
"There are things which seem incredible to most men who have not studied Mathematics."
(Archimedes)

Recollect the story or invent your own one connected with the exclamation "Eureka, eureka!"

Check your grammar

Exercices

1. Form nouns from the following verbs:
to define, to analyze, to charge, to apply, to employ, to buy, to test, to develop, to create, to own, to count

2. Form adjectives by using the following suffixes:

- able - to reason, to vary, to measur(e), to use, to consider, to realiz(e)

_____

- al - form, mechanic(s), physic(s), practice(e)

_____

- ive - progress, effect, act, product

_____

- less - air, sense, base, use, work

_____

- full - use, meaning, help

_____

3. Use the correct form of the verb *to be* in Present Simple:

1. The term mathematics (to be) _____ difficult to define.
2. The most important skills in mathematics (to be) _____careful analysis and clear reasoning.
3. (to be)_____ probability the mathematical study of the likelihood of events?
4. School courses in algebra and geometry also (to be) _____useful for study in architecture, engineering, and physics.
5. Arithmetic (to be) _____ one of the most important tools of daily living.
6. Mathematical models (to be) _____ sets of formulas used to predict how a change in one part of the economy might affect other parts.
7. Another name for the system (to be) _____ the decimal system.
8. The answer (to be) _____three boxes.
9. (to be) two fractions equal if the cross products (to be) _____ equal ?
10. I (to be) _____a school teacher of mathematics.

4. Dictate to each other the following numerals:

1 – 10	7 – 70
2 – 20	8 – 80
3 – 30	9 – 90
4 – 40	10 – 100
5 – 50	100 – 1000
6 – 60	1000 – 1000000

You will have to help with the spelling sometimes!

Examples:

't' for toy!
'h' for house!
'r' for red!
'e' for eagle!

Practise saying them.

_____
_____
_____
_____
_____
_____
_____
_____
_____

5. Write questions to which the sentences below are the answers:

1. Mathematical measurements have many practical uses.

_____

2. It is possible to find the location of this object in space.

_____

3. Mathematics is also part of many games, hobbies, and sports.

_____

4. This terminology needs improving.

_____

5. Scientists all over the world know Newton's name.

_____

6. You have to double this number.

_____

7. We expect to cover all these problems.

_____

8. I have no idea of the situation.

_____

9. There is a diagram below.

_____

10. Some statements in mathematics are concerned with single numbers.

_____

Read and Smile:

***

Read the following and answer the questions:

A college freshman was being severely criticized by his professor.

"Your last paper was very difficult to read," said the professor.

"Your work should be so written that even the most ignorant will be able to understand it."

"Yes, sir," said the student. "What part didn't you get?"

a) The fun of the joke is based in the word "ignorant" (неосвічений, недостатньо обізнаний у чомусь).

Whom did the professor consider (вважати) ignorant?

b) Whom did the freshman consider ignorant?

c) Who do you agree with?

***

Comment on the fun of the joke. Would you allow marks lower than a zero if you were a Minister of Education?

Soph – "But I don't think I deserve an absolute zero."

Prof. – "Neither do I, but it is the lowest mark that I am allowed to give."

Notes on the topic studied:

Notes on the topic studied:

Unit Two

Task 1. Discuss the following questions:

- What branches of mathematics do you know?
- Which branch is the most important? Which branch do you like best?
- What are numerals used for? In what way are the numerals in a numeration system grouped?
- What kind of mathematical sentences do you know?
- Are there statements in mathematics that are concerned with various sets of numbers?

Task 2. Read the phonetic transcription. Practise your pronunciation:

[ə'rɪθmətɪk] [ˌærɪθ'mətɪkəl] ['ældʒɪbrə] [dʒɪ'ɔmɪtrɪ] ['frækʃən] [ɪ'kweɪʃən] [ˌprɔbə'bɪlɪtɪ] ['erə] [ˌtrɪgə'nɔmɪtrɪ] ['reɪʃɪəu] ['θɪərɪ] ['sɪstɪm] ['sfɪə] [kə:v] ['wɪdθ] ['haɪt] ['fɪgə] ['bra:ntʃ] ['baɪnərɪ] ['leŋθ] ['æŋgl] ['kælkjuləs] ['kælkjuleɪt] [ˌkælkju'leɪʃən] [dɪ'menʃən]

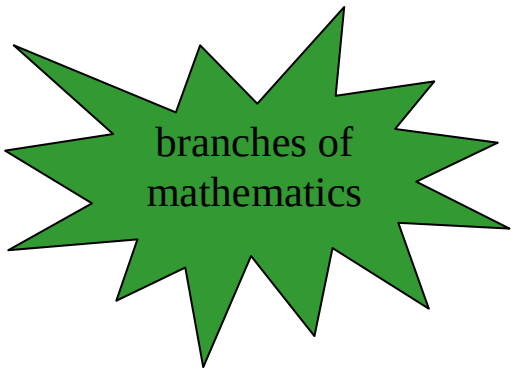
Task 3. Practise saying the following words and word-combinations. Pay attention to the pronunciation:

branch, method, arithmetic, fractions, decimals, theory, probability, statistics, algebra, geometry, calculus, analysis, nature, trigonometry, angle, triangle, practical application, square roots, unknown quantities, figure, equation, curve, amount of work, measurement, measuring and comparing quantities, basic concepts, whole numbers, addition, subtraction, multiplication, division, dimension, natural phenomena.

Task 4. Read these international words and guess their meaning:

informatics [ˌɪnfə'mætɪks] *n*, symbol ['sɪmbəl] *n*, universal [ˌju:nɪ'və:səl] *adj*, false [fɔ:ls] *adj*, discussion [dɪ'skʌʃn] *n*, binary ['baɪnərɪ] *adj* , process ['prəusəs] *n* valid ['vælɪd] *adj*, standard ['stændəd] *adj*, vertical ['və:tɪkəl] *adj*, diagram ['daɪəgræm] *n*, correct [kə'rekt] *adj*, modular ['mɔdjulə] *adj*, concept ['kɔnsept] *n*, horizontal [ˌhɔ:rɪ'zɔnt(ə)l] *adj*

Task 5. Read the text and complete the scheme:



Branches of Mathematics

Mathematics has many branches. They may differ in the types of problems involved and in the practical application of their results. However, mathematicians working in different branches often use many of the same basic concepts and operations.

Arithmetic includes the study of whole numbers, fractions and decimals, and the operations of addition, subtraction, multiplication, and division. It forms the foundation for

other kinds of mathematics by providing such basic skills as counting and grouping objects, and measuring and comparing quantities.

Algebra, unlike arithmetic, is not limited to work with specific numbers. Algebra involves solving problems with equations in which letters, such as x and y, stand for unknown quantities. Algebraic operations also use negative numbers and imaginary numbers (the square roots of negative numbers).

Geometry is concerned with the properties and relationships of figures in space. Plane geometry deals with squares, circles, and other figures that lie on a plane. Solid geometry involves such figures as cubes and spheres, which have three dimensions.

Analytic geometry and trigonometry. Analytic geometry relates algebra and geometry. It provides a way to represent an algebraic equation as a line or curve on a graph. Analytic geometry also makes it possible to write equations that exactly describe many curves. For example, the equation x = y2 describes a curve called a parabola.

Trigonometry is used widely by astronomers, navigators, and surveyors to calculate angles and distances when direct measurement is impossible. It deals with the relations between the sides and angles of triangles, especially right triangles (triangles that have a 90° angle). Certain relations between the lengths of two sides of a right triangle are called trigonometric ratios. Using trigonometric ratios, a person can calculate the unknown angles and lengths in a triangle from the known angles and lengths. Formulas involving trigonometric ratios describe curves that physicists and engineers use to analyze the behavior of heat, light, sound, and other natural phenomena.

Calculus and analysis have many practical uses in engineering, physics, and other sciences. Calculus provides a way of solving many problems that involve motion or changing quantities. Differential calculus seeks to determine the rate at which a varying quantity changes. It is used to calculate the slope of a curve and the changing speed of a bullet. Integral calculus tries to find a quantity when the rate at which it is changing is known. It is used to calculate the area of a curved figure or the amount of work done by a varying force. Unlike algebra, calculus includes operations with infinitesimals (quantities that are not zero but are smaller than any assignable quantity).

Analysis involves various mathematical operations with infinite quantities and infinitesimals. It includes the study of infinite series, sequences of numbers or algebraic expressions that go on indefinitely. The concept of infinite series has important applications in such areas as the study of heat and of vibrating strings.

Probability and statistics. Probability is the mathematical study of the likelihood of events. It is used to determine the chances that an uncertain event may occur. For example, using probability, a person can calculate the chances that three tossed coins will all turn up heads.

Statistics is the branch of mathematics concerned with the collection and analysis of large bodies of data to identify trends and overall patterns. Statistics relies heavily on probability. Statistical methods provide information to government, business, and science. For example, physicists use statistics to study the behavior of the many molecules in a sample of gas.

Set theory and logic. Set theory deals with the nature and relations of sets. A set is a collection of items, which may be numbers, ideas, or objects. The study of sets is important in investigating most basic mathematical concepts.

In the field of logic – the branch of philosophy that deals with the rules of correct reasoning--mathematicians have developed symbolic logic. Symbolic logic is a formal system of reasoning that uses mathematical symbols and methods. Mathematicians have devised various systems of symbolic logic that have been important in the development of computers.

Read the text again and analyze the sentences you find difficult to understand.

Glossary:

branch ['bra:ntʃ] *n* – галузь, гілка
theory ['θıərı] *n* – теорія
system ['sıstım] *n* – система, метод
arithmetic [ə'rıθmətık] *n* – арифметика
ratio ['reıʃıəu] *n* – відношення, пропорція, коефіцієнт
fraction ['frækʃən] *n* – дріб
probability [ˌprɔbə'bılıtı] *n* – імовірність
algebra ['ældʒıbrə] *n* – алгебра
geometry [dʒı'ɔmıtrı] *n* – геометрія
trigonometry [ˌtrıgə'nɔmıtrı] *n* – тригонометрія
calculus ['kælkjuləs] *n* – числення
curve [kə:v] *n* – дуга, крива
sphere ['sfıə] *n* – сфера, куля
angle ['æŋgl] *n* – кут
error ['erə] *n* – помилка, похибка
binary ['baınərı] *adj* – двійковий, бінарний
dimension [dı'menʃən] *n* – величина, вимір

Exercises

1. Explain the meanings of the following words and expressions from the text. Make sentences with each of them:

- branch;

_____

- statistics;

_____

- calculus;

_____

- set theory

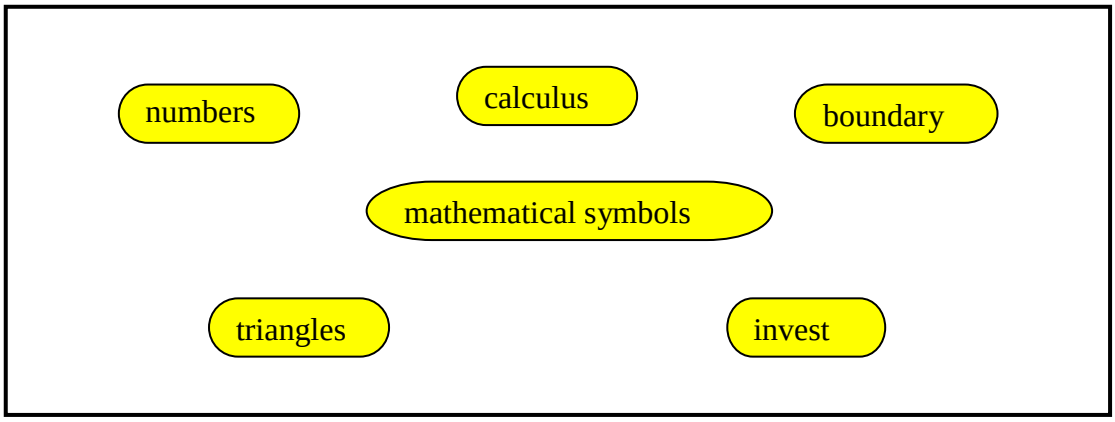
_____

2. Match a line in A with a line in B

A	B
Probability **Set theory** **Calculus** **Analytic geometry** **Geometry** **Arithmetic**	➢ deals with the nature and relations of sets. ➢ includes the study of whole numbers, fractions and decimals, and the operations of addition, subtraction, multiplication, and division. ➢ is concerned with the properties and relationships of figures in space. ➢ is the mathematical study of the likelihood of events. ➢ provides a way of solving many problems that involve motion or changing quantities ➢ relates algebra and geometry

Compare your answers.

3. Complete the sentences with one of the words in box. Check your answers in pairs.



1. Algebraic operations also use negative _____and imaginary numbers.
2. _____ and analysis have many practical uses in engineering, physics, and other sciences.
3. Trigonometry deals with the relations between the sides and angles of _____.
4. Symbolic logic is a formal system of reasoning that uses _____ and methods.
5. Bankers use mathematics to handle and _____ funds.
6. The _____ between pure and applied mathematics is not always clear.

4. Make up sentences of your own using the words and expressions given below:

statistical methods

_____

mathematical symbols

_____

important applications

_____

analytic geometry

_____

mathematicians

_____

Discuss the sentences together, then tell others in your group what you think.

5. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. Mathematics has two branches.
2. Algebra involves solving problems with equations in which letters, such as x and y, stand for unknown quantities.
3. Analytic geometry makes it possible to write letters that exactly describe many curves.
4. The study of sets is not important in investigating most basic mathematical concepts.
5. Mathematicians often use many of the same basic concepts and operations.

6. Translate into Ukrainian. Compare your translation in groups.

1. Infinity is a term commonly used to refer to a quantity or distance that is so large it cannot be counted or measured.
2. In mathematics, the idea of infinity forms an important part of set theory.
3. A set of objects or numbers is called finite if the objects or numbers can be paired with the positive integers (whole numbers) less than some positive integer.

4. An infinite set is defined as one that is not finite. Its members cannot be paired with the positive integers less than some positive integer, because the set continues without end.

_____
_____
_____
_____
_____
_____
_____

7. Read the underlined words aloud. Discuss this information in groups.

1. Oxygen accounts for 46,6% of the earth's crust.
2. The highest waterfall in the world is Angel Falls in Venezuela with a drop of 979 m.
3. The top coffee-drinking country in the world is England where 1,892 per annum are consumed per head of the population.
4. The tallest church is the Chicago Methodist Temple which is 173 m or 568 fr high.
5. The commonest item of lost property on London transport is the umbrella. 23.250 umbrellas were handed in to London transport lost property offices in 1987/8.
6. The country with the most telephones in the world is Monaco. It has 733 telephones per 1.000 population.
7. The smallest country in the world is the Vatican City with an area of 0.4 sq km.
8. The nearest star to earth is Proxima Centauri. It is 33.923.310.000 km from earth.

8. Complete the sentences with the correct number. Compare your lists in pairs.

Use one of the following words.
Use each word once only.

thirty	**five**	**seventy**	**twelve**
eleven	**hundred**	**ten**	**twenty**
fifteen	**seven**	**three**	

1. A football team has _____ players.
2. Two feet have _____ toes.
3. 50 - 30 = _____
4. A week has _____days.
5. 9 + 6 = _____
6. A century has _____years.
7. A triangle has _____sides.
8. 25 + 5 = _____
9. A year has _____months.
10. 14 x 5 = _____
11. 2 hands = 2 thumbs + _____ fingers.

9. Complete each word to give the correct number. Compare your answers in groups.

O							
	O						
		O					
			O				
		O					
	O						

10. Read the quotations:

"Mathematics is the door and key to the sciences."

"In mathematics I can report no deficiencies, except it be that men do not sufficiently understand the excellent use of the Pure Mathematics."

"There are four great sciences…. Of these sciences the gate and key is mathematics, which the saints discovered at the beginning of the world."

" …mathematics is absolutely necessary and useful to the other sciences."

"Neglect of mathematics works injury to all knowledge, since he who is ignorant of it cannot know the other sciences or the things of the world." (Roger Bacon)

Choose one of them you like best and express your ideas on the topic "The Importance of Mathematics".

Check your grammar

Exercises

1. Read and memorize the plural of the following nouns:

Singular		Plural
datum	дана величина	data
quantum	квант	quanta
spectrum	спектр	spectra
momentum	момент	momenta
phenomenon	явище	phenomena
radius	радіус	radii
formula	формула	formulas, formulae

2. Learn the synonyms. Translate them:

to suppose – to assume, to obtain – to receive, to change – to vary, to continue – to go on, to seek – to search for, to convert – to transform – to change, to define – to determine

_____

_____

_____

_____

3. Form nouns from the following verbs:

to direct, to indicate, to demonstrate, to measure, to state, to calculate, to change, to relate, to add, to divide, to multiply, to subtract

_____

_____

_____

_____

4. Repeat degrees of comparison. Replace the Ukrainian word with the English one:

1. He calculates (найкраще) _____in our group.
2. This is the (найменший) _____common factor.
3. He knows these rules (погано) _____.
4. She solves such equations (краще) _____ than I do.
5. She has (менше) _____time for her English than you.
6. Try to give (найкраще) _____definition.
7. This the (найгірше) _____possible solution of the problem.

5. Correct the mistakes if any (*have or has*):

1. Ideas developed in pure mathematics often have_____ practical applications.
2. Mathematics have _____many branches.
3. Solid geometry involves such figures as cubes and spheres, which have _____three dimensions.
4. Calculus and analysis have_____ many practical uses in engineering, physics, and other sciences.
5. If she have _____ a problem of finding the total number of objects in two or more groups, the solution to the problem is called addition.
6. Arithmetic have _____ the rule that tests the equality of fractions even when you cannot see a number by which to divide.
7. Each group have _____six computers.
8. Geometry also have _____practical applications in many fields.
9. A line have _____length, but no width.
10. As a rule he have _____a lot of problems with division.

6. Dictate to each other ordinal numerals to the following cardinal ones:

one –	twelve –
two –	thirty –
three –	fifty-seven –
five –	one hundred –
eight –	one hundred and forty-six –
nine –	one thousand –

You will have to help with the spelling sometimes!

Examples:

'e' for eagle!
'i' for ice!
'g' for goose!
'h' for house!
't' for ten

Practise saying these numerals in pairs.

7. Use the correct form of Present Simple:

1. When all the cards have been turned, the player with the most cards (to win) _____.
2. Each player (to draw) _____a tick-tack-toe figure on a piece of paper.
3. Arithmetic (to include) _____the study of whole numbers, fractions and decimals, and the operations of addition, subtraction, multiplication, and division.
4. The answer, or result, of the division (to be) _____the quotient.
5. When objects are measured, often the measurements (not to come) _____out in whole units.
6. The word fraction (to come) _____from a Latin word meaning to break.
7. If you (to break)_____ a stick into two pieces, however, you (not to have) _____necessarily two halves of the stick.
8. In arithmetic, a fraction generally (to stand) _____for the number of equal parts into which something has been divided.
9. (to involve) _____geometry studying the shape of geometric figures?
10. As a unit is broken into more and more equal parts, each part (to get) _____smaller and smaller.

Read the joke and say:

- Which mathematic terms are used in the joke?
- Do you think that private Honeywell had a sense of humor? Why?

Captain — "What are you scratching your head for, private Honeywell?"
Draftee — "Guess ah got arithmetic bugs."
Captain — "What are arithmetic bugs."
Draftee — "Cooties." .
Captain — "Why do you call them arithmetic bugs?"
Draftee— "Because they add to mah misery, subtract from mah pleasure, divide mah attenshun, and multiply like the dickens."

Notes:

scratch - чухати
private – (noun) рядовий (військове звання)
a bug – жук
a cootie – воша
….like the dickens – як чорти

Notes on the topic studied:

Notes on the topic studied:

Unit Three

Task 1. Discuss the following questions:

- What do you like to count better: stars or money?
- Who taught you how to count? At what age was it?
- Are there any people who cannot count nowadays?

Think and answer:

- How many digits do we use in our numeration system?
- How many combinations can be written with the digits 1, 2, 3?
- Could you name all the numerals?
- Are 5 and 7 natural numbers?

Task 2. Read the phonetic transcription. Practise your pronunciation:

[ə'rıθmətık] [ˌærıθ'mətıkəl] [ə'dıʃən] [ˌsəb'trækʃən] [ˌmʌltıplı'keıʃən] [dı'vıʒən] [kə'rekt] ['a:nsə] ['prɔbləm] ['dıdʒıt] ['ældʒıbrə] [dʒı'ɔmıtrı] ['frækʃən] [ı'kweıʃən] [ˌprɔbə'bılıtı] ['erə] [ˌtrıgə'nɔmıtrı] ['reıʃıəu] ['θıərı] ['sfıə] [kə:v] ['wıdθ] ['haıt] ['fıgə] ['bra:ntʃ] ['baınərı]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

arithmetic, calculation, addition, subtraction, multiplication, division, mistake, basic operations, digit, to add, to multiply, to check, correct answer, similar regrouping, decimal system, example, to estimate, column, clay tablet, error, rounding off, the value of a digit.

Task 4. Read the following international words and guess their meaning:

natural ['nætʃrəl] *n*, unique [ˌju:'n:ik] *adj*, general ['dʒenərəl *adj*], element ['elımənt] *n*, axiom ['æksıəm] *n*, discussion[dıs'kʌʃən] *n*, form ['fɔ:m] *n*, summarize ['sʌməraız] *v*, opposite ['ɔpəzıt] *adj* , essential [ı'senʃəl] *adj*, incorrect [ˌınkə'rekt] *adj*, fractional['frækʃənl] *adj*, rational ['ræʃənl] *adj* , principle ['prınsəpl] *n* , determine [dı'tə:mın] *v*, equivalent [ı'kwıvələnt] *n*

Task 5. Read the text and complete such sentences:

Arithmetic helps farmers …

Navigators use arithmetic …

Engineers use arithmetic …

Arithmetic

Arithmetic gives us the answers to questions such as "How many?" "How much?" "How long?" and "How far?" It helps us find short, easy ways of solving problems that have numbers in them. Arithmetic is sometimes called "the science of numbers" and "the art of calculation." It forms an important branch of mathematics.

Arithmetic is so important that, along with reading and writing, it forms the "Three R's" – the backbone of education.

Two main types of problems are studied in elementary arithmetic. You solve the first type of problem by counting objects, or by grouping and regrouping objects. In this kind of arithmetic, you do not deal with parts of things, but only with whole, unbroken things such as people, cows, houses, and so on.

A second kind of problem can be solved by measuring or comparing quantities.

Arithmetic often begins with curiosity about how many things there are in a collection or group. Every group has a number that stands for the quantity of things it contains. When the things in two groups can be matched in pairs, the two groups have the same number. Suppose you have a bowl of blue marbles and a bowl of white marbles. If you can match one blue marble with one white marble until no marbles are left in either bowl, then both bowls held the same

number of marbles. Mathematicians would call the group of marbles in each bowl a set. In this case, each set has the same number.

For very small numbers, you can see at a glance the number of things in a set. For example, you can quickly tell that there are three cookies on a plate, or two pieces of candy in a box, or four people in a room. But when a set gets large, you have to count to find its number.

The names of the numbers of things are called numerals. Before you can count, you must learn to say the numerals in order, such as one, two, three, and so on. This is called rote-counting. After you have learned the number names, you can match, in order, each object in a set with a numeral, until all the objects have been matched. Then you know the number of the set. It is possible to put all the numbers in order. Then we say the names of these numbers in order, like this: one, two, three, four, five, six, and so on. Or we can write the numerals, like this: 1, 2, 3, 4, 5, 6, and so on. Ways of putting numbers in order are called numeral systems, or sometimes number systems.

Throughout history, people have used various numeral systems. For example, the ancient Babylonians used little gouges in a clay tablet. The Greeks had two systems. One used letters of the Greek alphabet, as if we used a for 1, b for 2, and c for 3. The Romans used numerals such as MDCCLXXVII.

Our numeral system was invented by the Hindus and brought to Europe by the Arabs. For this reason, it is often called the Arabic, or Hindu-Arabic, numeral system. Another name for the system is the decimal system.

The decimal system is compact and permits a person to calculate rapidly with pencil and paper. It is based on ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The word digit means finger and comes from a time when people traditionally counted on their fingers. The most important feature of the decimal system is the idea of place value. This means that the value of a digit depends on its location within a numeral. For example, 2 means two ones, 20 means two tens and no ones, and 200 means two hundreds, no tens, and no ones. We use four basic operations to solve arithmetic problems. These are (1) **addition**, (2) **subtraction**, (3) **multiplication**, and (4) **division**.

Checking answers is an important part of arithmetic, because mistakes may creep into your work. People usually check addition by adding again, but in a different way. If you add a column going down, the best check is to add it going up. Subtraction is checked by addition. We check multiplication by division, and division is checked by multiplication.

Estimating what your answer should be serves as a good way to make a rough check to prevent bad errors. You can estimate by rounding off numbers until you can work with them easily. For example, if you wish to multiply 8 X 47, you can round off the 47 to 50 and note that 8 X 50 = 400. You can see that the correct answer must be a little less than 400.

You can do this sort of checking in your head, or by mental arithmetic. With mental arithmetic, you can go one step farther than just estimating. In the above example, you rounded off 8 X 47 to 8 X 50. But 47 is three less than 50. So 400 is 8 X 3, or 24, larger than 8 X 47. So the correct answer is 400 - 24, or 376. If you practice with this and similar regrouping examples, you can become an expert at figuring in your head.

– **Read the text again. Into how many logical parts could you divide the text?**

Glossary:

addition [ə'dɪʃən] *n* – додавання
subtraction [ˌsəb'trækʃən] *n* – віднімання
multiplication [ˌmʌltɪplɪ'keɪʃən] *n* – множення
division [dɪ'vɪʒən] *n* – ділення
digit ['dɪdʒɪt] *n* – цифра
operation [ˌɔpə'reɪʃən] *n* – дія
correct [kə'rekt] *adj* – правильний, точний
answer ['a:nsə] *n* – відповідь
problem ['prɔbləm] *n* – задача

Exercises

1. Explain the meanings of the following words and expressions from the text. Make 4 sentences with each of them:

arithmetic;
number;
decimal system;
mental arithmetic.

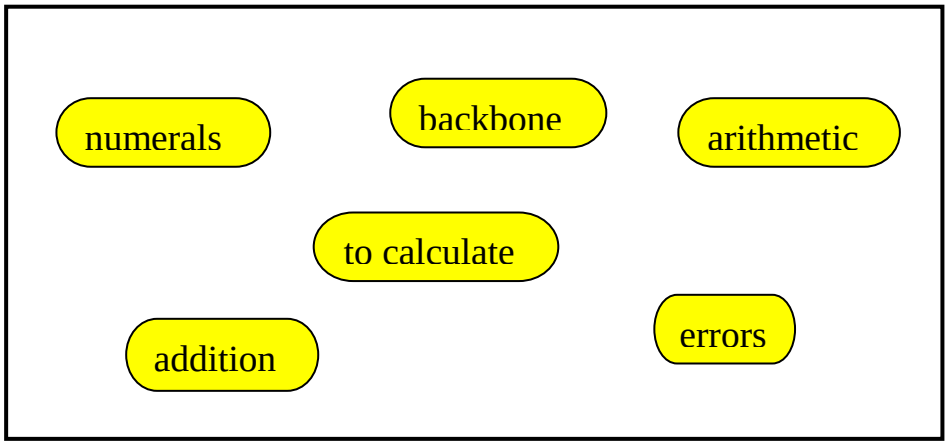
_____
_____
_____
_____
_____

Discuss in pairs

2. Are the following statements True (v) or False (x)? Correct the false ones.

	T	F
Arithmetic is sometimes called "the science of words".		
Five main types of problems are studied in elementary arithmetic.		
We use two basic operations to solve arithmetic problems.		
The most important feature of the decimal system is the idea of place value.		
Ways of putting numbers in order are called logic systems.		
The names of the numbers of things are called numerals.		

3. Complete the sentences with one of the words in box. Check your answers in pairs.



1. The Romans used _____ such as MDCCLXXVII.
2. People usually check _____ by adding again, but in a different way.
3. The decimal system is compact and permits a person _____rapidly with pencil and paper.
4. Checking answers is an important part of _____, because mistakes may creep into your work.
5. Arithmetic is so important that, along with reading and writing, it forms the "Three R's"-the _____of education.
6. Estimating what your answer should be serves as a good way to make a rough check to prevent bad _____.

4. Work in pairs and discuss the following questions:

1. What are the two main types of problems in elementary arithmetic?
2. What are the four basic arithmetic operations?
3. What are the ten digits?
4. Who gave us our modern system of writing numbers?
5. How many digits do we use in Hindu – Arabic system?
6. Is the sum of two numbers also a natural number?
7. Is 25 a natural number?

5. Give English equivalents of:

цифровий, дані, обчислення, двійковий, теоретична математика, додавання, цифра, загальний, знання, задача, елементарна математика, перегрупування, результат обчислення, загальний.

_____

_____

_____

6. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. We use four basic operations to solve arithmetic problems.
2. Arithmetic often begins with curiosity about how many things there are in a collection or group.
3. Subtraction isn't checked by addition.
4. People usually check addition by adding again, but in a different way.
5. The decimal system is used in geometry.

7. Translate into Ukrainian. Compare your translation in groups.

a. Traditional math programs stressed the development of basic computational skills - such as how to add, subtract, multiply, and divide – through repetitious drills and memorization.
b. New math programs urged students to understand concepts rather than learn rules.
c. To provide a better understanding of numbers, for example, many programs taught students to work problems in numeration systems with bases other than 10.
d. In business companies, accountants and bookkeepers use arithmetic to keep financial records. Business people must understand arithmetic in order to know how much to charge for their products. Engineers use arithmetic to plan bridges, factories, machines, and ships. Scientists could not discover new knowledge without the aid of arithmetic in experiments and research. Doctors need arithmetic to write the quantities of drugs in prescriptions and to measure blood pressure.

8. Read the following quotations about Arithmetic:

"What are numbers? What is the nature of arithmetical truth?" (Ludwig Frege)
"Mathematics is the queen of the sciences and number theory is the queen of mathematics" (Carl Gauss)
"God does arithmetic" (Carl Gauss)
"Mathematics is concerned only with the enumeration and comparison of relations" (Carl Gauss)
"God ever arithmetizes" (Carl Jacobi)
Choose one of them you like best and discuss it in pairs.

Check your grammar

Exercises

1. Form nouns from the following verbs:

to check, to estimate, to solve, to collect, to understand, to fill, to count, to mix, to put, to correct.

_____
_____
_____
_____

2. Read and memorize the plural of the following nouns:

Singular		Plural
criterion	критерій	criteria
maximum	максимум	maxima
minimum	мінімум	minima
analysis	аналіз	analyses
axis	вісь	axes
thesis	тезис, положення	theses

3. Give the plural forms of the following nouns. Compare your lists.

half –	statistics –
fraction –	course –
object –	formula –
foot –	angle –
number –	degree –
analysis –	area –

4. Choose the correct article:

1. (A, an, the)_____ most important skills in mathematics are careful analysis and clear reasoning.
2. It provides (a, an, the) _____ way to represent (a, an, the)_____ algebraic equation as (a, an, the) _____line or curve.
3. According to tradition, one of (the, a, an) _____ first to provide mathematical proofs based on deduction was (the, a, an) _____philosopher Thales.
4. Arithmetic is (a, an, the) _____ one of (a, the) most important tools of daily living.
5. Arithmetic forms (a, an, the) _____ important branch of mathematics.
6. (An, the, a) _____Arabs brought our present-day numeral system to (an, the, an) _____Europe sometime before 1200.
7. Here is (an, the, a) ____ another example of addition of two numbers.
8. (A, the, an) _____ first, add (a, the) ____ 1's column: 4+2=6, and 6+7=13.
9. (The, a) _____first player with (the, a)_____ correct answer wins.
10. (A, the) _____symbol of multiplication is X.
11. (The, an, a) _____ earliest uses of geometry included measuring lengths and areas of land.
12. Division is one of (the, a, an) _____ four basic operations in arithmetic.
13. (An, the, a) _____ each basic operation in arithmetic is indicated by (a, an) _____special symbol.

5. Use the correct form of Present Simple:

1. Mathematics (to include) _____ many topics of study.
2. It (to come) _____ from a Greek word meaning "inclined to learn".
3. Geometry (to concern) _____the properties and relationships of figures in space.
4. Starting from widely accepted statements, mathematicians (to use) _____logic to draw conclusions and develop mathematical systems.
5. Nearly every part of our lives (to involve) _____ mathematics.
6. Plane geometry (to deal) with squares, circles, and other figures that (to lie) _____ on a plane.
7. Insurance companies (to employ) _____ mathematicians as actuaries to calculate risks and help design policies.
8. Arithmetic (to give) _____us the answers to questions such as "How many?" and "How much?"
9. The idea of proportion (to become) _____important when you (to know) _____three terms and (to want) _____ to find the fours.
10. The game (to continue), with two new players turning the cards.

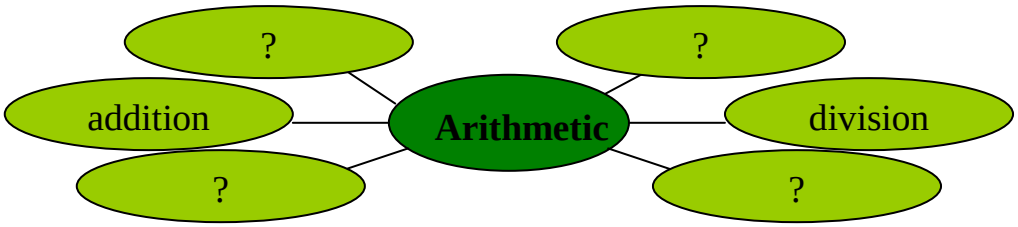
6. Use the correct form of Future Simple:

1. Using probability, a person can calculate the chances that three tossed coins (to turn) _____ all up heads.
2. Arithmetic helps farmers find how much lumber it (to take) _____to build a barn.
3. If you look at all the facts in which a number and 1 are added, you (to see) _____that learning them is something like ordinary counting.
4. With practice, adding two-place numbers and long columns (to be) _____easy.
5. Learning the 81 addition facts (to help) _____ you think the answers to addition problems.
6. Suppose you want to know how much six monitors (to cost) _____.
7. Often, understanding one of the meanings of fractions (to help) _____make understanding other uses easier.
8. A political scientist may gather data and use statistics to predict the percentage of voters who (to vote) _____for a particular candidate in an election.
9. Next time we (to speak) _____about the importance of mathematics.
10. Tomorrow we (to learn) _____some information about addition.

7. **Complete the chart with the missing verb forms:**

Infinitive	Past Simple	Past participle
speak		
	left	
		met
find		
	laid	
		worn
draw		
	kept	
		struck
grow		
	gave	
		written
show		
	got	

8. Complete the diagram trying to recall as much as possible about “Arithmetic”:



Read and Smile:

Teacher — "How many fingers have you?"
Bobbie — "Ten."
Teacher — "Well, if four were missing, what would you have then?"
Bobbie — "No music lessons."

Answer the questions:

a) Which answer did the teacher mean? Which sum did he want Bobbie to do?
b) Do you think Bobby was happy with his music lessons?

Notes on the topic studied:

Notes on the topic studied:

Unit Four

Task1. Answer such questions:

- What do you like to do better: add or subtract?
- Do you add by counting or by thinking? Which way is easier? Give your reasons.

Task 2. Read the phonetic transcription. Practise your pronunciation:

[ə'dıʃən] [saın] ['rekɔ:d] ['ədend] ['fıgə] [sʌm] ['kærı] ['sɔlv] [æd] ['a:nsə] ['kaunt] ['nʌmbə] [ˌæplı'keıʃən] [ə'rıθmətık] ['brækıt] [ıg'za:mpl] ['vælju:] [daıəgræm] ['desıməl] ['fækt] ['ælgərıðəm] [dı'skri:t] [dı'skri:t,mæθı'mætıks] ['meʒə] ['meʒəmənt] ['æŋgl] ['tʃek] [dı'gri:] ['i:kwəl] ['ri;'grupıŋ] ['kwɔntıtı] ['mınıt]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

addition, sign, figure, number, to carry, record, to count, addition facts, addends, sum, answer, boundary, short cuts, by thinking, the equals sign, total number, kind of record, value, counting on, regrouping, adding up, adding down, ordinary counting, thinking together, quantities, two-place numbers, to check addition, the idea of place value, to measure angles in degrees, minutes.

Task 4. Read the following international words and guess their meaning:

separate ['seprıt] *adj*, decimal ['desıməl] *adj*, indefinitely [ın'defınıtlı] *adv*, algorithm['ælgərıðəm] *n*, situation [ˌsıtju'eıʃən] *n*, procedure ['prə'sıdʒə] *n*, popular ['pɔpjulə] *adj*, double['dʌbl] *adj*, discrete [dı'skri:t] *adj*, visible ['vızəbl] *adj*, period ['pıərıəd] *n*, performance [pə'fɔ:məns] *n*, maximum ['mæksıməm] *n*

Task 5. Read the text and find some information about *addition facts:*

Addition

If you have the problem of finding the total number of objects in two or more groups, the solution to the problem is called addition. You may push the groups together and count the total number. In this way, you use counting to add. But this process is so clumsy and slow that people have invented short cuts. For example, if you put four apples together with three apples and find the sum, we record the process as **4 + 3 = 7**. Mathematicians call this an addition fact.

In order to do more complicated additions without counting, you must learn 81 facts like this. Some of them are easy, such as **2 + 3 = 5** and **2 + 1 = 3.** Some of the other addition facts are more difficult to learn, such as **9 + 8 = 17** and **9 + 9 = 18.**

Addition is a way of putting together two or more things to find out how many there are all together. Only like things can be added. This is, you cannot add apples and pencils together. Suppose you have a set of 5 apples and a set of 3 apples on a table:

Now put the sets together in a new set of 8 apples.

You add when you put together two or more sets to find out how many there are all together.

To find out how many things you have added to make a new set, you can count them or think them together.

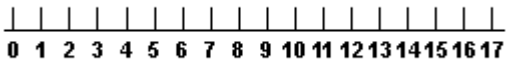
Addition by counting.

Suppose you have drawn 3 circles. Now draw 4 more circles next to the first 3.

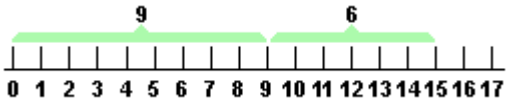
You know that there were already 3 circles. So you can think "3" and point to each of the 4 new circles, and count "4, 5, 6, 7." This is called counting on. You can find out how many 3 and 4 are together by thinking "3" for the first set, and counting on until you have counted the 4 circles in the second set. Counting on serves as a quicker way of adding things than counting them together.

Addition by thinking. Suppose there are 4 girls at the blackboard and 5 girls at the reading table. You find how many girls there are all together by thinking. For example, you could think: "I already know that 4 and 4 are 8, so 4 and 5 will be 1 more. That means that 4 and 5 are 9." Or, you could think: "4 girls and 5 girls are 9 girls." We call this thinking together. Thinking together is a quicker way of adding than counting together or counting on.

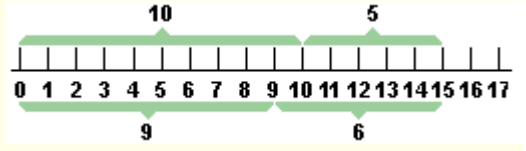
Regrouping. Suppose you want to put together two sets in a new set and the new set will be more than 10. For example, Nancy wanted to know how many 9 and 6 are. To find out, she drew a number line:



Then, she drew lines to show 9 and 6 as shown below:



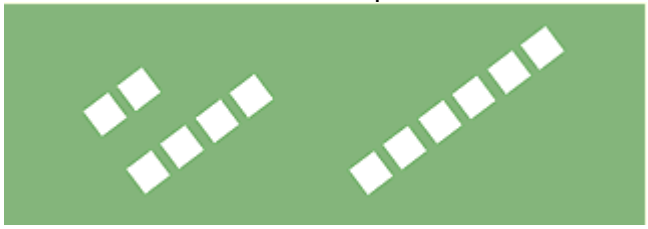
Nancy found out that 9 and 6 are 15. But she saw something interesting and drew two more lines:



Nancy found that 9 and 6 are the same as 10 and 5. It is easier for beginners to add 10 and 5 than it is to add 9 and 6. We call changing the sets 9 and 6 to the sets 5 and 10 regrouping

Writing addition. You should write down your addition problems, so you have a record of your counting or thinking.

You can make a record with pictures:



Or you can make a record with numbers and words:

2 and 4 are 6

But it is easiest and best to make a record with numbers and signs:

$2 + 4 = 6$ or $\begin{array}{r} 2 \\ 4 \\ \hline 6 \end{array}$

1. In the first example, the plus sign (+) tells you to add. You can read 2 + 4 as "two and four." The equals sign (=) means that the sets on one side of the sign are equal to the set on the other side of the sign. You can read 2 + 4 = 6 as "two and four are six." The second example shows how you write an addition problem when you want to work out the answer on paper. The two or more groups you want to put together, or add, are called **addends**. The new group is called the **sum.**

$\begin{array}{r} 2 \\ 4 \\ \hline 6 \end{array}$ ← *Addend* ← *Addend* ← *Sum*

Addition facts. By putting together sets, you have discovered that 5 + 3 = 8, 3 + 4 = 7, and 9 + 6 = 15. We call these addition facts. Each addition fact is made up of two addends and a sum. You can discover all the addition facts by putting together sets of things.

Adding larger numbers

You use the addition facts and the idea of place value to add larger numbers.

Adding 10's. Last week, Tom earned 2 dimes, or 20¢. This week, Tom earned 3 dimes, or 30¢. How much has Tom earned all together? You can find the answer by counting:

You find that Tom earned 5 dimes, or 50¢. You can find the answer by adding.

It is best to learn the addition facts so you can use them quickly and easily. You will be able to use them in your daily life. You will also need them to add larger numbers and solve problems.

Learning these addition facts looks like work at first. But there are several ways to make learning the facts easier. For instance, if you look at all the facts in which a number and 1 are added, you will see that learning them is something like ordinary counting. Also, many of the pairs of addends are just the reverse of each other. For example, 4 + 5 adds up to the same thing as 5 + 4. We call a fact like 3 + 3 = 6 a double. Knowing doubles is useful. If you know that 4 + 4 = 8, then 4 + 3 is 1 less than 8, and 4 + 5 is 1 more than 8.

Here is another example:

4	4 tens	40
2	2 tens	20
6	6 tens	60

You can see that 4 + 2 = 6, 4 tens + 2 tens = 6 tens, and 40 + 20 = 60. The 6 in the 60 shows six 10's because it is in the 10's place. You add 10's the same way you add 1's. But you must write the sum in the 10's place. And you must remember to write a zero in the 1's place to show that the sum is 10's, not 1's.

Here is a third example:

8	8 tens	80
9	9 tens	90
17	17 tens	170

Here the sum of the 10's is seventeen 10's. Seventeen 10's is the same as ten 10's and seven 10's. But ten 10's is 100. So you must write the sum in the 10's and 100's places, and write in a zero to show that the answer is one 100, seven 10's, and no 1's.

When there are several addends, we often speak of the 1's, 10's, and 100's as columns. When you add columns, you must learn to think the additions. At first it may help to keep some kind of record.

22 31 45 98	1's	Think: 2 + 1 = 3. 3 + 5 = 8. Write: 8 in the 1's place.
	10's	Think: 2 tens + 3 tens = 5 tens. 5 tens + 4 tens = 9 tens. Write: 9 in the 10's place.

With practice, adding two-place numbers and long columns will be easy.

How to carry. When you add two-place numbers, the sum of the 1's column is often 10 or more. To add such numbers, you must learn to carry.

Here is an example of carrying:

45 27 2	1's	Think: Five 1's and seven 1's are twelve 1's: 5 + 7 = 12. Twelve is one 10 and two 1's. Write: 2 in the 1's place.
	Carry	From the 1's column, there is a 10 to be added to the 10's column. Write a 1 for the one 10 at the top of the 10's column. This is what *carrying* means.
45 27 72	10's	Think: One 10 + four 10's + 2 10's = seven 10's. 1 + 4 + 2 = 7. Write: 7 in the 10's place.

Checking addition

Good workers always check their addition to see if they have made any mistakes. There are several ways to check addition.

Adding up. You have learned to add a column of figures by starting at the top and adding down. After you have written the sum, you can check your answer by adding up. That is, starting at the bottom of the column and adding up to the top. Here is an example:

		CHECK
21 34 42 97	1's	2 + 4 = 6. 6 + 1 = 7.
	10's	4 + 3 = 7. 7 + 2 = 9.

If you get the same answer adding up as you did adding down, your answer is probably right.

Addition rules to remember

1. Remember what addition means. You can find the answers to addition problems by counting. But it is quicker and easier to think the answers.
2. Learning the 81 addition facts will help you think the answers to addition problems.
3. You can put the addends in any order without changing the sum of the equation. For example, 3 + 2 + 7 = 12, 2 + 7 + 3 = 12, and 7 + 3 + 2 = 12.
4. You can add only quantities of the same kind. That is, you must add 1's to 1's and 10's to 10's, and be careful not to mix them up.

Glossary:

sign [saɪn] *n* – знак
record ['rek ɔ:d] *n* – запис; *v* – записувати
check ['tʃek] *v* – перевіряти
regrouping ['ri;'gruрɪŋ] *n* – перегрупування
addend ['ədend] *n* – доданок
figure ['fɪgə] *n* – цифра
add [æd] *v* – додавати
count ['kaunt] *v* – підраховувати
sum [sʌm] *n* – сума
carry ['kærɪ] *v* – переносити
solve ['sɔlv] *v* – вирішувати, розв'язувати
example [ɪg'za:mpl] *n* – приклад, зразок
value ['vælju:] *n* – величина, значення
fact ['fækt] *n* – дія

Exercises

1. Explain the meanings of the following words and expressions from the text. Make sentences with each of them:

addition facts

_____

adding up

_____

adding down

_____

adding two-place numbers

_____

Work in pairs

2. Ask and answer the following questions:

1. How much is 120 plus 205? _____
2. How much is 28 plus 39? _____
3. How much is 287 plus 154? _____
4. How much is 99 plus 26? _____
5. How much is 878 plus 523? _____
6. How much is 77 plus 55? _____

3. Read the following phrases of Aristotle and say how they sound to you (categorical, wise, philosophic, logical, joyful, paradoxical, absurd). Explain your choice.

- Now what is characteristic of any nature is that which is best for it and gives most joy. Such a man is the life according to reason, since it is that which makes him man.
- There is nothing strange in the circle being the origin of any and every marvel.
- It is not once nor twice but times without number that the same ideas make their appearance in the world.
- The chief forms of beauty are order and symmetry and definiteness, which the mathematical sciences demonstrate in a special degree.

4. Express your agreement or disagreement with the following statements. If you disagree, say why.

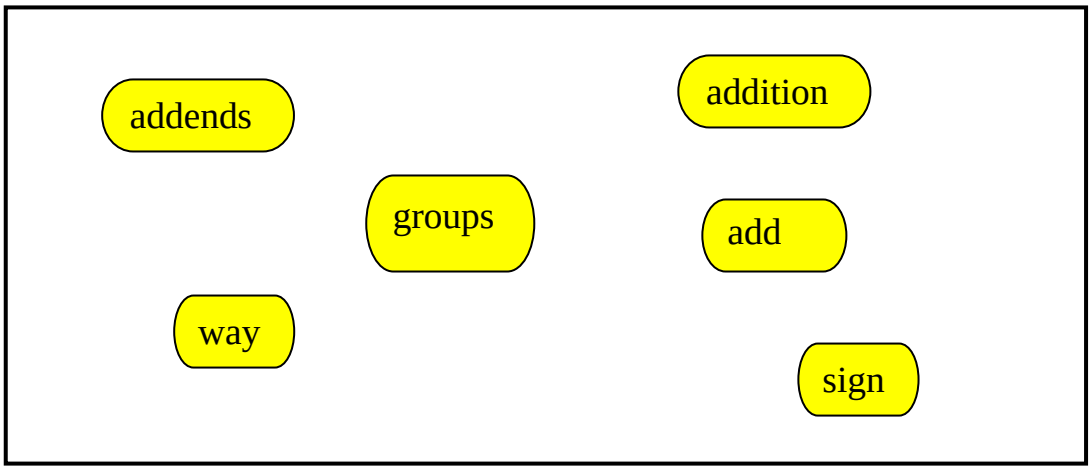
1. Each addition fact is made up of three addends and a sum.
2. The two or more groups you want to put together, or add, are called addends.
3. If you have the problem of finding the total number of objects in two or more groups, the solution to the problem is called division.
4. It is best to learn the addition facts so you can use them quickly and easily.
5. There is the only way to check addition.

5. Dictate to each other the following cardinal numerals:

- **3; 13; 30; 4; 14; 40; 5; 15; 50; 2; 12; 20; 8; 18; 80.**
- **21; 82; 35; 44; 33; 55; 96; 67; 79; 41; 53; 22.**
- **143; 258; 414; 331; 972; 205; 101; 557; 999; 313.**
- **1,582; 7,111; 3,013; 5,612; 2,003; 9,444; 4040.**
- **15,500; 57,837; 45,971; 92,017; 65,331; 11,443.**
- **235,142; 978,218; 106,008; 321,103; 627,344; 552,331.**
- **1,352,846; 4,125,963; 35,756,394, 257,382,761.**

Practise saying the following numerals in groups.

6. Complete the sentences with one of the words in box. Compare your answers.



1. When you ____ columns, you must learn to think the additions.
2. Thinking together is a quicker ____ of adding than counting together or counting on.
3. There are several ways to check_____.
4. Each addition fact is made up of two _____ and a sum.
5. The equals sign (=) means that the sets on one side of the sign are equal to the set on the other side of the ____.
6. The two or more _____ you want to put together, or add, are called addends.

7. Make up 2 sentences of your own using the words and expressions given below:
to find the answer by counting, to find the answer by adding, counting together
Discuss the sentences together, then tell others in your group what you think.

_____
_____
_____
_____
_____

8. Translate into Ukrainian. Compare your translation in groups.

1. Scholars have translated clay tablets that show that the Babylonians were highly skilled in arithmetic and astronomy more than 4,000 years ago. They developed the system we use today to measure angles in degrees, minutes, and seconds. Because there are 60 seconds in a minute and 60 minutes in an hour, this system is based on tens up to 60, and on sixties from there on.
2. The clay tablets also show that 2,400 years ago the Babylonians had a symbol for zero, and another symbol that worked in the same way as the decimal point. Although we inherited the idea of sixties for time and angles, the Babylonian idea of place value was lost until the Hindus rediscovered it.

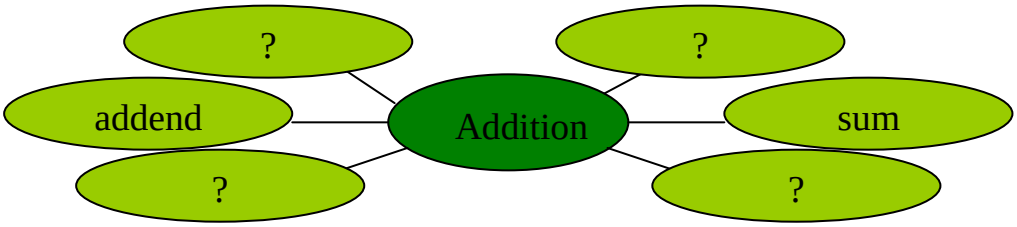
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Discuss in pairs

9. Are the following statements True (v) or False (x)? Correct the false ones.

	T	F
You use the addition facts and the idea of place value to add larger letters.		
The numbers to be added are called the difference.		
The result of additions of numbers is called the sum or total of the numbers.		
Only unlike things can be added.		
In adding a series of numbers, begin with the column at the right.		

10. How much do you remember about addition? Complete the diagram to refresh your knowledge.



Check your grammar

1. Complete the sentences with prepositions:

- ≈ Statistics is the branch … mathematics concerned … the collection and analysis … large bodies… of data to identify trends and overall patterns (of, of, of, with).
- ≈ The study … sets is important … investigating most basic mathematical concepts (in, of).
- ≈ Many mathematicians … a doctor's degree teach … colleges and universities (at, with).
- ≈ You can solve the first type … problems … counting objects (by, of).
- ≈ You can do this kind … checking …your head, or … mental arithmetic (in, by, of).
- ≈ You have learned to add a column … figures … starting … the top and adding … (down, at, of, by).
- ≈ After you have written the sum, you can check your answer … adding … (up, by).
- ≈ You can put the addends … any order … changing the sum … the equation (in, of, without).
- ≈ Fractions are written … numerical form as two numerals separated … a line (by, in).
- ≈ The terms … geometry fall … two categories: undefined and defined (into, of).

2. Translate the following phrases and sentences:

а) багато помилок, мало користі, багато роботи, багато людей, багато читати, мало рівнянь, мало слів, багато проблем, багато прикладів, мало зусиль, мало досвіду, багато знань, багато доданків;

_____

_____

_____

b) 1. Скільки задач ти вирішив? Не дуже багато.
2. Мало студентів можуть вирішити це рівняння. Воно потребує багато терпіння.
3. У мене було небагато часу для підготовки до заліку.
4. Ти говориш англійською? Так, я трохи знаю англійську та достатньо добре розмовляю італійською.

_____

_____

_____

_____

_____

3. What is the Past Simple and Past Participle of the following verbs:

make	…	…
be	…	…
do	…	…
include	…	…
study	…	…
know	…	…
give	…	…
lie	…	…
count	…	…
call	…	…

4. Use the correct form of Past Simple:

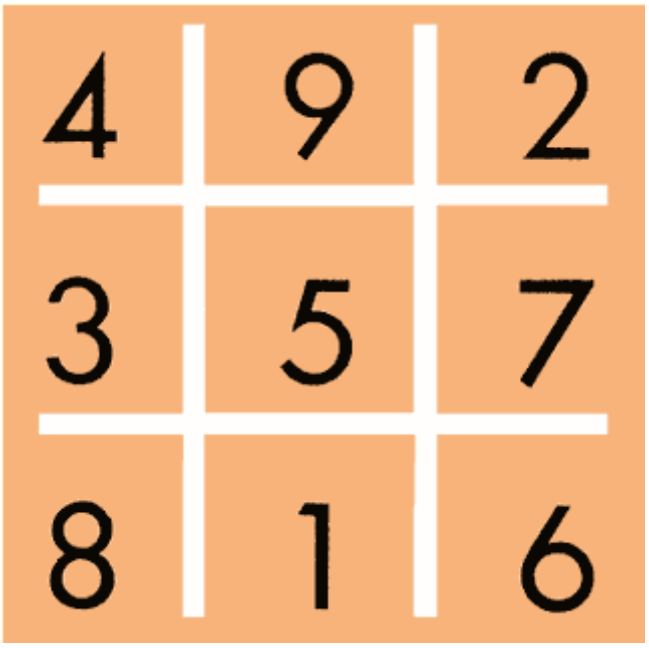
1. According to tradition, one of the first to provide mathematical proofs based on deduction (to be) _____ the philosopher Thales.
2. He (to work) _____ in geometry about 600 B.C.
3. The Greek philosopher Pyphagoras (to live) _____about 550 B.C.
4. Jacob's brother Johann also (to work) _____in analytic geometry and physics.
5. What (to accomplish) _____Euclid in his book the Elements?
6. The Greeks (to have) _____two systems.
7. The Babylonians (to develop) _____ the system we use today to measure angles in degrees, minutes, and seconds.
8. The Babylonian idea of place value was lost until the Hindus (to rediscover) _____it.
9. Who (to invent) _____ our present-day numeral system?
10. The Hindus (not to bring) _____the numeral system to Europe.

Fun with addition

Two winks. Make a pack of 20 cards on which the numbers from 1 to 10 have been written. Make two cards for each number. Divide the pack of cards into two piles, and put one pile face down in front of each player. The first player turns a card and holds it up for both players to see. The second player does the same thing from the other pile of cards. The player who first sees that the sum of the numbers on the two cards is 10 or more calls out "Two winks!" Then, that player takes the two cards. If the two cards do not equal 10 or more, the players put them back in the piles. The game continues, with two new players turning the cards. When all of the cards have been turned, the player with the most cards wins.

Tick-tack-toe puzzle

Each player draws a tick-tack-toe figure on a piece of paper.



Then, each tries to fill in the spaces with the numbers from 1 to 9, so that if three numbers are added across, up and down, or diagonally the sums will be 15. The player must use each number from 1 to 9. The first player with the correct answer wins.

Notes on the topic studied:

Notes on the topic studied:

Unit Five

Task 1. Answer such questions:

- Do the subtraction:

6 – 3= …	21 – 9= …
5 – 1= …	40 – 13= …
45 – 45= …	98 – 76=…

Task 2. Read the phonetic transcription. Practise your pronunciation:

[ˌsəb'trækʃən] ['sʌbtrəhənd] ['mɪnjuənd] ['dɪfrəns] [rɪ'meɪndə] ['estɪmɪt] ['ri:znəbl] ['zɪərəu] [ə'dɪʃən] [saɪn] ['rekɔ:d] ['ədend] ['fɪgə] [sʌm] ['kærɪ] ['sɔlv] [æd] ['a:nsə] ['kaunt] ['nʌmbə]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

subtraction**,** remainder, subtrahend, minuend, difference, exact answer, to compare, to estimate, quantities, reasonable, subtraction problem, to subtract by thinking, to take away, signs, to find the answer, zero, to solve problems, sets of things, to find the difference, to add the subtrahend and the remainder, to subtract the remainder from the minuend.

Task 4. Read the following international words and guess their meaning:

hemisphere ['hemɪsfɪə] *n*, instrument ['ɪnstrumənt] *n*, hyperbola[hɑɪ'pəbələ] *n*, isolate ['aɪsəleɪt] *n*, prism ['prɪzm] *n*, pentagon['pentəgən] *n*, report [rɪ'pɔ:t] *n*, resolution[ˌrezə'lu:ʃən] *n*, transmission [trænz'mɪʃən] *n* , transport ['trænspɔ:t] *n*, vacant ['veɪkənt] *adj*, transform [træns'fɔ:m] *v*, stable['steɪbl] *adj*, constant['kɔnstənt] *n*, constantly['kɔnstəntlɪ] *adv*

Task 5. Read the text and complete this sentence:

- Subtraction answers such questions:

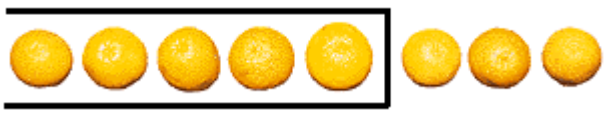
- how…
- what…
- how…

Subtraction

Subtraction is a way of taking away a number of things from a larger number. You take them away to find how many things are left. Only like things can be subtracted. That is, you cannot subtract apples from pencils.

Suppose you have a set of 8 oranges.

Suppose you want to take away a set of 5 oranges.



You find that you have 3 oranges left.

A question such as "3 from 6 is how many?" is a subtraction problem. To find out how many things are left in a subtraction problem, you can count or find the answer by thinking.

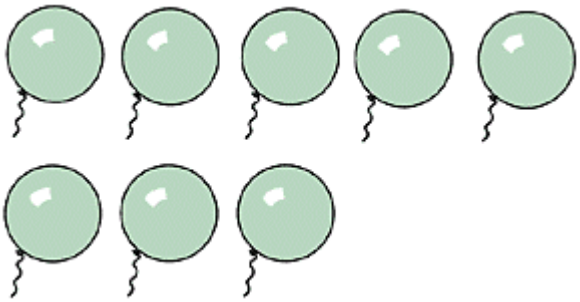
Subtraction by counting. Here are two groups of chocolate cupcakes.

How many cupcakes are there in the first group? Count them. There are 6 cupcakes in the first group. Mary took 3 cupcakes from the second group. How many cupcakes are left in the second group? Count them. There are 3 cupcakes left. You counted to find how many cupcakes are left if you take 3 from 6. You discovered that 3 taken from 6 leaves 3.

Subtraction by thinking. Tommy has 5 pennies.

He wants to spend 2 pennies for a pencil. How many pennies will Tommy have left? Cover 2 pennies in the picture. You should be able to tell how many pennies are left by just looking at the picture, without counting. You should learn to think "2 from 5 leaves 3." This article will show you the facts you need to know to subtract by thinking. Thinking the answer is a quicker way of subtracting than counting.

Subtraction questions. Subtraction tells you how many things are left when you take away one set of things from another. It also lets you compare two sets of things. Suppose Mary has 5 balloons and Sue has 3 balloons.



To compare the two sets of balloons, you must find the difference between the two sets. You can find the difference by subtracting. When you subtract 3 from 5, you discover that the difference between the two sets is 2 balloons, or 2.

Writing subtraction. It is best to write your subtraction problems and their answers. This gives you a record of your thinking.

You can make a record with pictures.

The picture shows that 3 taken from 5 leaves 2.

You can write this in numbers and words:

3 from 5 leaves 2

But you must learn to write with numbers and signs:

5 - 3 = 2

The - sign means to subtract or take away. So 5 - 3 means "3 taken from 5." We call the - sign the minus sign, and read 5 - 3 as "5 minus 3." The = sign means that the sets on one side of the = sign are equal to the sets on the other side. Here is how it works:

There is another way to use numerals and signs.

$$\begin{array}{r} 5 \\ -\,3 \\ \hline 2 \end{array}$$

Each part of a subtraction problem has a name. When we are subtracting to find out how many things are left, we call the answer the remainder. When we are subtracting to compare two groups or to find how many more things are needed, we call the answer the difference. We call the number being taken away or subtracted the subtrahend. The number from which the subtrahend is taken is called the minuend.

5	*Minuend*
- 3	*Subtrahend*
2	*Remainder or Difference*

Subtraction facts. By subtracting one group from another, you discover that 8 - 5 = 3, 6 - 3 = 3, and 12 - 5 = 7. We call these subtraction facts.

Each subtraction fact consists of a minuend, a subtrahend, and a remainder, or difference. You can discover each subtraction fact for yourself by counting and taking away one set of things from another.

Subtracting larger numbers

Subtracting larger numbers is not difficult, if you know the subtraction facts and understand the number system.

Subtracting 10's and 100's. Suppose you have 5 dimes. This is the same as 50¢. Suppose you want to spend 3 dimes on a book. This is the same as 30¢. How much money will you have left? The problem is 5 dimes - 3 dimes or 50¢ - 30¢. You can find the answer by counting.

You can also find the answer by using the subtraction facts and thinking.

5 dimes	50¢
- 3 dimes	- 30¢
2 dimes	20¢

If you know that 5 - 3 = 2, you can see that 3 dimes taken from 5 dimes leaves 2 dimes. A dime is 10¢, so you can see that 50 - 30 = 20. The subtraction fact 5 - 3 = 2 helps you find the answer. You subtract 10's the same way that you subtract 1's. But you must write the remainder in the 10's place. And you must remember to write in a zero to show that the remainder is 10's, not 1's.

Checking subtraction

You should always check your work in subtraction to make sure that you have done it correctly.

Checking by subtraction. One way to check a subtraction problem is to subtract the remainder from the minuend.

Problem		Check	
628	Minuend	628	Minuend
- 361	Subtrahend	- 267	Remainder
267	Remainder	361	

The new remainder should be the same as the old subtrahend. This checks your work.

Checking by addition. A good way to check subtraction problems is by addition, because addition is the opposite of subtraction. You add the subtrahend and the remainder.

Problem		Check	
628	Minuend	361	Minuend
- 361	Subtrahend	+ 267	Remainder
267	Remainder	628	

The sum of the addition should be the same as the old minuend in the subtraction problem.

Estimating helps you know if your answer is reasonable. Try to estimate the answer before you work the problem. Here is an example:

476
- 254
222

ESTIMATING

(Think)

476 is about 475.
254 is about 250.
475 is 400 and 75.
250 is 200 and 50.
75 - 50 is 25.
400 - 200 is 200.
The answer should be about 225.

This is almost the exact answer. You can estimate in larger numbers. For example, 476 is about 500, and 254 is about 250. Subtracting 500 - 250 gives you 250. This gives you a good idea of what the answer should be. Estimating the answer before you work a problem will save you time if you make a mistake, because you know about what the answer should be.

Subtraction rules to remember

Here are six rules that will help you solve subtraction problems:

1. Remember what subtraction means. You can find the answers to subtraction problems by counting. But it is quicker and easier to think the answers.
2. Learning the subtraction facts will help you think the answers to subtraction problems quickly.
3. Subtraction is the opposite of addition. Because of this, addition will help you learn the subtraction facts and check problems.
4. The subtraction facts help you subtract larger numbers to solve problems.
5. You can only subtract quantities of the same kind. That is, you must subtract 1's from 1's and 10's from 10's.
6. Subtraction answers three kinds of questions: how many are left, what is the difference, and how many more are needed.

Glossary:

subtraction [ˌsəb'trækʃən] *n* – віднімання
subtrahend ['sʌbtrəhənd] *n* – від'ємник
minuend ['mɪnjuənd] *n* – зменшуване
difference ['dɪfrəns] *n* – різниця
remainder [rɪ'meɪndə] *n* – залишок
estimate ['estɪmɪt] *n* – оцінка; *v* – оцінювати, підраховувати приблизно
reasonable ['ri:znəbl] *adj* – раціональний, розумний, коректний

Exercises
Work in pairs

1. Ask and answer the following questions:

1. How much is 200 minus 45? _____
2. How much is 63 minus 19? _____
3. How much is 56 minus 36? _____
4. How much is 398 minus 123? _____
5. How much is 571 minus 167? _____
6. How much is 323minus 299? _____

2. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. The number from which the subtrahend is taken is called the dividend.
2. Subtracting larger numbers is not difficult, if you know the subtraction facts and understand the number system.
3. It is best to write your subtraction problems and their answers.
4. A good way to check subtraction problems is by multiplication.

3. Read and write the following ordinal numerals from the following cardinal. Compare your lists.

- **7; 4; 8; 9; 5; 12; 1; 13; 11; 10**

_____

- **20; 21; 30; 32; 40; 43; 50; 54; 60; 75; 98**

_____

- **100; 120; 125; 200; 230; 231; 300; 450; 563; 892**

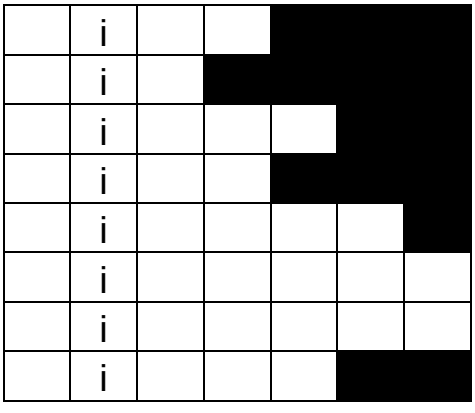
_____

4. Make up 4 sentences of your own using the words and expressions given below:
subtraction facts, opposite of subtraction, by using, to check a subtraction problem, numbers and signs

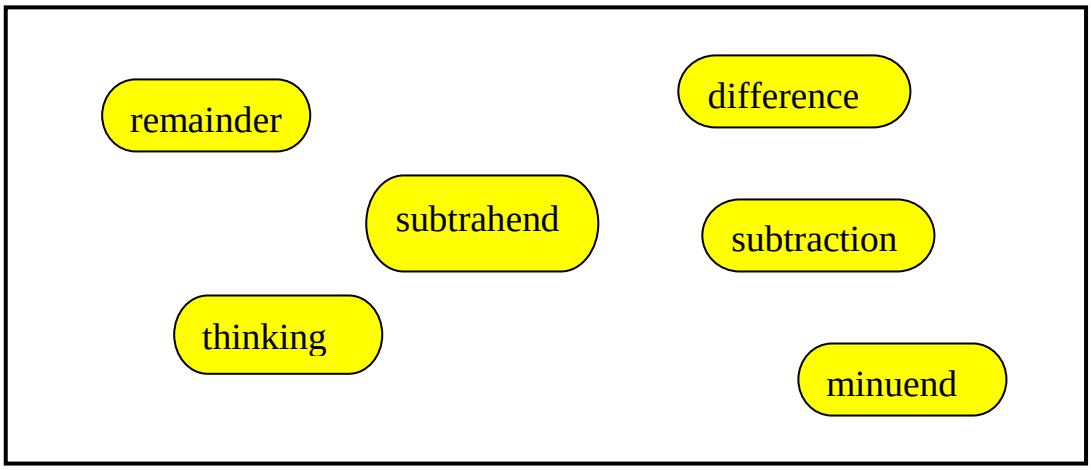
_____
_____
_____
_____
_____
_____

Discuss the sentences together, then tell others in your group what you think.

5. Complete each word to give the correct number. Compare your answers in groups.



6. Complete the sentences with one of the words in box. Check your answers in pairs.



1. When we are subtracting to find out how many things are left, we call the answer the _____.
2. When we are subtracting to compare two groups or to find how many more things are needed, we call the answer the _____.
3. We call the number being taken away or subtracted the _____.
4. _____ the answer is a quicker way of subtracting than counting.
5. _____ tells you how many things are left when you take away one set of things from another.
6. One way to check a subtraction problem is to subtract the remainder from the _____.

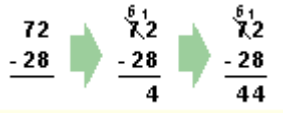
7. Match a line in A with a line in B

A	B
Estimating	➢ a minuend, a subtrahend, and a remainder, or difference.
The - sign means	➢ is a way of taking away a number of things from a larger number.
The = sign	➢ helps you know if your answer is reasonable.
The number from which the subtrahend is taken	➢ to subtract or take away.
Each subtraction fact consists of	➢ that the sets on one side of the = sign are equal to the sets on the other side.
Subtraction	➢ is called the minuend.

- Compare your answers.

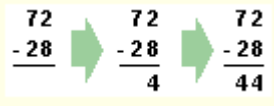
8. Translate into Ukrainian. Compare your translations in groups.

There are several ways of thinking out a subtraction problem. The method we have used is called the "take-away-borrow" method. Here is another example:



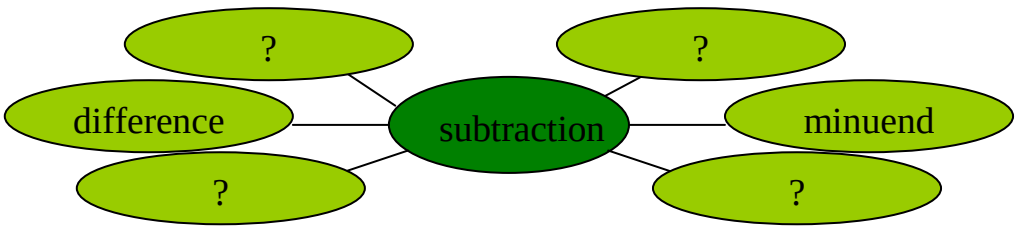
First, you see that you cannot take eight 1's from two 1's. You borrow a 10, making the minuend six 10's and twelve 1's. Then you subtract eight 1's from twelve 1's: 12 - 8 = 4. You write the 4 in the 1's place in the answer. Next you subtract two 10's from six 10's: 6 - 2 = 4. You write the 4 in the 10's place in the answer.

Another method is called the "addition-borrow" method.



The numbers are the same as in the "take-away-borrow" method, but the thinking is different. You see that you cannot take eight 1's from two 1's, and borrow a 10. Instead of subtracting eight 1's from twelve 1's, you think "what added to 8 makes 12?" You know that 8 + 4 = 12, so you write the 4 in the 1's place in the answer. Instead of subtracting two 10's from six 10's, you think "what added to 2 makes 6?" You know that 2 + 4 = 6, so you write the 4 in the 10's place in the answer.

9. What associates with the word "subtraction"? Complete the diagram.



Check your grammar

1. Give nouns to such adjectives:

long – _____
wide – _____
high – _____
easy – _____
heavy – _____
important – _____
round – _____

2. Translate the sentences using the appropriate pronouns:

1. У мене немає жодної ідеї.
2. Ця задача не дуже складна, проте ніхто не може її розв'язати.
3. Я сподіваюсь отримати якусь інформацію.
4. Ми не розраховуємо на чиюсь допомогу.
5. Хтось повинен вирішити цю проблему?
6. Деякі математичні задачі потребують більш досконалих знань для вирішення.
7. Ніякі зусилля не допомогли їм.

_____
_____
_____
_____
_____
_____
_____

3. Choose the correct tense (use Present, Past or Future Progressive**):**

1. We (work) _____at the laboratory the whole week.
2. They (solve) _____ these problems at 6.00 in the evening.
3. I (study) _____English during the summer of 2007.
4. My college (return) _____from Europe in September.
5. Her son (travel) _____ about the country next year.
6. For the last four months we (work) _____hard.
7. I (go) _____in a few weeks' time.
8. Why you (hurry) _____?
9. What you (do) _____this morning?
10. Your friends (wait) _____for you.

4. Translate the following sentences:

1. Подивись, студенти працюють в комп'ютерному класі.

_____

2. Наступного року він збирається закінчити навчання в магістратурі.

_____

3. Минулого тижня він готувався до іспиту.

_____

4. Він приїде завтра вранці.

_____

5. Не розумію, чому ти не дивишся телебачення.

_____

6. Ми обговорили всі питання, коли зустрічалися вчора ввечері.

_____

7. Поки я виконувала домашнє завдання, моя мама приготувала вечерю.

_____

8. Про що ти зараз думаєш? Чому ти не відповідаєш на мої запитання?

_____

5. Ask questions to which the following sentences are the answers:

1. He found the whole system relatively simple.

_____

2. Both members of the equation name the same number.

_____

3. This is the closure property.

_____

4. Our teacher gave us the general idea.

_____

5. This definition is true.

_____

6. I was thinking about her when she came.

_____

7. Usually, from 4 till 7 o'clock in the evening the students are working in the library.

_____

8. He showed the result of his work.

_____

Fun with subtraction

You know many games that can be played with the addition, multiplication, and division facts can be changed a little for the subtraction facts.

To play a game called More or Less, make a pack of 36 cards. Write the numbers from 1 to 18 separately on two sets of cards. There will be two cards for each number. Shuffle the cards and place the pile facedown. The leader of the game takes the first card and holds it up for the players to see. Suppose it is 14. The first player takes a card from the pile and shows it. Suppose it is 6. The player compares it with the 14 card and says "It is less." Then he must tell how much less. In this case, the player would say "It is 8 less than 14." He must find the answer by thinking the subtraction. Suppose the next player turns up 17. She compares it with the first card. She must say "It is more. It is 3 more than 14." A player who gives the wrong answer is out of the game. When you have gone through the cards once, you can mix them up and play again with new numbers.

Notes on the topic studied:

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Unit Six

Task 1. Answer the following questions:

- Do you know the symbol of multiplication?
- What is the result of multiplication called?
- What are the numbers to be multiplied called?
- Do you know multiplication table? Let's check:

6 x 5=…
5 x 5=…
3 x 8=….
6 x 7=….

7 x 8=…
9 x 8=…
4 x 7=…
9 x 5=….

Task 2. Read the phonetic transcription. Practise your pronunciation:

[ˌmʌltɪplɪ'keɪʃən] ['mʌltɪplaəɪ] [ˌmʌltɪplɪ'kænd] ['prɔdʌkt] ['steɪtmənt] [ˌmʌltɪplɪ'keɪʃən'fækt] ['ɔ:də] [ˌkɔmbɪ'neɪʃ(ə)n] ['mʌltɪplaɪ] [dɪs'kʌvə] ['sɪmɪlə] ['pa:ʃəl] ['pa:ʃəl 'prɔdʌkt] ['zɪərəu]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

multiplication, multiplier, product, single digit, partial product, multiplicand, zero, combination, similar, order, statement, multiplication by memorizing, to discover the multiplication facts, the same number, addition, subtraction, division, equal numbers, the commutative property of multiplication, to illustrate, to recall the facts quickly.

Task 4. Read the following international words and guess their meaning:

absolute['æbsəlu:t] *adv*, result [rɪ'zʌlt:] *n*, video ['vɪdɪəu] *n*, example [ɪg'za:mpl] *n*, abbreviation [ə,bri:vɪ'eɪʃən] *n*, categorize ['kætɪg(ə)raɪz]*v*, plus ['plʌs] *n*, basic['beɪsɪs] *n*, minus ['maɪnəs] *n*, spiral['spaɪərəl] *n*, personal ['pə:snl] *adj*, computer [kəm'pju:tə] *n*, contact ['kɔntækt] *n*, finish ['fɪnɪʃ] *v*

Task 5. Read the text and find *definitions* of such words:

multiplicand – …
multiplier – …
product – …

Multiplication

Multiplication is a short way of adding or counting equal numbers. Multiplication is one of the four basic operations in arithmetic along with addition, subtraction, and division.

Suppose you want to know how much six gumballs will cost. The gumballs are 5cents each. You can find the answer by addition: 5 + 5 + 5 + 5 + 5 + 5 = 30. Six gumballs will cost 30 cents. However, it is easier to learn that six 5's are 30. Learning facts like this is the basis of multiplication.

Many people learn multiplication only by memorizing its facts and rules. Often people do not understand the methods that they are using. The best way to learn how to multiply is to find out how multiplication works.

Writing multiplication. Operations in arithmetic are shown by symbols. The symbol of multiplication is **X.** The statement 6 X 5 = 30 means "six 5's are 30." People also say, "5 multiplied by 6 is 30," or they can say "6 times 5 is 30."

The number that is being multiplied, or added together a number of times, is called the multiplicand. The number that does the multiplying, or the number of multiplicands to be added,

is called the multiplier. The result, or answer, is called the product. A multiplication problem is usually written like this:

5	*Multiplicand*
x 6	*Multiplier*
30	*Product*

Multiplication facts. A statement such as 6 X 5 = 30 is a multiplication fact. It consists of a multiplier, a multiplicand, and a product. You should use addition to discover the multiplication facts. For example, 5 + 5 + 5 + 5 + 5 + 5 = 30. After discovering a multiplication fact, you should memorize it. By knowing the 100 multiplication facts, you can learn to multiply any numbers.

The two boxes of eggs shown below illustrate an important rule in multiplication. Each box contains 12 eggs. You can look at the box of eggs at the left in two ways. You might say that there are six rows of eggs with two eggs in each row. Or, you could say that there are two rows of eggs with six eggs in each row.

You can also look at the box of eggs at the right in two ways. You might say that there are four rows of eggs with three eggs in each row. Or, you could say that there are three rows of eggs with four eggs in each row. The multiplication facts that show this are:

6 X 2 = 12
2 X 6 = 12
4 X 3 = 12
3 X 4 = 12

The examples of the boxes of eggs illustrate that numbers can be multiplied in any order, which is known as the commutative property of multiplication. The products will always be the same. Knowing this rule cuts down the number of multiplication facts to be learned from 100 to 55.

Multiplying by one digit

Any number from 0 to 9 is called a digit. The number 26 is a two-digit number. The number 514 is a three-digit number. A digit gets its value from the place it occupies in a number. The first place on the right is for 1's, the next to the left is for 10's, the next for 100's, and so on. For example, in the number 347, the 3 means three 100's, the 4 means four 10's, and the 7 means seven 1's. Depending on its place, the digit 2 may mean two 1's, (2), two 10's (20), two 100's (200), or two 1,000's (2,000).

Here is an example of the steps needed to work a multiplication problem using more than one multiplication fact. There are 32 students in a class. Each student uses one sheet of paper a day. How many sheets of paper will be needed for three days? We could solve the problem by using addition: 32 + 32 + 32 = 96. The class will need 96 sheets of paper for three days. Multiplication is quicker and easier. The number 32 is three 10's and two 1's. The basic idea is to multiply first the 1's by 3 and then the 10's.

32
x 3
96

First, you multiply the two 1's by 3. This is 3 X 2 = 6. You write the 6 in the 1's place in the product. Next, you multiply the three 10's by 3. This is 3 X 30 = 90. The 90 is nine 10's, and you write the 9 in the 10's place in the product. The answer is 96.

You multiply a larger number by one digit in much the same way:

```
  302
x   4
------
 1208
```

First, you multiply the two 1's by 4. This is 4 X 2 = 8. You write the 8 in the 1's place in the product. Next, you multiply the 0 or "no" 10's by 4. This is 4 X 0 = 0. You write the 0 in the 10's place in the product. Then you multiply the three 100's. This is 4 + 300 = 1,200. You write the 12 in the 100's and 1,000's place in the product. The answer is 1,208.

When you multiply a large number by one digit, you must multiply each digit of the larger number-the 1's, 10's, 100's, 1,000's, and so on--one at a time. As you multiply, write down the products of each of these multiplications--the 1's, 10's, 100's, 1,000's, and so on.

How to carry in multiplication

Students learn how to "carry" when they learn addition. When you add several numbers, there may be a 10 in the sum of the 1's column. You carry or add this 10 to the 10's column, usually by writing a small 1 above the 10's column. Carrying in multiplication is similar to carrying in addition:

Addition

```
  1
  12
  12
  12
  12
  12
  12
  12
+ 12
----
  96
```

```
  1
  12
x 8
----
 96
```

When you add the eight 12's, the eight 2's total 16, or one 10 and six 1's. You write the six 1's in the 1's place in the sum. You add the 10 to the column of eight 10's by writing a 1 at the top of that column. Adding the 1's in the 10's column gives you nine 10's. You write nine 10's in the 10's place in the sum. To multiply 8 X 12, you multiply the 1's first. This is 8 X 2 = 16. You write the six 1's in the 1's place in the product. You write a 1 to be added to the product of 8 X 1 in the 10's place. This is 8 X 1 = 8 and 8 + 1 = 9. You write the nine 10's in the 10's place in the product. Be sure to multiply first. Then add the "carry number" to the product.

Multiplying by large numbers

A multiplier that has more than one digit introduces a new idea in multiplication. This idea is the use of the partial product. You can learn this idea best from an example.

Jim wants to know how many cartons of milk his school used last month. It used 312 cartons each day for 23 days.

```
  312
x  23
-----
  936   <-- Partial Product
 624    <-- Partial Product
-----
 7176    Product
```

First, you multiply 312 by the three 1's. This is 3 X 2 = 6. You write the 6 in the 1's place in the product. Then, 3 X 1 = 3 and 3 X 3 = 9. You write the 3 and the 9 in the 10's and 100's places in the product. This product of 3 X 312 is a partial product. Next, you multiply 312 by the two 10's. You write the product of this multiplication below the first product. You start this new partial product one place to the left, in the 10's place, because 312 is now being multiplied by 10's, not by 1's. First, 2 X 2 = 4. This is four 10's. You write the 4 below the 10's place in the first product. Next, 2 X 1 = 2 and 2 X 3 = 6. You write the 2 and the 6 in the 100's and 1,000's places of the second partial product. Now, the two partial products must be added together. The first partial product is 3 X 312 or 936. The second partial product is 20 X 312 or 6,240. Thus, 936 + 6,24 = 7,176. The answer is that the school uses 7,176 cartons of milk in 23 days.

Multiplying by zero

Zeros in combination with other digits represent 10's, 100's, 1,000's, and so on. When there are zeros in a multiplier, you can shorten the work of multiplication.

```
  14        14
x 20      x 20
  00       280
 28
280
```

In the example at the right, you can see that there will be no 1's in the 1's place. So you can write a 0 to show the 1's place, and write the product of the two 10's on the same line. This shortens the work. When you use this method with a three-digit multiplier that ends in zero, the difficulty comes in placing the second partial product:

```
  214
x 320
 4280
642
68480
```

You begin the second partial product in the 100's place, because 3 represents 100's. Always check the place of the multiplier when you write its partial product.

An easy way to multiply by 10, 100, 1,000, and other multiples of 10 is to annex zeros. This means to place zeros at the end of a number.

10 X 2 = 20

100 X 2 = 200

1,000 X 2 = 2,000

How to check multiplication

You should always check the answer in multiplication to be sure you have solved the problem correctly. You have seen that numbers can be multiplied in any order and the product remains the same. For example, 2 X 4 = 8 and 4 X 2 = 8. The best way to check a product is to change the places of the multiplier and multiplicand and do the multiplication again.

```
  15      12        342      153
x 12    x 15      x 153    x 342
  30      60       1026      306
 15      12       1710      612
180     180        342      459
                  52326    52326
```

The products are the same, but the partial products are different. If you make a mistake one way, you probably will not make it the other way. If your answers are different, you can locate your mistake. When you multiply a large number by one digit, you can check it easily by dividing the product by the single digit.

```
 3425        3425
 x  5      5)17125
17125
```

Multiplication rules

These five rules will help you solve problems.

1. Remember that multiplication is a short way of adding equal numbers. The multiplier tells you how many times a number is to be multiplied.

2. Learn the meaning of the multiplication facts and learn to recall the facts quickly. Remember that a number multiplied by zero is zero and that a number multiplied by one is the same number. Also remember that zero multiplied by any number is zero.

3. Remember the methods for multiplying by one or more digits. You multiply the 1's, 10's, 100's, and 1,000's of the multiplicand one after the other and write the result in the product. When the multiplier has two or more digits, you must use partial products.

4. Place value has great importance in multiplication. Always keep the columns straight, and start the product under the digit you are using in the multiplier.

5. Learn to check the answer after working a problem in multiplication. You can do this by changing the places of the multiplier and multiplicand, and doing the multiplication again.

Glossary:

multiplier ['mʌltɪplaəɪ] *n* – множник
multiplicand [ˌmʌltɪplɪ'kænd] *n* – множене
product ['prɔdʌkt] *n* – добуток
multiply ['mʌltɪplaɪ] *v* – множити
multiplication fact [ˌmʌltɪplɪ'keɪʃən'fækt] *n* – дія множення
statement ['steɪtmənt] *n* – твердження, формулювання
order ['ɔ:də] *n* – порядок, ступінь
discover [dɪs'kʌvə] *n* – виявляти
similar ['sɪmɪlə] *adv* – подібний
partial ['pa:ʃəl] *adv* – частковий

Exercises

1. Look at the phonetic transcription and write the words next to them:

[ə'rɪθmətɪk]
[ə'dɪʃən]
['ədend]
[ˌkælkju'leɪʃən]
[kə:v]
[ɪ'kweɪʃən]
['erə]
['fɔ:mjulə]
['frækʃən]
[dʒɪ'ɔmɪtrɪ]
['haɪt]
['leŋθ]
['prɔbləm]
['kwɔntɪtɪ]

Work in pairs

2. Ask and answer the following questions:

1. How much is 7 multiplied by 8?
2. How much is 6 multiplied by 9?
3. How much is 15 multiplied by 6?
4. How much is 12 multiplied by 4?
5. How much is 36 multiplied by 3?

3. Work in groups of four or five to discuss the questions:

a. Is multiplication one of the four basic operations in arithmetic?
b. What way is the best to learn how to multiply?
c. What is the result of multiplication called?
d. How do we check a multiplication example?
e. Why do we sometimes make mistakes in multiplying numbers?

4. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. A number multiplied by zero is zero.
2. When the multiplier has two or more digits, you must use partial products.
3. The best way to learn how to multiply is to find out how multiplication works.
4. The number that is being multiplied, or added together a number of times, is called the addend.
5. Students learn how to "carry" when they learn subtraction.

5. Practise saying the following multiplication facts:

The 100 multiplication facts

0	1	2	3	4	5	6	7	8	9
x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0
0	0	0	0	0	0	0	0	0	0
0	1	2	3	4	5	6	7	8	9
x 1	x 1	x 1	x 1	x 1	x 1	x 1	x 1	x 1	x 1
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
x 2	x 2	x 2	x 2	x 2	x 2	x 2	x 2	x 2	x 2
0	2	4	6	8	10	12	14	16	18
0	1	2	3	4	5	6	7	8	9
x 3	x 3	x 3	x 3	x 3	x 3	x 3	x 3	x 3	x 3
0	3	6	9	12	15	18	21	24	27
0	1	2	3	4	5	6	7	8	9
x 4	x 4	x 4	x 4	x 4	x 4	x 4	x 4	x 4	x 4
0	4	8	12	16	20	24	28	32	36
0	1	2	3	4	5	6	7	8	9
x 5	x 5	x 5	x 5	x 5	x 5	x 5	x 5	x 5	x 5
0	5	10	15	20	25	30	35	40	45
0	1	2	3	4	5	6	7	8	9
x 6	x 6	x 6	x 6	x 6	x 6	x 6	x 6	x 6	x 6
0	6	12	18	24	30	36	42	48	54
0	1	2	3	4	5	6	7	8	9
x 7	x 7	x 7	x 7	x 7	x 7	x 7	x 7	x 7	x 7
0	7	14	21	28	35	42	49	56	63
0	1	2	3	4	5	6	7	8	9
x 8	x 8	x 8	x 8	x 8	x 8	x 8	x 8	x 8	x 8
0	8	16	24	32	40	48	56	64	72

6. Read the text and try to reproduce it:

Arabic numerals

It is hard to imagine life without Arabic numerals. No other number system ever invented has a simple way to writer a complex number like 1984. In Roman numerals, it comes out like this: MCMLXXXIV. Imagine trying to multiply that by three!

The Arabs, however, call their numbers “Indian numerals.” This is probably because they got the original idea a long time ago from India. There were no printing presses or scientific journals then, so mathematics traveled along the same trade routes that silk and spite did, as businessmen showed each other new ways of figuring or accounting. The Arabs took the new numbers and made improvements that quickly led to advances in technology.

The achievements of Arabic technology can be seen from a 10th-century description of Cordova, an Arabic city: “The neighboring country showed the results of careful supervision in agriculture, trade, and industry. Rice and sugar cane were grown in fields that had been irrigated

by Arab engineers. The city included 900 public baths, stone-paved streets, fountains, and marble architecture." At this time, London was a small town with mud streets, and Berlin was a farming village. In fact, cities outside the Arab world did not reach the same level of civilization until centuries later.

7. Discuss the following questions in groups:

1. Where do our numerals come from?
2. How did the idea for them get from India to Arabia?
3. What was 10th-century Cordova like?
4. Why are Arabic numerals more useful than other numerals?
5. What effect did Arabic numerals have on the world?

8. Make up a dialogue with a partner using information from the text "Arabic numerals"

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

9. Match a line in A with a line in B

A	B
Multiplication	- represent 10's, 100's, 1,000's, and so on.
The symbol of multiplication is	- is called the multiplier.
The number that is being multiplied	- the product.
The number that does the multiplying	- **X.**
The result, or answer, is called	- is called the multiplicand
Zeros in combination with other digits	- is a short way of adding or counting equal numbers.

Compare your answers.

10. Make up 4 sentences of your own using the words and expressions given below:
multiplier, product, multiplication fact, the methods for multiplying, carrying in multiplication, equal numbers

_____
_____
_____
_____
_____
_____

Discuss the sentences together, then tell others in your group what you think.

11. Translate into Ukrainian. Compare your translation in groups.

1. Algorithm is a step-by-step procedure for solving a mathematical problem in a limited number of steps. The instructions for each step are precise. Many algorithms involve repeating the same steps several times and can be carried out by a computer.

2. Probably the most famous algorithm is Euclid's algorithm. It is used to find the greatest common divisor of any two whole numbers, a and b. To use this algorithm, first divide the smaller number (b) into the larger number (a): a/b. If the numbers divide evenly, with a remainder (r) of 0, the algorithm ends and b is the answer. But if the remainder is not 0, divide the remainder into the former divisor: b/r. Keep dividing each succeeding remainder into the previous divisor until you reach a remainder of 0. Then stop. The last divisor is the greatest common divisor of the original numbers a and b.

_____
_____
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_____

Check your grammar

1. Use the correct form of Present Perfect:

1. Mathematics (to play) _____an essential role in the development of modern technology.
2. Mathematicians (to devise) _____various systems of symbolic logic.
3. Many people who (to earn) _____a master's or doctor's degree in mathematics conduct research for the communications, energy, manufacturing, or transportation industries.
4. Throughout history, people (to use) _____various numeral systems.
5. Scholars (to translate) _____ clay tablets that show that the Babylonians were highly skilled in arithmetic.
6. To find out how many things you (to add) _____, you can count them or think them together.
7. You (to draw) _____already 3 circles.
8. How much (to earn) _____you all together?
9. Good workers always check their addition to see if they (to make) _____any mistakes.
10. The earliest uses of geometry (to include) _____measuring lengths and areas of land.

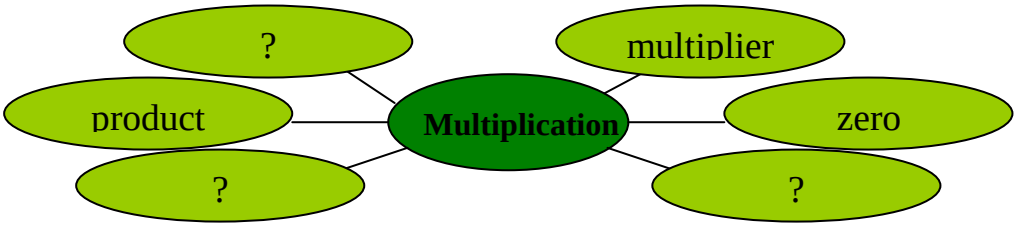
2. Define the functions of the *–ing* forms:

1. Seeing a straight line we know it is a geometric figure.
2. Drawing a correct conclusion is not always easy.
3. We usually use letters of the alphabet for naming geometric ideas.
4. The arrow indicating the direction in which the line is extending is placed over the letters.
5. They are concerned with applying their knowledge of the subject to solving these problems.
6. He is defining the volume of a geometric object.
7. Measuring the length of a segment one must use the ruler.
8. Geometry presented practical ways for obtaining information about the size and shape of various objects.

3. Ask questions using the question-words in brackets:

1. Many people learn multiplication only by memorizing its facts and rules. (who)
2. Newton discovered how the universe is held together through his theory of gravitation. (what theory)
3. In 1637, French philosopher Rene Descartes proposed mathematics as the perfect model for reasoning. (when)
4. The idea of infinity has other applications in mathematics in addition to set theory. (where)
5. In everyday life, we use mathematics for such simple tasks as telling time from a clock or counting our change after making a purchase. (what)

4. Complete the diagram trying to recall as much as possible about "Multiplication":

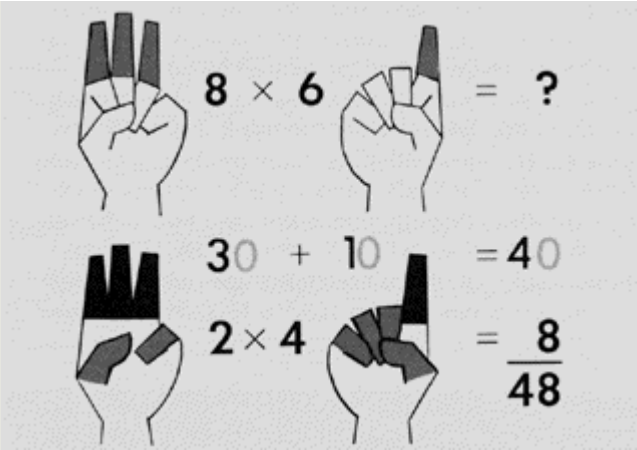


Fun with multiplication

Product! is played by a group of students sitting in a circle. The leader picks a number, such as 5. The player next to the leader begins with 1, and the group counts around to the left. When the counting comes to a product of 5, the player calls "Product!" instead of the number. The counting goes like this: "1, 2, 3, 4, Product!, 6, 7, 8, 9, Product!" , and so on. A player who forgets to say "Product!" is out, and the winner is the last player left.

Finger multiplying can be fun. By using fingers, you can multiply 5, 6, 7, 8, or 9 by 5, 6, 7, 8, or 9.

Suppose you want to multiply 8 X 6. Close the fingers of both hands. Open 3 fingers on the left hand. The 5 closed on the right hand and the 3 open stand for 8. Now open 1 finger on the right hand. The 5 that were closed and the 1 now open on the right hand stand for 6. Now 3 fingers should be open on the left hand and 1 finger open on the right. This is the 10's digit of the answer. Add the fingers open: 3 + 1 = 4. There are four 10's in the answer. The closed fingers give the 1's digit. There are 2 fingers closed on the left hand and 4 fingers closed on the right hand. Multiply these to get the 1's digit. This is 2 X 4 = 8. Add the 10's and the 1's. Four 10's and eight 1's are 48. This shows that 8 + 6 = 48.



Another example is 9 X 7. Start with the fingers closed. Open 4 fingers on the left hand for 9 (4 + 5 = 9). Open 2 fingers on the right hand for 7 (5 + 2 = 7). Add the fingers open: 4 + 2 = 6. This is the 10's digit. There is 1 finger closed on the left hand and 3 fingers closed on the right hand. Multiply these for the 1's digit. This is 1 X 3 = 3. Add the six 10's and the three 1's: 60 + 3 = 63. This shows that 9 X 7 = 63.

Notes on the topic studied:

Notes on the topic studied:

Unit Seven

Task 1. Answer the following questions:

- Do you know the symbol of division? Write it down.
- What will you get if you divide 0: 3?
- Could you divide 10 by 3 without a remainder?
- Which number is the divisor in the expression 8:2=4?
- Could you divide 7 by 0? What will you get as a result of this operation?
- Divide these whole numbers and put down the answers. Read these expressions:

60 : 5=	40 : 2=
100 : 10=	39 : 3=
81 : 9=	64 : 4=

Task 2. Read the phonetic transcription. Practise your pronunciation:

[dɪ'vɪʒən] [dɪ'vaɪʒə] [dɪ'vɪdend] [rɪ'meɪndə] ['kwəuʃənt] [ɪks'preʃən] ['sensəbl 'a:nsə] ['nʌmbə]] ['ʃeə] ['erə] ['eksɪkju:t] ['ɪlə,streɪt] [bɪ'ləu] ['desɪməl] [,ɪnkə'rekt] ['gru:p] ['frækʃən] [rɪ'zʌlt:] ['sɪmbəl] ['tɪpɪkəl] ['prɔbləm] [,mʌltɪplɪ'keɪʃən] [,mʌltɪplɪ'kænd] ['mʌltɪplaəɪ]

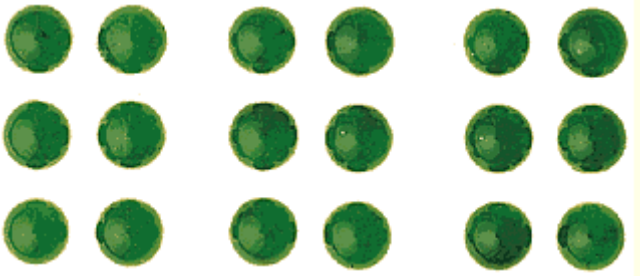
Task 3. Practise saying the following words. Pay attention to the pronunciation:

division, divisor, remainder, quotient, dividend, one-digit number, general rule, division fact, nonzero number, expression, to share, sensible answer, equal parts, to change the quotient, decimal places, to subtract the divisor from the dividend, short division, long division, an example of division, quickly and accurately, mentally, the decimal point, to use automatically, to estimate the quotient, to catch an error.

Task 4. Read the text and think over such question: What should we learn first: *division or multiplication*?

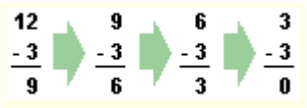
Division

Division is a way of separating a group of things into equal parts. Suppose you have 18 marbles and you want to share the marbles with two friends. You want each of you to end up with the same number of marbles. To find out how many marbles each of you would get, you can count out the marbles into three equal groups. Each group has six marbles. So each of you would get six marbles as shown below. Separating a group of 18 things into three equal parts of 6 things is an example of division.



Once people learned division only by memorizing. Most teachers now agree that the best way to learn division is by understanding. You can learn to understand division without much difficulty.

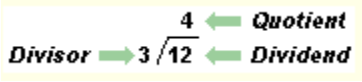
Writing division. One way of separating a group into equal parts is by counting it out into equal parts. But there is a much easier way to divide. To find how many groups of 3 there are in 12, you can subtract 3 from 12 until nothing is left:



This shows that there are four 3's in 12.

Each basic operation in arithmetic is indicated by a special symbol. The symbol for division is **:** The statement 12 : 3 = 4 means that when 12 things are separated into groups of three, there are four such groups. Or, that there are four 3's in 12. It can also mean that when 12 things are separated into three equal groups, there are four things in each group. People who know division usually read 12 : 3 = 4 as "12 divided by 3 is 4." A problem in division also may be written this way:

The parts of a division problem have special names. The number being divided is called the dividend. The number by which the dividend is divided is the divisor. The answer, or result, of the division is the quotient.



Another way of writing a problem in division is the form used in writing fractions 12/3 = 4

Division facts. By using subtraction, you discovered that there are three equal groups of 4 things in a group of 12. Or, 12 : 3 = 4. This is a division fact. You can find all the division facts by using subtraction.

It is important to learn the division facts so well that you can use them automatically. The facts are useful themselves. They are also necessary in learning how to divide larger numbers quickly and accurately.

Division of decimal fractions. You can also use long division to divide numbers that include decimal fractions. The statement 78.35 : 3.6 is this kind of problem. In order to understand division of decimal fractions, you must learn an interesting feature of division.

You know that 15 : 3 = 5 is a division fact. What would happen if both the 15 and 3 were multiplied by 10? That is, what is the result of dividing 150 by 30? Long division will show you that this quotient is also 5. Thus, 15 : 3 = 5, and 150 : 30 = 5. Similarly, 72 : 6 = 12 and 720 : 60 = 12. If the 72 and 6 are multiplied by 100, the quotient of 7,200 ¸ 600 is also 12. These examples illustrate a general rule: multiplying both the dividend and divisor by 10, 100, 1,000, or any other nonzero number, does not change the quotient.

For every division problem with a remainder of zero, there is a corresponding multiplication problem. The two numbers that are multiplied are the quotient and divisor in the division problem. For example:

3.25 : 1.3 = 2.5

1.3 X 2.5 = 3.25

Experience with such problems has resulted in two rules. In multiplication, the number of decimal places in the product (answer to the multiplication problem) is the sum of the number of decimal places in the numbers that were multiplied. In division, the number of decimal places in the quotient is the number of decimal places in the dividend minus the number of decimal places in the divisor. If the divisor is a whole number, you can ignore the decimal point in the dividend while you are working the problem. When you get a number for the quotient, put as many decimal places in the quotient as there are in the dividend. Because the divisor has no decimal places, none must be subtracted from the number in the dividend.

Short division

When dividing by a one-digit number such as 7, you can do some of the work in long division without writing it down. Division of this kind, which is usually done in the mind rather than on paper, is called short division. The method is the same as in long division, but you do the work mentally.

Long Division		*Short Division*
212		212 R(emainder) 1
4/849	200	4/849
- 800		
49		
- 40	10	
9		
- 8	2	
1	212	

The only difference between these two examples is that in short division you do the work mentally and indicate the remainder next to the quotient. The letter R is often used to mean Remainder. In this example, you first see that you can subtract two hundred 4's from 849. You write the 2 in the 100's place over the 8 in the dividend. Next, you can subtract ten 4's from the remaining 49. You write the 1 in the 10's place over the 4 in the dividend. Finally, you can subtract two 4's from the remaining 9. You write the 2 in the 1's place over the 9 in the dividend. You show the remainder to the right of the quotient.

How to check division

You will be wise to check the answer to a division problem to be sure you have solved it correctly.

Rounding off. One way to check is to see whether or not the quotient is a sensible answer. You can estimate a quotient by rounding off the dividend and divisor. To estimate the quotient of 158 : 76, you can round off 158 to 160 and 76 to 80. Because 160 : 80 = 2, the quotient of 158 : 76 should be about 2. To estimate the quotient of 5,124 ¸ 36, you can round off 5,124 to 5,000 and 36 to 50. You can see that 5,000 : 50 = 100, and 5,000 : 25 = 200. Thus, the quotient of 5,124 : 36 should be somewhere between 100 and 200. Estimating the quotient will help you decide whether your answer is sensible.

Checking by multiplication. Another way of checking a quotient is to multiply the quotient by the divisor to see if the product is the dividend. If you have multiplied correctly, this method will catch any error. This is because multiplication is the opposite of division.

13	13
24/312	x 24
	52
	26
	312

The next example shows how to use the remainder in checking by multiplication:

42	R 7	42	
21/889		x 21	
		42	
		84	
		882	
		+ 7	R
		889	

The quotient is multiplied by the divisor, and the remainder is added to the product.

<u>Here are four important rules to remember for solving division problems.</u>

1. Remember that division means breaking up a number into smaller equal groups. The divisor can show the size of these groups or the number of groups.

2. Learn the division facts so well that you do not have to stop and figure them out each time. You will use the division facts constantly in everyday arithmetic, and will need to know them to divide larger numbers.
3. Remember the method for dividing larger numbers used in long division. In long division, subtract the divisor from the dividend as many times as possible in a single step. In this way, you can reduce the number of steps in long division.
4. Always check the answer after finishing a division problem. You can do this by estimating or by multiplying the quotient by the divisor and adding any remainder.

Glossary:

division [dɪ'vɪʒən] *n* – ділення
divisor [dɪ'vaɪzə] *n* – дільник
dividend [dɪ'vɪdend] *n* – ділене
remainder [rɪ'meɪndə] *n* – залишок
quotient ['kwəuʃənt] *n* – частка, коефіцієнт
expression [ɪks'preʃən] *n* – вираз
sensible answer ['sensəbl 'a:nsə] *n* – правильна відповідь

Exercises
Work in pairs

1. Ask and answer the following questions:

1. How much is 42 divided by 6?
2. How much is 102 divided by 2?
3. How much is 36 divided by 3?
4. How much is 88 divided by 8?
5. How much is 660 divided by 6?

2. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. The number being divided is called the divisor.
2. Each basic operation in arithmetic is indicated by a special symbol.
3. Estimating the quotient will help you decide whether your answer is sensible.
4. For every division problem with a remainder of zero, there is a corresponding multiplication problem.
5. You can use long division to divide numbers that include decimal fractions.

3. Work in groups of four or five to discuss the questions:

1. What does division mean?
2. What can the divisor show?
3. How is the result of division called?
4. How do we check a division problem?

4. Practise saying the following table:

$2/4$	$2/6$	$2/8$	$2/10$	$2/12$	$2/14$	$2/16$	$2/18$
$3/6$	$3/9$	$3/12$	$3/15$	$3/18$	$3/21$	$3/24$	$3/27$
$4/8$	$4/12$	$4/16$	$4/20$	$4/24$	$4/28$	$4/32$	$4/36$
$5/10$	$5/15$	$5/20$	$5/25$	$5/30$	$5/35$	$5/40$	$5/45$
$6/12$	$6/16$	$6/24$	$6/30$	$6/36$	$6/42$	$6/48$	$6/54$
$7/14$	$7/21$	$7/28$	$7/35$	$7/42$	$7/49$	$7/56$	$7/63$
$8/16$	$8/24$	$8/32$	$8/40$	$8/48$	$8/56$	$8/64$	$8/72$
$9/18$	$9/27$	$9/36$	$9/45$	$9/54$	$9/63$	$9/72$	$9/81$

5. Complete the sentences with correct numerals. Discuss your answers in groups:

- The work of mathematicians may be divided into … kinds.
- Solid geometry involves such figures as cubes and spheres, which have … dimensions.
- The decimal system is based on … digits: 0… … 9.
- They say it is easier to learn that six 5's are … .
- Division is one of the … basic operations in arithmetic.
- People who know division usually read …:3 = 4 as "… divided by 3 is 4".

6. Discuss the following quotations in groups:
" The essence of mathematics is its freedom" (Geode Cantor)
" The real end of science is the honour of the human mind" (Carl Jacobi)
"Mathematics is the science of what is clear by itself" (Carl Jacobi)

7. Translate into Ukrainian. Compare your translation with others.

1. To divide one number by another, look up the logarithms of the two numbers in a table. Subtract the logarithm of the denominator from the logarithm of the numerator. Then, using the table again, find the number whose logarithm is the same as the logarithm found by this subtraction. This number is the desired quotient.
2. To raise a number to a power, look up the logarithm of the number in a table. Multiply this logarithm by the exponent of the power. Then, using the table again, find the number whose logarithm is the same as the logarithm found by this multiplication. This number is the desired power of the first number.
3. To find a root of a number, look up the logarithm of the number in a table, and divide this logarithm by the index of the root. Then, using the table again, find the number whose logarithm equals the number found by the division. This is the desired root of the number.

Check your grammar

1. Form nouns from the following verbs. Compare your lists in groups.

to decide, to share, to mean, to record, to reduce, to draw, to indicate, to correspond, to separate

_____

_____

_____

_____

_____

_____

_____

_____

2. Use the correct form of Passive Voice:

1. Mathematics (to base) _____upon logic.
2. In business, mathematics (to use) _____ in transactions that involve buying and selling.
3. Algebra, unlike arithmetic, (not to limit) _____to work with specific numbers.
4. Certain relations between the lengths of two sides of a right angle (to call) _____ trigonometric ratios.
5. Probability (to use) _____to determine the chances that an uncertain event may occur.
6. Arithmetic (to call) _____sometimes "the science of numbers" and "the art of calculation".
7. Two main types of problems (to study) _____in elementary arithmetic.
8. Operations in arithmetic (to show) _____by symbols.
9. The fraction form (to use) _____ also for expressing division.
10. The different uses and meanings of fractions (to relate) _____closely.

3. Compare and translate the following sentences. Note the form of the Predicate:

He has defined the relation.	The relation has just been defined.
I have tried all the possible ways.	All the possible ways have already been tried.
Has she checked the result?	Has the result been checked?
You have not multiplied the denominator yet.	The denominator has not yet been multiplied.
She has changed the order.	The order has been changed.

4. Use the correct form of Perfect (Passive):

Pattern: *- The new department just (to open).*

- The new department has just been opened.

1. All the digits(to align), as appropriate.

_____

2. The necessary information just (to obtain).

_____

3. Many books in mathematics (to translate) from Ukrainian into English.

_____

4. The coma and the point (to place) properly.

_____

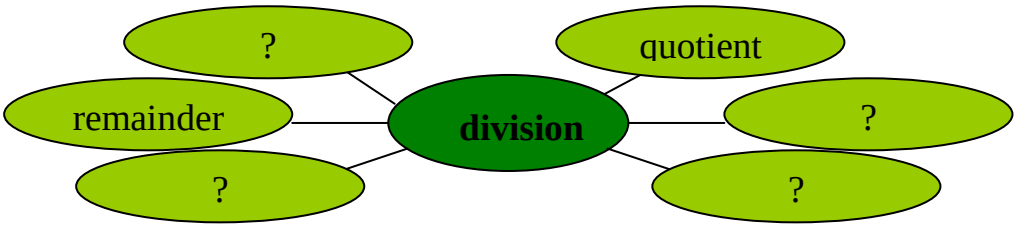
5. All her questions (to answer).

_____

6. Each step of the process (to study) carefully.

_____

5. Complete the diagram trying to recall as much as possible about "division":



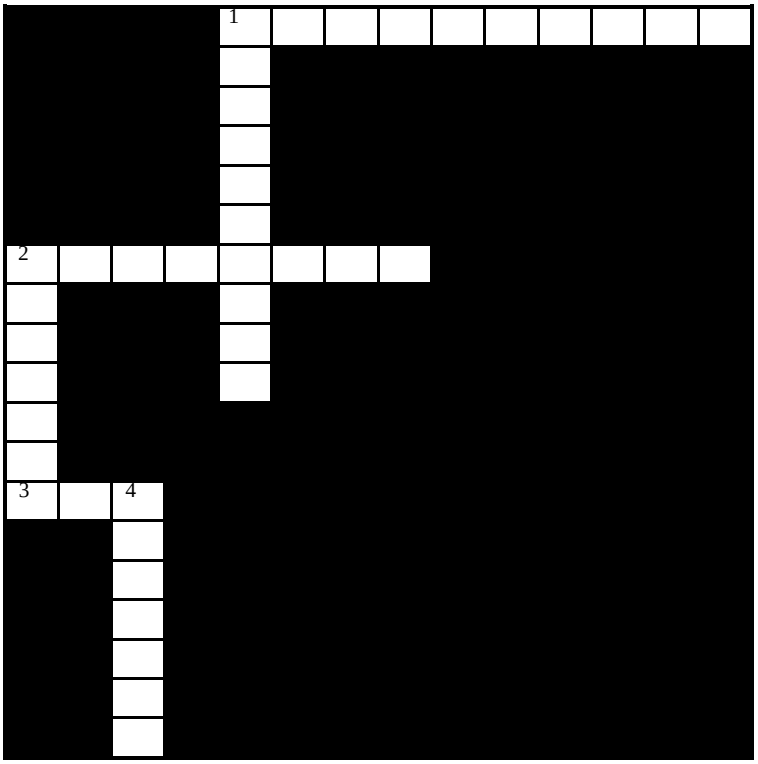
Fun with division

Space is a game played with cards much like those used in bingo. Each card has a square drawn on it. The square is subdivided into 25 smaller squares. The letters S P A C E are written across the top of the card. The squares are filled in with any arrangement of the numerals from 1 to 9. Each square has one number, except the one in the center which is marked F for "free." Each card should have a different pattern of numerals on it. Each player has a card and a set of small markers. The leader of the game calls out questions on the division facts, for example, "Under A, the 4's in 20." There are five 4's in 20. If the players have the number 5 under A on their card, they cover the number. The first player to completely cover all numbers in a row, a column, or a diagonal calls out "Space!" and wins the game. The leader keeps a record of the division facts called and uses this record to check the winner's card. For a new game, exchange the cards among the players.

S	P	A	C	E
2	1	3	4	5
3	4	5	5	3
5	6	F	6	4
6	8	6	7	6
8	9	8	9	8

- Try the crossword!

All of the words are in Units 4-5.



Across

1.A way of putting together two or more things to find out how many there are all together.(2)

2.The new group of addends.(3)

3. The number from which the subtrahend is taken. (1)

Down

1.The two or more things you put together.(2)

2.The way of taking away a number of things from a larger number.(1)

3. The number being taken away or subtracted.(4)

Notes on the topic studied:

Notes on the topic studied:

Unit Eight

Task 1. Discuss the following questions:

- Nowadays computer is considered to be our best friend. It can help you practically in any situation. For example, some programs can quickly solve linear or quadratic equations. So, is it so necessary to know algebra? Give your reasons.

Task 2. Answer the following questions:

- Do you remember any formulas used in algebra? Recollect them.
- What is an equation?
- Could you name all the numerals in the equation 8 – 5=3? Say what is what?

Task 3. Read the phonetic transcription. Practise your pronunciation:

['ældʒıbrə] [ıks'preʃən] [pə'renθıss] ['brækıt] ['breıs] ['vɛərıəbl] [pə'rımıtə] ['meʒəmənt] [rı'pleıs] [rek'tæŋgjulə] ['tə:m] ['lɔ:] [set] [ı'kweıʃən] [ˌkɔ'mju:tətıv]

Task 4. Practise saying the following words. Pay attention to the pronunciation:

algebra, expression**,** the domain, a variable, equation, measurement, positive number, negative number, rectangular, parentheses, brackets, general expression, braces, to replace a variable, mathematical sentences, a simple equation, to represent the width, a number of terms, a wide variety of arithmetic situations, fundamental law, the separate products, perimeter, the same value, sets of numbers.

Task 5. Read the text and find some information about signs of aggregation.

Algebra

Algebra is one of the chief branches of mathematics. Mastery of mathematics depends on a sound understanding of algebra. Unknown numbers in algebra are represented by letters, such as **x** or **y.** Letters in algebra are related to sets of numbers. These are the kinds of sets used in algebra.

Imagine a group of people whose ages are 12 years, 15 years, 20 years, and 24 years. You can write these ages as a set of numbers:

A = (12,15,20,24)

How old will these people be three years from now? One way of answering this question is to write out 12 + 3, 15 + 3, 20 + 3, and 24 + 3. However, the number 3 is the same in all four of these expressions. In algebra, you can write all four expressions as one general expression, m + 3, in which m can be replaced with any number of the set A. For example, you can replace m with 12, 15, 20, or 24.

The letter m is called a variable, and the set A is the domain of the variable. The number 3 in the expression m + 3 is called a constant, because 3 always has the same value. A variable in algebra is a letter that can be replaced by one or more numbers belonging to a set.

In algebra, you do not use names to replace a variable. Instead, you use numbers.

Equations are one kind of sentence in algebra. They are mathematical sentences that say two things are equal. Here is a simple equation:

7 + x = 12

Mathematicians use a number of terms to describe parts of an equation. They call the expression on each side of the equals sign a member of the equation. For example, in the equation 3x + 2 = 11, 3x + 2 is the left member and 11 is the right member. Each part of a member that is connected by addition or subtraction signs--or stands alone-is called a term. Therefore, 3x and 2 are the terms in the left member, and 11 is the term in the right member.

Positive and negative numbers. In arithmetic, you can always add, multiply, or divide numbers. But you cannot always subtract. For example, "3 - 5" is meaningless in ordinary arithmetic. Algebra has an extended number system that solves this problem.

Writing formulas. Algebra uses general formulas to help solve many practical problems in science, engineering, and everyday life. A wide variety of arithmetic situations can be expressed in general formulas.

One example of the use of general formulas involves room dimensions. Consider a room that is 5 meters long and 4 meters wide. Its perimeter, or outside measurement, is 5 + 4 + 5 + 4 meters, or 2 X (5 + 4) meters. If the room is 5 meters long and the width is unknown, you can use w, a variable, to represent the width. The perimeter is then 5 + w + 5 + w, or 2 X (5 + w). Going one step further, you can write a formula for the perimeter of any rectangular room by using l for the length and w for the width. The formula is 2 X (l + w).

Symbols in algebra. The symbol + indicates addition. But in algebra, it also signifies a positive number. The symbol - indicates subtraction and a negative number. You usually do not use X to indicate multiplication in algebra, because it might be confused with the letter x. Instead, you use a dot × or no symbol at all. You write a multiplied by b as a × b, (a)(b), or ab. (Note that 3 × 6 and (3)(6) both mean six multiplied by three, but that 36 still means 36, as in arithmetic.) The symbol ¸ for division is the same as it is in arithmetic.

Parentheses (), brackets [], and braces {} often enclose quantities or numbers. They are called signs of aggregation because everything within them must be treated as a single expression. You must often simplify the enclosed expression before it can be used in other parts of a problem.

Fundamental Laws

There are five fundamental laws in algebra. These laws govern addition, subtraction, multiplication, and division. They are expressed in variables, and the variables can be replaced with any numbers. Here are the laws:

1. The Commutative Law of Addition is written x + y = y + x. This means that if you want to add two numbers, you can add them in either order, and the sum will be the same. For example, 2 + 3 = 3 + 2 = 5, and (-8) + (-36) = (-36) + (-8) = -44.

2. The Associative Law of Addition is written x + (y + z) = (x + y) + z. This means that if you want to add several numbers, you can add any combination first, and the final sum will be the same. For example, 2 + (3 + 4) = (2 + 3) + 4, or 2 + 7 = 5 + 4 = 9.

3. The Commutative Law of Multiplication is written x × y = y × x. This means that if you want to multiply two numbers, you can multiply them in either order, and the product will be the same. For example, (2)(3) = (3)(2) = 6, and (-8)(-36) = (-36)(-8) = 288.

4. The Associative Law of Multiplication is written x × (y × z) = (x × y) × z. This means that if you want to multiply several numbers, you can multiply any combination first, and the final product will be the same. For example, 2(3 × 4) = (2 × 3)4, or 2(12) = (6)4 = 24.

5. The Distributive Law of Multiplication over Addition is written x(y + z) = xy + xz. This law can be illustrated with an example: 3 × (4 + 5) = (3 × 4) + (3 × 5). If a number multiplies a sum, for example, 3(4 + 5), or 3 × 9, the result is the same as the sum of the separate products of the multiplier and each addend, (3 × 4) + (3 × 5), or 12 + 15. In this example, you can see that 3 × 9 = 12 + 15 = 27.

Glossary:

algebra ['ældʒıbrə] *n* – алгебра
domain *n* – область визначенняєє

expression [ıks'preʃən] *n* – вираз

parentheses [pə'renɵıss] *n* – круглі дужки
bracket ['brækıt] *n* – дужка
brace ['breıs] *n* – фігурна дужка
variable ['vєərıəbl] *n* – змінна (величина)
perimeter [pə'rımıtə] *n* – периметр

measurement ['meʒəmənt] *n* – вимірювання, (pl) розміри
replace [rı'pleıs] *v* – заміняти, заміщати, відновити
term ['tə:m] *n* – термін, член, елемент

Exercises
Work in pairs

1. Practise saying the following expressions:
x + y = y + x, x × y = y × x, x × (y × z) = (x × y) × z, x(y + z) = xy + xz.

2. Give English equivalents of:
рівняння, математичний вираз, додавання, віднімання, множення, ділення, формула, добуток, різниця, сума, раціональне число, ірраціональне число, арифметика, дужки, кома, крапка, цифра, алгебра, точні науки, таблиця множення, зменшуване, від'ємник, частка, ділене, символ.

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Compare your answers.

3. Match a line in A with a line in B

A	B
Letters The symbol + The symbol – Algebra Mathematicians Equations	➢ use a number of terms to describe parts of an equation. ➢ uses general formulas. ➢ in algebra are related to sets of numbers ➢ are one kind of sentence in algebra. ➢ indicates addition. ➢ indicates subtraction and a negative number.

Compare your answers.

4. Make up 3 sentences of your own using the words and expressions given below:
mathematics depends on, sets of numbers, mathematical sentences, fundamental laws

_____
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Discuss the sentences together, then tell others in your group what you think.

5. Work in pairs and discuss the following questions:

1. How many fundamental laws are there in algebra?
2. How are they are expressed?
3. What symbols do we use in algebra?
4. What does a symbol '-' indicate?
5. What is the symbol for division?
6. What is an equation?
7. What are the two parts of the equation called?
8. Why do we check both elements of the equation?

6. Complete the sentences with the correct answer. Discuss your answers in groups.

1. The work of mathematicians may be divided into_____.
2. Arithmetic concerns problems with _____.
3. Algebra is one of the chief branches of_____.
4. Multiplication with whole numbers is a short way of _____.
5. You use the addition facts and the idea of place value to _____.

7. Translate into Ukrainian. Compare your translation in groups.

1. Engineers and scientists use algebra every day. Business and industry rely on algebra to help solve many problems.
2. Because of its importance in modern living, algebra is studied in schools and colleges in all parts of the world.
3. The widespread use of computers has caused major changes in the study and use of algebra. Inexpensive software can perform most problem-solving steps studied in algebra. For example, the programs can quickly solve linear or quadratic equations.
4. The emphasis in algebra classes has therefore begun to shift from learning basic symbol-manipulation skills to understanding algebra's underlying concepts.

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Check your grammar

1. Read the sentences below. Define the functions and the forms of the Gerund. Name the predicate in every sentence. Translate the sentences:

1. Knowing the properties of equality will help you decide whether a sentence is true or false.

_____

2. Reducing a fraction means bringing it to lower terms.

_____

3. He likes being consulted.

_____

4. Our task is proving the correctness of the given statement.

_____

5. Having performed the first step made it possible to take the following steps.

_____

6. Before trying to multiply terms containing letters, let us summarize the basic facts you will need to remember for performing multiplication.

_____

_____

7. We expected being given further assistance.

_____

8. Writing a sentence in algebraic form as we have seen, involves two steps.

_____

2. Put all types of questions to the following sentences:

- Nearly every part of our lives involves mathematics.

_____

_____

_____

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- Mathematics has played an essential role in the development of modern technology – the tools, materials, techniques, and sources of power.

_____

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- We found these statements to be mathematically correct.

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- Basic concepts of mathematics are rooted in mans experience as a living and thinking being.

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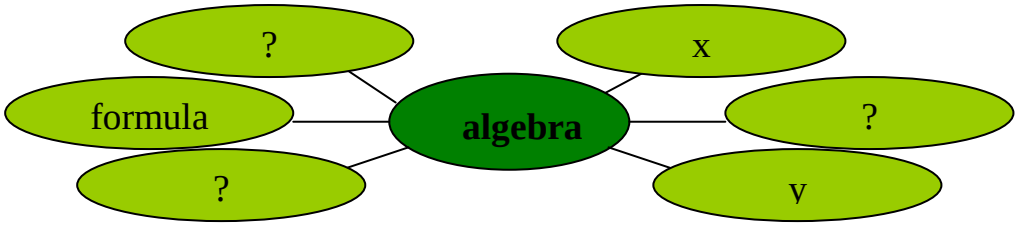
3. What is algebra in your understanding? What associates with the term “algebra”:



- Read and Smile:

****

"I am delighted to meet you," said the father of college student, shaking hands warmly with the professor. "My son took algebra from you last year, you know."

"Pardon me," said the professor, "he was exposed to it, but he did not take it."

Notes:

“Take” is a verb with very many meanings. In the joke it has two meanings “вивчати у когось “ та “засвоювати”. …he was exposed – (тут) йому було запропоновано.

Ask and answer:

- Was the professor’s answer polite or impolite? Why do you think so?

****

Read the joke and say why the mother was wrong.

Fond Mother — "Yes, Genevieve is taking French and Algebra. Say 'Good morning' to Mrs. Jones in Algebra, darling."

Notes on the topic studied:

Notes on the topic studied:

Notes on the topic studied:

Unit Nine

Task 1. Discuss the following questions:

- There are many kinds of fractions. Do you know any of them?
- Why do we use fractions?
- Can you give an example of a composed fraction?
- What will you get if you multiply 1/2 by 2/2?
- What will you get if you multiply 2/5 by 1?
- Will you change the fraction if you divide it by 0 or 1?
- Can you change 2/3 to lower terms?

Task 2. Read the phonetic transcription. Practise your pronunciation:

['frækʃən] ['desıməl'frækʃən] ['kɔmən'frækʃən] ['prɔpə'frækʃən] [kəm'pəuzd 'frækʃən] ['nju:məreıtə] [dı'nɔmırneıtə] ['reıʃıəu] [prə'pɔ:ʃən] [kəm'pɛə] ['həul'nʌmbə] [pə'sentıdʒ] ['ju:nıt] ['i:kwəl] ['hɑ:f]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

fraction, fractions, arithmetic problems, quantities, ratio, common fraction, proper fraction, composed fraction, numerator, denominator, measurement, length, the nearest quarter, per cent, percentages**,** proportion, centimeters, decimal point, solutions, equation, whole number, per cent of a number, the numeral system, the measuring device, a fraction bar, solution.

Task 4. Read the text and find out if the statements are *true* or *false*:

- The word fraction comes from a Greek word meaning to break.
- A unit can be broken only into two or three parts.
- When a unit is broken into three equal parts, each part is called a half.

Fractions

We have seen that many arithmetic problems can be solved by counting or by grouping objects. The records of these solutions use whole numbers. Other problems are solved by measuring and comparing quantities. To record the solutions to these kinds of problems, we often need fractions.

In order to solve problems that involve inches or centimeters, for example, we may use a ruler. A gasoline pump measures the volume of gasoline purchased in gallons or liters. When measuring these quantities, we often find that the answer is not an exact number of inches, centimeters, gallons, or liters. We then record the measurement to the nearest quarter, or tenth, or hundredth, or some other fraction of a unit, depending on the accuracy we want and the measuring device or instrument that we use.

Thus, in problems that relate to numbers of people, eggs, houses, and so on, we can answer in whole numbers. The numeral system 0,1,2,3, and so on, fits this sort of problem and we have no need of fractions. But in measurement, we often have in-between values for which we need fractions.

When we compare two quantities we have a ratio. For example, if Joe has six marbles and Pete has eight marbles, the ratio of Joe's marbles to Pete's marbles is six to eight. This is

commonly written 6/8. This ratio of two whole numbers is called a fraction. The common fraction 6/8 may also be written in decimal form as 0.75 or in percentage form as 75%. These three numerals all stand for the same number.

Common fractions. Each common fraction consists of two parts. The top part is called the numerator and the bottom part is the denominator. A fraction bar separates the two parts. If we have an inch divided into four equal parts, and consider the length of three of them, we record the length as 3/4 of an inch. The fraction shows that we are taking three out of four parts into which the inch has been divided.

Common fractions have two other meanings. In ratio problems, the numerator is a number being compared with the number in the denominator. Also, we sometimes record a division to be performed in fraction form. For example, 8/4 means the same thing as 8 divided by 4.

In common fractions, one measurement or ratio may be represented by different fractions. For example, 3/4, 6/8, 9/12, 75/100, and so on, all have the same value. You can reduce these to the same value by dividing the numerator and denominator by the same number. For example, in the fraction 9/12, if you divide the numerator by three and the denominator by three, you get the equal fraction 3/4. But arithmetic has a rule that tests the equality of fractions even when you cannot see a number by which to divide. Two fractions are equal if, and only if, the cross products are equal. For example, 2/3 = 34/51 because 2 X 51 and 3 X 34 both equal 102.

Decimals are fractions written as part of the decimal system. The decimal point is next to the units digit, which is the center of the decimal system. For example, a decimal might look like this: 3210.123. The first numeral to the left of the decimal point indicates ones, and the first numeral to the right indicates tenths. The second place to the left shows tens, the second place to the right indicates hundredths, and so on. Thus, 16.7 means 1 ten, 6 ones, and 7 tenths. It could also be written 167/10.

Percentages are fractions expressed in hundredths. One per cent of a number is one hundredth of the number. The symbol for per cent is %. Thus, 80% means 80/100 or .80. Changing fractions. It is awkward to have three kinds of symbols for fractions, because we must learn to change from one kind of fraction to another.

But you can easily learn the rules for changing fractions:

1. To change a common fraction to a decimal fraction, divide the numerator by the denominator.
2. To change a per cent into a decimal fraction, think that the per cent sign means per hundred. Divide the number before the per cent sign by 100 by moving the decimal point two places to the left. For example, 75% equals .75.
3. To change a decimal fraction to a common fraction, read it out loud. Then write this number as a fraction. For example, read .25 as "twenty-five hundredths," and write it as 25/100. You can divide both numerator and denominator of the fraction by 25, so that 25/100 becomes 1/4.

Proportion. Two equal fractions make a proportion, such as 3/4 = 6/8, or 2/25 = 8/100. The idea of proportion becomes important when you know three terms and want to find the fourth. For example, suppose you solve 16 out of 25 problems on a test, and you want to find out how many per hundred this would make. The best way to do this is to say that 16 compares to 25 as the number you want compares to 100. This can be written 16/25 = ? /100. There are two ways to solve this problem. One solution is to see that if you multiply 25 by 4, it would make 100. Thus, you must multiply 16 by 4. So you have 16/25 = 64/100. You can check this with cross multiplication. In the other method, let the letter P stand for the number you want. Then, 16/25 = P/100. Since these two fractions must be equal, cross multiply to get 1,600 = 25P. If you divide both sides of this equation by 25, you find that P = 64.

Glossary:

decimal fraction ['desıməl'frækʃən] *n* – десятковий дріб

common fraction ['kɔmən'frækʃən] *n* – простий дріб

proper fraction ['prɔpə'frækʃən] *n* – правильний дріб

composed fraction [kəm'pəuzd 'frækʃən] *n* – неправильний дріб

numerator ['nju:məreıtə] *n* – чисельник

denominator [dı'nɔmırneıtə] *n* – знаменник

ratio ['reıʃıəu] *n* – відношення, пропорція, коефіцієнт

proportion [prə'pɔ:ʃən] *n* – пропорція, кількісне відношення

compare [kəm'pɛə] *v* – порівнювати, зіставляти

whole number ['həul'nʌmbə] *n* – ціле число

percentage [pə'sentıdʒ] *n* – відсоток, процентне відношення

half ['hɑ:f] *n* – половина, частина, ½

Exercises
Work in pairs

1. Give English equivalents of:

дріб, чисельник, знаменник, прості дроби, десятковий дріб, бути рівними, скорочувати дроби, правильні дроби, неправильні дроби

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Compare your answers.

2. Read and write out in words the following common and decimal fractions:

- **1/7; 1/5; 1/9; 1/3; 1/12; 1/15; 1/25; 3/8; 2/5; 4/7; 9/23; ¾; 3/5; 25/7; 51/3**

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- **3.5; 2.34; 12.3; 52.51; 0.1; 0.25; 0.302; 132.054; 5.37; 6.4**

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Dictate them to your partner.

3. Discuss in pairs

- Are the following statements True (v) or False (x)? Correct the false ones.

	T	F
When we compare two quantities we have a numerator.		
The per cent sign means per hundred.		
Each common fraction consists of four parts.		
Three equal fractions make a proportion.		
Percentages are fractions expressed in hundredths.		
The first numeral to the left of the decimal point indicates ones, and the first numeral to the right indicates hundredth.		

4. Make up sentences of your own using the words and expressions given below:

equal fractions, numerator and denominator, decimal system, whole numbers, to solve the problem.

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Discuss the sentences together, then tell others in your group what you think.

5. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. Every fraction has a numerator and denominator.
2. Fractions like 2/3 are called proper fractions.
3. A mixed fraction contains an integer and a decimal fraction.
4. The idea of proportion becomes important when you know three terms and want to find the fourth.
5. In common fractions, one measurement or ratio may be represented by one fraction.

6. Read the following fractions:

1.23; 0.43; 0.87; 0.175;

$\frac{7}{6}$; $\frac{5}{3}$; $\frac{3}{4}$; $\frac{1}{2}$

Choose two of them and do the addition. Discuss your answers.

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7. Translate into Ukrainian. Compare your translation in groups.

1. The Hindus invented our present-day numeral system, and the Arabs brought it to Europe sometime before 1200.
2. However, it was not until the 1600's that the decimal point and decimal fractions were introduced. We are making increased use of decimal fractions. Instead of measuring gasoline in quarts, pints, or cups, we use gallons and tenths.
3. In the metric system, decimal fractions are nearly always used, rather than common fractions. Thus, the use of the decimal fraction system is still developing.

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8. Work in pairs and discuss the following questions:

1. What are three kinds of fractions?
2. What does a fraction represent?
3. What is a common fraction called?
4. What is the numerator?
5. What is the denominator?
6. What does a fraction indicate?
7. What is a good way to check multiplication? (division)
8. What are the three rules for changing fractions?
9. When is the fraction equal to 1?
10. If you know three terms of a proportion, how do you find the fourth term?

Check your grammar

1. Read these words and say which part of speech they belong to. Give their Ukrainian equivalents:

proportion, fraction, common, fourth, numeral, method, way, expression, express, population, populate, hope, differ, hopeful, equal, equally, equate, equality, think, thinker, remainder, remain, electric, electricity, combination, combine, indicator, indicate, indication, agree, disagree, form, formal, inform, informal, formality, formalize

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2. State the function of the Infinitive. Translate the sentences:

1. You are to give your viewpoint on the subject. 2. We must use braces or brackets so as to avoid misunderstanding. 3. The method to be described is rather convenient. 4. Similar situations will be described in the chapter to follow. 5. To adjust the new program to the existing machine is the purpose of this work. 6. The tools to be used for this experiment should be very precise. 7. To find the truth is the aim of our discussion. 8. To solve this equation multiply each term in it by the quantity that precedes it. 9. To prove this theorem means to find a solution for the whole problem. 10. They must have attended his lecture. 11. To check the result of the calculation is very important. 12. To define which of these numerals is greater is not difficult. 13. Our aim is to extend the previous definition. 14. There are some important properties of division to be considered at this lesson. 15. It is to be noted that the decimal point separates every three numbers.

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3. Note the use and meanings of the verb “do”. Translate these sentences:

1. These two planets do travel at the same speed.
2. The point does lie inside the triangular region.
3. This system as well as the other one does require a certain modification.
4. This term students do not attend as many lectures as they did during the previous term.
5. The article describes the method worse than the book does.

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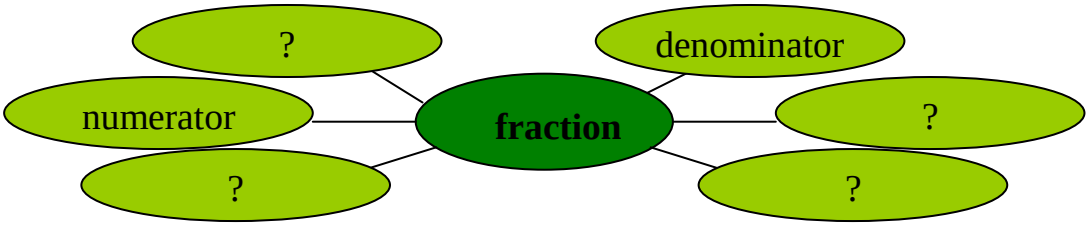
Give your associations with the word “fraction”:



Read the joke and say:

What was the reason of Tommy’s answer? Do you think the teacher expect such an answer? Why?

Teacher (giving a lesson on fractions.) — "Here, children, is a piece of meat. If I cut it in two, what shall I have?"
Class — "Halves!"
Teacher — "And if I cut it again in two, what do I get?"
Class — "Quarters!"
Teacher — "And if I again do the same?"
Class — "Eighths!"
Teacher — "And if I continue in the same way?"
Class (a duet) — "Sixteenths!"
Teacher — "Good! And if we cut our pieces once more in two, what then shall We have?"
Tommy (after a long silence) — "Please, miss, mincemeat!"

Notes:

mincemeat – фарш

Notes on the topic studied:

Notes on the topic studied:

Notes on the topic studied:

Unit Ten

Task 1. Discuss the following questions:

- Do you consider geometry to be useful in our life?
- In what fields can we apply our knowledge of geometry?
- Will you draw some geometric figures and name them?

Task 2. Questions for Eagers:

1. Where did geometry begin?
2. What is the name of a man who put all the known facts about geometry into a logical sequence?
3. What is the most fundamental idea in the study of geometry?
4. Is the dot a point or only a picture of a point?
5.

Task 3. Read the phonetic transcription. Practise your pronunciation:

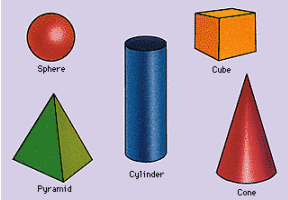
[dʒɪ'ɔmɪtrɪ] [ˌænə'lɪtɪc dʒɪ'ɔmɪtrɪ] ['pleɪn dʒɪ'ɔmɪtrɪ] ['sɔlɪd dʒɪ'ɔmɪtrɪ] ['ɵɪərəm] ['ʃeɪp] ['æŋgl] [sə:kl] ['traɪæŋgl] ['rektæŋgl] [kə:v] ['ɑ:tʃ] [saɪz] [ˌkwɔdrɪ'lætərəl] [ɪ'lɪps] [kəun] ['sfɪə] [pæ'rəbələ] [pə'rɪmɪtə] [ˌpəpən'dɪkjulə] [baɪ'sekt] [baɪ'sektə] [reɪ] [ˌdefɪ'nɪʃən] ['meʒə]

Task 4. Practise saying the following words. Pay attention to the pronunciation:

geometry, geometric figures, analytic geometry, plane geometry, solid geometry, Euclidean geometry, shape, geometric shapes, size, circles, triangles, rectangles, solid figures, cubes, cones, sphere, quadrilaterals, curves, planes, ellipses, parabolas, perpendicular, to bisect, angle, arc, ray, theorem, axiom, line segment, postulate, an axiomatic system, practical applications, earth, to measure, undefined terms, defined terms, to prove, definition, to bisect, algebraic methods, coordinate.

Task 5. Read the text and match two columns:

A line has length	➢ an axiomatic system.
The world is full	➢ but no width.
The terms of geometry fall into two categories	➢ of geometric shapes.
Geometry is organized as	➢ undefined and defined.



Geometry

Geometry is a branch of mathematics. Geometry involves studying the shape, size, and position of geometric figures. These figures include plane (flat) figures, such as circles, triangles, and rectangles, and solid (three-dimensional) figures, such as cubes, cones, and spheres.

The name geometry comes from two Greek words meaning earth and to measure. The earliest uses of geometry included measuring lengths and areas of land.

Geometry also has practical applications in many fields. For example, architects and carpenters must understand the properties of geometric objects to construct stable and attractive buildings. Navigators of airplanes, ships, and spacecraft rely on geometric ideas to chart and follow the correct course. Designers, engineers, metalworkers, and photographers also use geometric principles in their jobs.

Geometry is organized as an axiomatic system. Such a system is based on statements that are accepted as true. From these truths, we can reason deductively to prove statements about classes of things. In geometry, those things are geometric figures. Any axiomatic system consists of three sets of elements: (1**) terms**, (2) **axioms,** and (3) **theorems**.

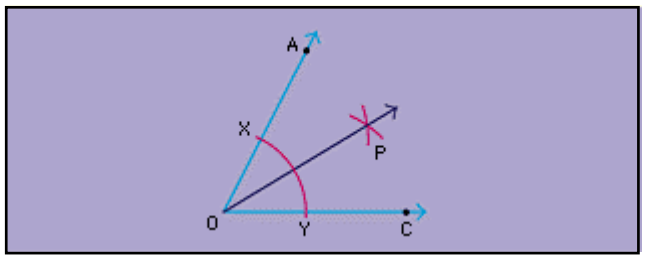
Terms. The terms of geometry fall into two categories: undefined and defined. Undefined terms, such as point, line, and plane, form the basic building blocks of the axiomatic system of geometry. Undefined terms can be used in defining other terms. For example, line segment AB (symbol, CAB), shown below can be defined as the set of points A and B and all points between A and B on line AB (DAB). Similarly, ray AB (IAB) can be defined as the part of line AB that contains point A and all points on the same side of the line as B.

Axioms, also called postulates, are statements that are assumed to be true and are therefore accepted without proof. An example of an axiom is the statement for every pair of distinct points, there is exactly one line that contains them.

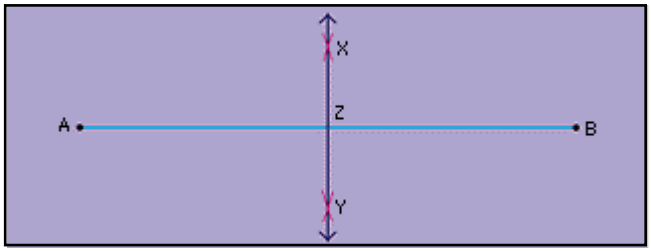
Theorems are statements that can be proved true by using deductive reasoning. A step-by-step procedure is used in proving a theorem. Each step involves a reference to a definition, an axiom, a previously proven theorem, or some other information already given.

Some basic geometric constructions

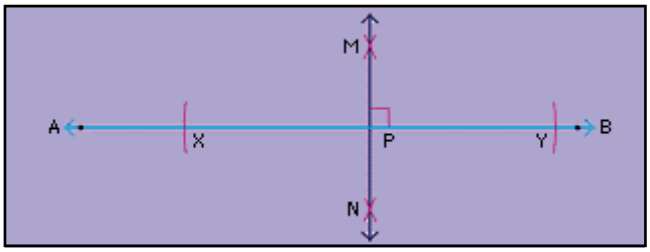
Bisecting an angle. Suppose we want to bisect (divide into two equal parts) angle AOC, below. Place the point of a compass on point O and draw an arc that intersects the sides of the angle at points X and Y. Extend the width of the compass to a length greater than half the distance from X to Y. Place the compass point on X and draw an arc in the interior of ∠AOC. Repeat, with the compass point on Y. Draw ray OP. This ray bisects ∠AOC, creating two congruent angles, ∠POA and ∠POC.



Bisecting a line segment. To bisect line segment AB, below, set the compass width at greater than half the length of CAB. Put the compass point on point A and draw an arc above and below CAB. Move the compass point to point B and repeat. Draw line XY. The point Z bisects CAB. Furthermore, DXY is perpendicular to CAB.



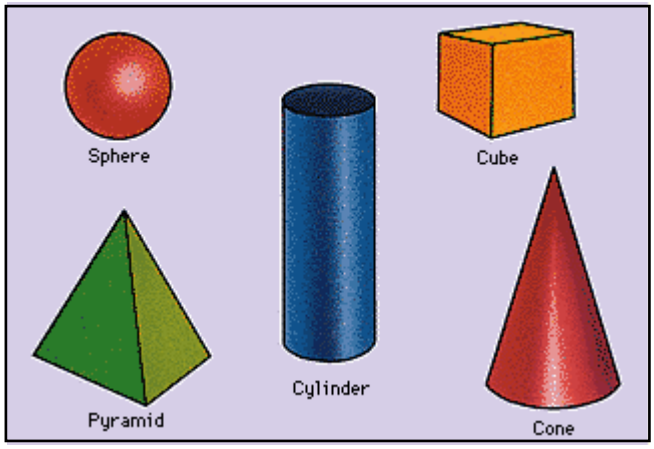
Drawing a perpendicular to a line. Suppose we want to construct a perpendicular to line AB from a point on the line (point P) (see the diagram below). Put the compass point on P and draw arcs that intersect DAB on either side of P (at points X and Y). Using X and Y as end points, bisect CXY according to the directions given above. The bisecting line, DMN, is perpendicular to DAB at point P.



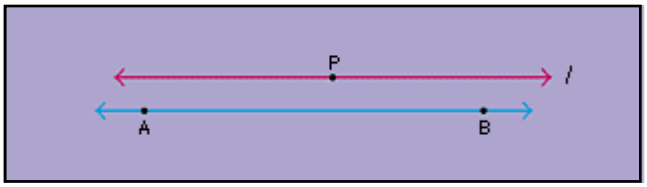
Types of geometry

The study of geometry can be approached in a number of ways. Analytic geometry uses the same axioms as Euclidean geometry, but it employs algebraic methods in working with geometric figures. All geometries that do not use algebraic methods are called synthetic geometries.

Euclidean geometry can be divided into plane geometry and solid geometry. Plane geometry involves the study of such two-dimensional figures as lines, angles, triangles, quadrilaterals, and circles. Solid geometry involves the study of three-dimensional figures, such as those shown below.

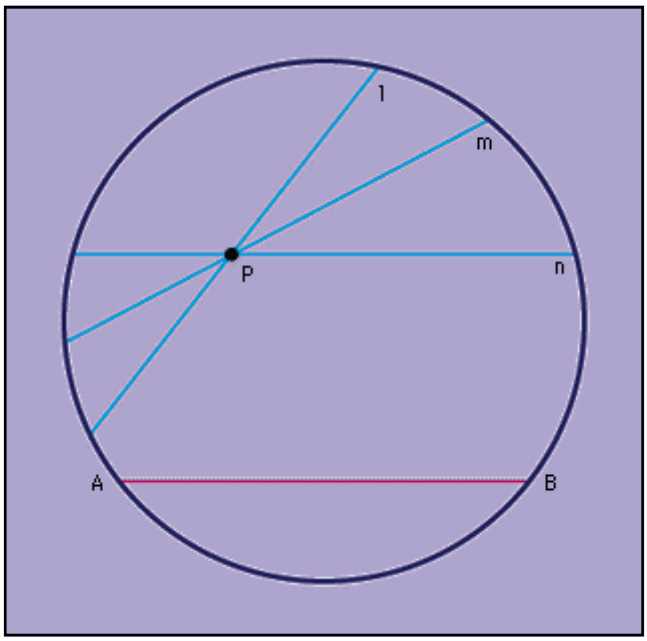


One of the most famous axioms in Euclidean geometry is Euclid's parallel axiom, also known as Euclid's fifth axiom or the parallel postulate. One way of stating the parallel axiom is through a point not on a given line, only one line can be drawn parallel to the given line. For example, in the illustration below, line I is the only line parallel to line AB that can be drawn through point P.



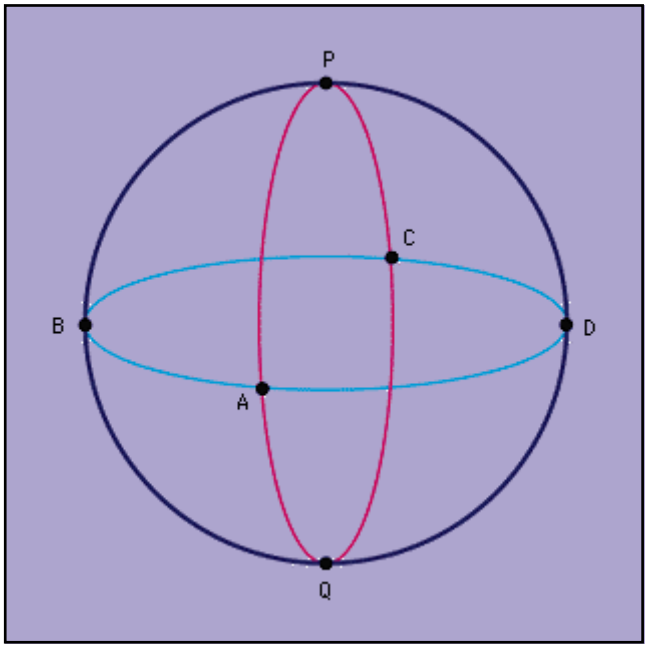
Non-Euclidean geometry. One basic type of non-Euclidean geometry is called hyperbolic geometry. In it, the parallel axiom is replaced by the following axiom: through a point not on a given line, more than one line may be drawn parallel to the given line.

In one model of hyperbolic geometry, plane is defined as a set of points that lie in the interior of a circle. Line is defined as a chord of a circle. And parallel lines are defined as lines that never intersect. In the diagram below, therefore, lines L, M, and N are all considered parallel to line AB, even though they all pass through the same point, P. Hyperbolic geometry is sometimes called Lobachevskian geometry, because it was developed--in the early 1800's - by the Russian mathematician Nikolai Lobachevsky.



Another basic type of non-Euclidean geometry, elliptical geometry, replaces the parallel axiom with the statement through a point not on a given line, there are no lines that do not intersect the given line. In other words, in elliptical geometry, parallel lines do not exist.

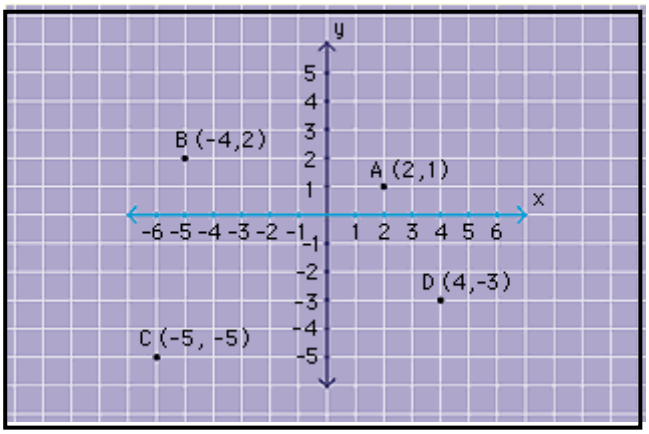
In one model of elliptical geometry, line is defined as the great circle of a sphere. A great circle is any circle that divides a sphere into equal halves. Any two such circles on a sphere must intersect. In the sphere below, the great circle ABCD intersects the great circle



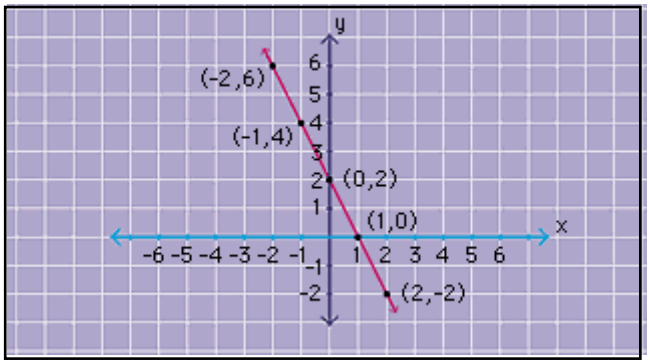
Analytic geometry is a method of studying the properties of geometric figures by using algebraic techniques. Analytic geometry deals with the same subject matter as Euclidean geometry, but provides simpler ways of proving many theorems. It plays an important role in trigonometry and calculus.

Analytic geometry makes use of a coordinate system. This system consists of two perpendicular number lines in a plane. Points of a geometric figure are located in the plane by assigning each point two coordinates (numbers) on the number lines x and y. The x-coordinate, called the abscissa, gives the location of the point along the x-axis (horizontal number line). The y-coordinate, called the ordinate, locates the point along the y-axis (vertical number line).

For example, the paired coordinates for point A in the figure below are (2,1).



We can describe geometric figures in terms of coordinates by devising algebraic equations that represent the points that make up the figures. For example, the equation 2x + y = 2 has many solutions of the form (x,y), such as (-2,6), (-1,4), (0,2), (1,0), and (2,-2). If these points are plotted on a coordinate graph and then connected with a smooth line, they are found to lie on a straight line. A graph of solutions of the equation is shown below. Any point (x,y) that lies on the line has coordinates that satisfy the equation 2x + y = 2, and any pair of numbers (x,y) that satisfy the equation will be a point on the line. Other plane geometric figures also have their own equations and can be graphed on a coordinate system. These figures include conic sections. Conic sections are types of curves formed by the intersection of planes and cones. They include circles, ellipses, and parabolas.



Glossary:

geometry [dʒɪ'ɔmɪtrɪ] *n* – геометрія

analytic geometry [ˌænə'lɪtɪc dʒɪ'ɔmɪtrɪ] *n* – аналітична геометрія

plane geometry ['pleɪn dʒɪ'ɔmɪtrɪ] *n* – планіметрія

solid geometry ['sɔlɪd dʒɪ'ɔmɪtrɪ] *n* – стереометрія

theorem ['θɪərəm] *n* – теорема
prove ['pru:v] *v* – доводити, перевіряти

shape ['ʃeɪp] *n* – форма
angle ['æŋgl] *n* – кут
circle [sə:kl] *n* – коло, окружність
triangle ['traɪæŋgl] *n* – трикутник

quadrilateral [ˌkwɔdrɪ'lætərəl] *n* – чотирикутник
rectangle ['rektæŋgl] *n* – прямокутник
curve [kə:v] *n* – дуга, крива

arch ['ɑ:tʃ] *n* – дуга
ellipse [ɪ'lɪps] *n* – еліпс, овал
perpendicular [ˌpəpən'dɪkjulə] *n* – перпендикуляр
bisector [baɪ'sektə] *n* – бісектриса

Exercises
Work in pairs

1. Match a line in A with a line in B

A	B
Analytic geometry	➢ involves studying the shape, size, and position of geometric figures.
Plane geometry	➢ are statements that can be proved true by using deductive reasoning.
Axioms	➢ involves the study of three-dimensional figures.
Theorems	➢ is a method of studying the properties of geometric figures by using algebraic techniques.
Geometry	➢ are statements that are assumed to be true and are therefore accepted without proof.
Solid geometry	➢ involves the study of such two-dimensional figures as lines, angles, triangles, quadrilaterals, and circles.

Compare your answers.

2. Work in pairs and discuss the following questions:

1. Is geometry an old subject?
2. Does geometry include only the study of the shape and size of objects?
3. What is a point?
4. Has a point any dimensions?
5. Are points represented by dots?
6. Does a line segment include its endpoints?
7. Can you draw a straight line by using a ruler?
8. What do we mean when we say that we draw a geometric figure?
9. What do the figures above the letters indicate?
10. What does the symbol indicate?

3. Complete the sentences with the correct answer. Discuss your answers in groups.

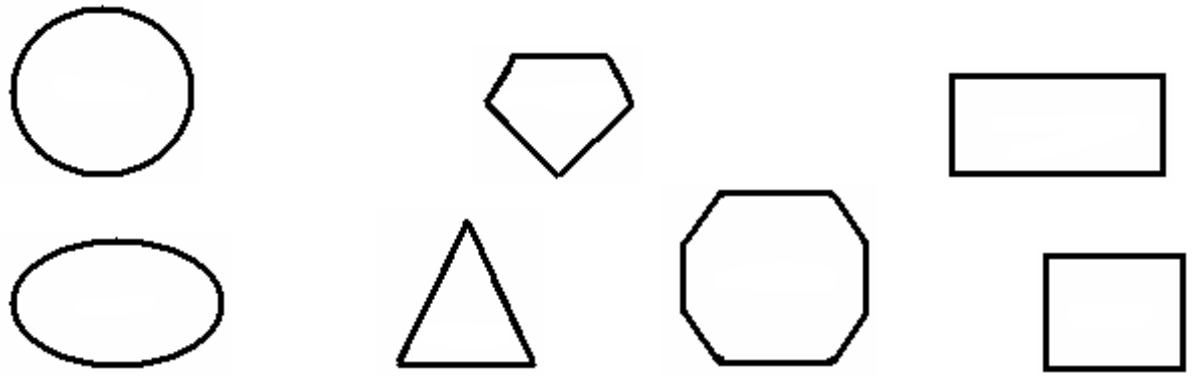
1. A great circle is any circle that divides a sphere into _____.
2. One of the most famous axioms in Euclidean geometry is Euclid's parallel axiom, also known as Euclid's fifth axiom or the parallel _____.
3. All geometries that do not use algebraic methods are called _____.
4. Undefined terms can be used in defining other _____.
5. The name geometry comes from two Greek words meaning _____.
6. Geometry is organized as an _____.

4. Make up sentences of your own using the words and expressions given below:
hyperbolic geometry, plane geometry, a coordinate system, geometric figures, theorems

_____
_____
_____
_____
_____

Discuss the sentences together, then tell others in your group what you think.

5. Work in groups. How many two-dimensional shapes do you know? Name them.

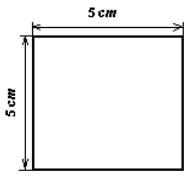


6. Learn three dimensional shapes

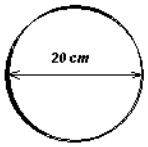
 sphere  cube  pyramid  spiral

7. Fill the blanks with the right words or numbers.

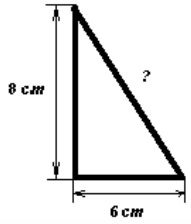
1. a) This is a _____ . It has four _____ sides.
   b) It is _____ centimetres_____ .
   c) It Is also _____centimetres in _____ .
   d) Its area is _____square centimeters.



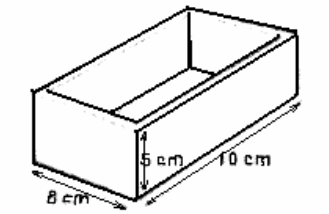
2. a) This is a circle. It is _____.
   b) It is 20 centimetres in _____ .



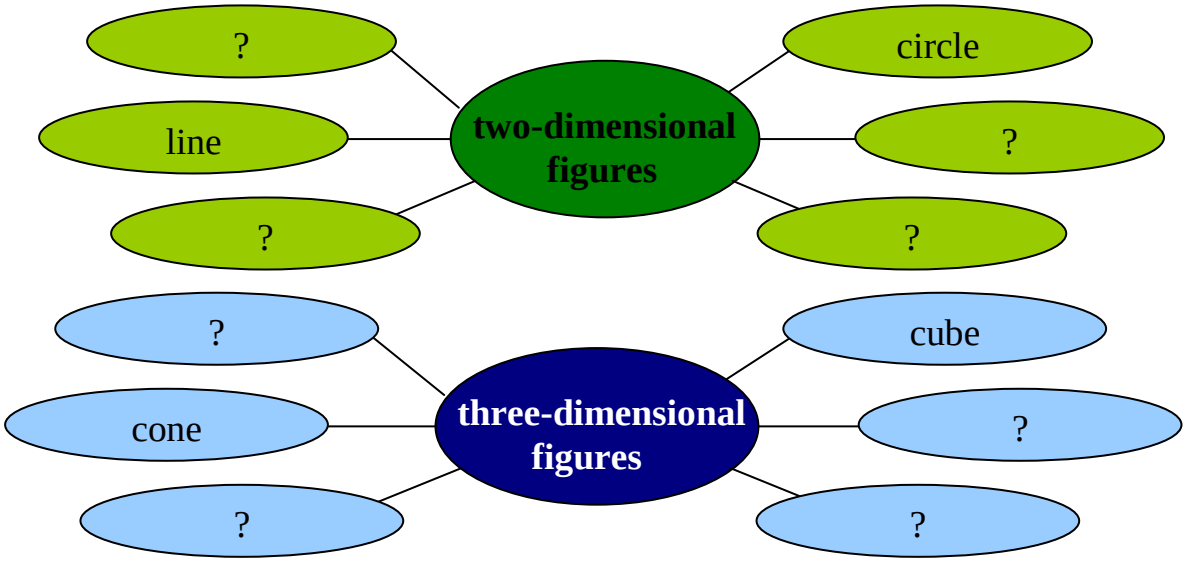
3. a) This is a_____ with an _____ of 90^0.
   b) It is 8 centimetres in_____ .
   c) The base is 6 centimetres _____ .
   d) Its area is_____square centimetres.
   e) The _____ of me other side is_____centimetres.



4. a) This is an _____ box.
   b) It is 5 centimetres_____ .
   c) It is 10 centimetres _____ .
   d) It is 8 centimetres _____ .



8. Complete the diagrams using your knowledge in geometry:



9. Read and answer very quickly.

Blitz - Quiz

1. How high is the highest mountain? How long is the longest river? How deep is the deepest ocean?
2. Are you good at guessing sizes? Can you guess the size of the room you are in, and the tables, chairs, and people that are near you now?
3. Can you describe a simple mathematical theorem or principle of geometry in English?

10. Translate into Ukrainian. Compare your translation in groups.

1. The exact origins of geometry are not known. However, records of the ancient Egyptians and the Babylonians indicate that they were aware of some geometric principles as long as 5,000 years ago. The Egyptians developed geometric ideas that could be used to reestablish land boundaries after the annual flooding of the Nile River. The Egyptians also used geometry in building the pyramids.
2. The Babylonians also were aware of the ideas later expressed in certain geometric theorems, including the Pythagorean theorem. .
3. Most scholars believe that the ancient Egyptians were the first people to make extensive use of geometry.
4. The Greek mathematician Euclid developed the first set of geometric axioms about 300 B.C. in his book called the Elements.
5. Geometry is important for many reasons. The world is full of geometric shapes. For example, snowflakes are shaped like hexagons (six-sided figures), and earthworms are shaped like cylinders.

11. **Read some quotations about geometry and invent your own one:**

"Geometry is one and eternal shining in the mind of God. That share in it accorded to men is one of the reasons that man is the image of God" (Johannes Kepler)

"There is no royal road to geometry" (Euclid)

"Mighty is geometry; joined with art, resistless" (Euripides)

- Discuss it in pairs.

Check your grammar

1. Form nouns from the following verbs and compare your answers.

to use, to satisfy, to study, to locate, to provide, to construct, to describe, to prove, to found

_____

_____

_____

_____

2. Complete the sentences using prepositions suggested in a box:

Geometry concerns the properties and relationships of figures … space.

± The work of mathematicians may be divided … pure mathematics and applied mathematics.

± We use mathematics … such simple tasks as telling time … a clock or counting our change after making a purchase.

± Scientists use mathematical formulas to make predictions based … these findings.

± The physical sciences, such as astronomy, chemistry, and physics rely heavily … mathematics.

± Algebra, unlike arithmetic, is not limited … work with specific numbers.

± Plane geometry deals … squares, circles, and other figures that lie … a plane.

± It represents an algebraic equation as a line or curve … a graph.

± Trigonometry is used widely… astronomers, navigators, and surveyors.

± Certain relations … the lengths of two sides of o right triangle are called trigonometric ratios.

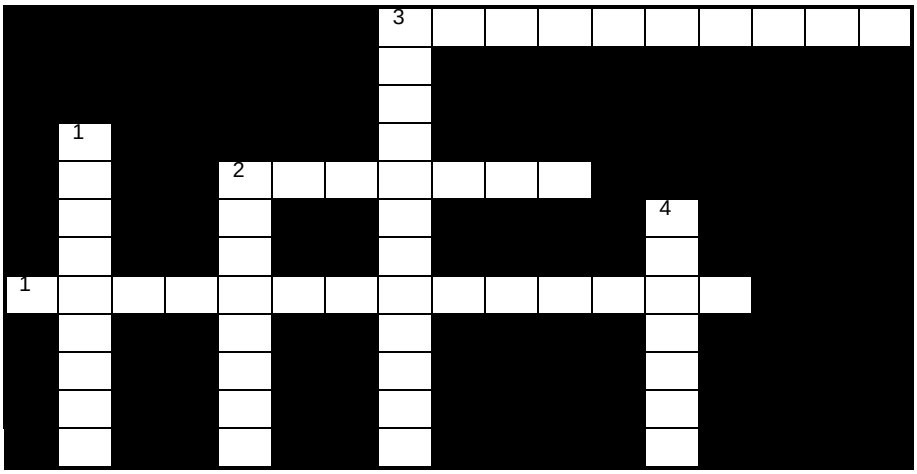
between, by, for, from, in, into, on, on, on, on, to, with.

3. Correct the mistakes if any (pay attention to the verb forms):

1. The result, or answer, is call the product. _____
2. The political scientist use probability to calculate the possible error of the estimate. _____
3. A step-by-step procedure are used in proving a theorem. _____
4. Deductive reasoning begins with statements that is already accepted as true. _____
5. Geometry is organized as an axiomatic system. _____
6. Geometry also have practical applications in many fields. _____
7. Rate to be the relation between two quantities that are measured in different units. _____
8. You has made a lot of mistakes. _____
9. She seen something interesting and draw two more lines. _____

10. Invented the Hindus our present-day numeral system? _____

4. Try the crossword!
All of the words are in Units 6-7.



Across
1. The number by which the dividend is divided.(2)
2. A short way of adding or counting equal numbers.(1)
3. The number that does the multiplying.(3)

Down
1. The way of separating a group of things equal parts.(2)
2. The result of the division.(4)
3. The result of multiplication.(1)
4. The number that is being multiplied.(3)

- Read and Smile:

Commencing the discussion having to do with the atomic theory, the instructor of a physical class in the nukes course wrote an equation on the board and stated that a certain number of electrons were involved. From this he developed an entire board full of equations winding up at the bottom with:
"So you see, we have five less electrons than at the start. What has become of them?"
No answer from the class. Sternly the instructor asked: "Well, where are those electrons?"
From a rear seat came a gruff command of the top sergeant: "Nobody leaves this room till they're found!"

Notes:
commence – починати
to have to do with smth. – стосуватися чогось, мати відношення до чогось
a nukes course – (розм..) курс з основ ядерної енергетики
wind up – закінчувати, закруглятися
a rear seat – задня лава
gruff – різкий, суворий

Ask and answer:
- Do you think that the sergeant understand need in atomic theory?

Notes on the topic studied:

Notes on the topic studied:

Notes on the topic studied:

Self-access independent work
Unit One

Task 1. Answer the following questions:

- √ Extract roots of such numbers and write down the answers …
  H25, H81, H-125, H-30, …
- √ If you need to extract roots how do you do it? Do you often use an electronic calculator?
- √ Do you know any square roots by heart? Give your examples.
- √ What does the radical sign denote?
- √ Do you use the division method in finding the square root?

Task 2. Read the phonetic transcription. Practise your pronunciation:

['skwɛə ru:t] ['kju:b ru:t] ['ekstrækt] [dı'tə:mın] [ə,prɔksı'meıʃən] ['rædıkəl saın] ['lɔgərıðəm] ['slaıd'ru:l] ['həul'nʌmbə] [ın'defınıtlı] ['fæktə] ['kælkjuləs] [prə'sıdʒə]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

square root, cube root, approximation, radical sign, numeric figure, positive number, negative number, averaging process, logarithm, slide rule, indefinitely, factor, whole number, to extract, to determine, calculus, imaginary numbers, approximation, tables of logarithms, the original number, guess, estimate, procedure, to improve, root sign.

Task 4. Read the text and find some information about Isaac Newton's method of extracting roots.

Square Root

Square root of a number is a second number whose product with itself gives the original number. For example, a square root of 4 is 2, because 2 X 2 = 4. The symbol for a square root, called a radical sign, is H. For example, H25 = 5 and H4 = 2. The negative number -2 is also a square root of 4, because -2 X -2 = 4. Each positive number has both a positive and negative square root. These two square roots will always be the positive and negative values of the same numeric figure.

Finding square roots. The easiest and fastest way to find the square root of a number is to use an electronic calculator. Other aids to finding square roots are tables of square roots, tables of logarithms, and slide rules.

It is possible to compute square roots to any desired accuracy using the basic operations of arithmetic. The method described here was discovered by the English mathematician Isaac Newton in the late 1600's.

To find the square root of a number, first make a guess or estimate of the square root of that number. It does not have to be a good guess, and, in fact, the number itself may be used. Next, take the average of the estimate and the number divided by the estimate. This average becomes a new and better estimate for the square root. To tell how good an estimate it is, multiply it by itself and compare the result to the number whose square root is sought. To improve the estimate, repeat the dividing and averaging process.

For example, to find H40 using a first estimate of 40, the number divided by the estimate is 40 ¸ 40, or 1, and the average of this number and the estimate is 1/2 X (40 + 1), or 20.5. Next take the average of this second estimate and its division into 40, 1/2 X [20.5 + (40 ¸ 20.5)], to obtain the third estimate, 11.23. By repeating the procedure, the fourth estimate becomes 1/2 X

[11.23 + (40 ¸ 11.23)] = 7.40; the fifth, 1/2 X [7.40 + (40 ¸ 7.40)] = 6.40; and the sixth, 1/2 X [6.40 + (40 ¸ 6.40)] = 6.33. Checking the square, one finds that 6.33 X 6.33 = 40.07, which means that 6.33 is a close approximation of H40.

The process goes faster if a better guess is used for the first estimate. However, it always eventually gives a good approximation of the square root. Newton gave a logical proof of why this is true using an advanced kind of mathematics called calculus. Because the process is completely mechanical if the number itself is used as the first estimate, it can be programmed into a computer. Mathematical processes like these are called algorithms.

If a square root of a number that does not fall between 1 and 100 must be found, first multiply or divide the number by 100 to bring it within this range. Consider, for example, finding H4,000. Divide 4,000 by 100. This yields 40, a number within the 1 to 100 range. Now multiply the square root of 40, already determined as 6.33, by 10 (the square root of 100) to obtain the square root of 4,000: 63.3. In the same way, H0.4 = 0.633, which can be found by multiplying by 100, finding the square root of 40, and dividing by 10.

Square roots of negative numbers. What is the square root of -4? Or, what number multiplied by itself gives a product of -4? If there is such a number, it cannot be positive, negative, or zero. None of these multiplied by itself can give a negative number. But, for convenience in solving certain problems, mathematicians have invented a system of imaginary numbers, whose squares are negative numbers.

Cube Root

Cube root is one of three equal factors of a number. The same number (m) taken as a factor three times is the cube root of another number (n). Thus, m X m X m = n. For example, 2 is the cube root of 8, because 2 X 2 X 2 = 8, and -5 is the cube root of -125, because -5 X -5 X -5 = -125. A real number has only one real cube root, which is positive or negative, according to whether the given number is positive or negative. When a cube root or any other root of a number is to be extracted (determined), another symbol is placed over the number. This symbol is called the root sign, or radical sign. If the root to be extracted is a cube root, a small figure 3 is added to the root sign.

To find the cube root of a number, you can use a scientific calculator, or you can look up the root in a table of cube roots. If neither of these is available, you must calculate the root.

You can use a procedure called Newton's method to calculate the cube root of a number between 1 and 1,000. For example, you might wish to find the cube root of 200. Since 5 X 5 X 5 = 125, and 6 X 6 X 6 = 216, it is easy to see that 6 is the closest integral, or whole number, cube root of 200. A closer complete approximation can be made by dividing 200 by the square of 6, or 6 X 6, which equals 36. To the nearest tenth, this gives 5.6. Thus, 6 X 6 X 5.6 is approximately 200.

To get the second approximation of the cube root of 200, average the three factors 6, 6, and 5.6. This will give (6 + 6 + 5.6)/3 = 5.9. This procedure is repeated to obtain a still better approximation. Thus, 200/(5.9 X 5.9) = 200/34.81 = 5.74, and the next approximation is given by (5.9 + 5.9 + 5.74)/3 = 5.85. Repeating once more gives 200/(5.85 X 5.85) = 200/34.2225 = 5.8441, which gives the next approximation (5.85 + 5.85 + 5.8441)/3 = 5.8480.

This process may be continued indefinitely. In each approximation beyond the second, you can retain a number of digits that is one less than twice the number of digits found in the previous approximation. For example, the second approximation, 5.9, contains two digits. The third approximation may retain three digits, and the fourth approximation may retain five digits.

If the number whose cube is desired is not between 1 and 1,000, either multiply or divide it successively by 1,000 to bring it within this range. The cube root of this number will lie between 1 and 10. After finding the cube root, either divide or multiply it successively by 10 as many times as necessary to give the cube root of the original number.

Glossary:
square root ['skwɛə ru:t] *n* – корінь квадратний
cube root ['kju:b ru:t] *n* – корінь кубічний
extract ['ekstrækt] *v* – добувати (корінь)
determine [dı'tə:mın] *v* – визначати, встановлювати
approximation [ə,prɔksı'meıʃən] *n* – наближення, наближене значення
radical sign ['rædıkəl saın] *n* – знак кореня, знак радикалу
logarithm ['lɔgərıðəm] *n* – логарифм
slide rule ['slaıd'ru:l] *n* – логарифмічна лінійка
indefinitely [ın'defınıtlı] *adv* – невизначено
factor ['fæktə] *n* – множник
calculus ['kælkjuləs] *n* – числення
procedure [prə'sıdʒə] *n* – методика проведення

Exercises
Work in pairs

1. Match a line in A with a line in B

A	B
Square root of a number is Cube root is The symbol for a square root A real number has only This symbol is called the root sign, or	➢ one real cube root. ➢ a second number whose product with itself gives the original number. ➢ one of three equal factors of a number. ➢ radical sign. ➢ is H.

- Compare your answers.

2. How numerate are you? Try this numbers quiz.

1. Name the first four odd numbers.
2. Name the first four even numbers.
3. Name the first four prime numbers.
4. Give an example of a decimal fraction.
5. Give an example of a vulgar fraction.
6. How do you read this formula and what does it represent: $e = mc^2$
7. How do you read this and what does it represent: *2 pr*

3. Write the following in words rather than in figures or symbols. Compare your answers in groups.

1. 2% of the British population owned 90% of the country's wealth in 1992.

_____

2. 0°C = 32°F

_____

3. 62.3% of adults have false teeth.

_____

4. $^2/_3 + {}^1/_4 \times 4^2 = 14^2/_3$

_____

5. 2,769,425 people live here.

_____

4. Match the English words with their Ukrainian equivalents:

1. proper fraction	a) ціле число
2. quadrilateral	b) відсоток
3. rectangle	c) віднімання
4. remainder	d) трикутник
5. shape	e) поверхня
6. subtraction	f) правильний дріб
7. surface	g) чотирикутник
8. triangle	h) прямокутник
9. whole number	i) залишок
10. percentage	j) форма

5. Complete the following sentences with the correct answer. Discuss your answers in groups.

1. To find the square root of a number, first make a guess or estimate of_____.
2. If the root to be extracted is a cube root, a small figure 3 is added _____.
3. When a cube root or any other root of a number is to be extracted, another symbol is placed over _____.
4. Newton gave a logical proof of why this is true using an advanced kind of mathematics called _____.
5. It is possible to compute square roots to any desired accuracy using _____.

6. Translate into Ukrainian. Compare your translation in groups.

1. Root, in arithmetic, is a quantity that yields a given quantity when it is taken as a factor a specified number of times The number of times the root is taken as a factor is called its index. Roots are named from their indexes. Thus, 3 is a fourth root of 81, because 3 X 3 X 3 X 3 = 81. Roots with indexes of 2 and 3 are also called square roots and cube roots, respectively.
2. A root in algebra is a solution of an equation-that is, it is a quantity which, when substituted for the variable in an equation, satisfies the equation. For example, 3 is a root of x + 2 = 5, because if 3 is substituted for the variable x, the equation correctly reads 3 + 2 = 5.

_____
_____
_____
_____
_____
_____
_____
_____
_____

7. Write a description of an object but do not say what it is used for.
Remember to describe the following:

a) Its shape (e.g. 'It is round- It is box-shaped etc.')
b) Its size (e.g. 'it is usually about 7 centimetres high/long/wide/deep etc.')
c) The material it is usually made of (e.g. 'it is usually made of wood/plastic etc.')
d) Its colour (e.g. 'It is usually black/white/green etc.')

_____
_____
_____

Read your description to another person and see if they can guess what it is.

Check your grammar

1. Read these words and say which part of speech they belong to. Give their Ukrainian equivalents:

memory – memorize – memorial; nature – natural – unnatural, local – localize; circle – circulate – circulation; symbol – symbolize – symbolically; closely – close – closure – enclose; limit – limitless – unlimited – limitation; approximate – approximately – approximation

_____
_____
_____
_____
_____
_____

2. Change the following according to the model:

A. I know that he is a good mathematician.
B. I know of his being a good mathematician.

1. I know that he studies algebra. 2. Everybody knows that mathematics is one of the most useful and fascinating divisions of human knowledge. 3. We know that mathematics is an essential part of nearly all scientific study. 4. I know that geometry concerns the properties and relationships of figures in space.

_____
_____
_____
_____
_____

3. Use the correct form of Imperative Mood:

1. (to check) _____your answer.
2. (to add) _____ the 10's column: 2+3+2+1=8.
3. (to write) _____ 9 in the 100's place of the answer.
4. (to use) _____the same method of carrying for 1.000's and larger numbers.
5. (to remember) _____what addition means.
6. (to find) _____the answers to addition problems by counting.
7. (to make) _____ two cards for each number.
8. (to divide) _____the pack of cards into two piles.
9. (to draw) _____a tick-tack-toe figure on a piece of paper.
10. (to fill) _____in the spaces with the numbers from 1 to 9.

4. Put all types of questions to the following sentences:

- Johann Bernoulli worked in analytic geometry and in physics.

_____
_____
_____
_____

- Statistical methods provide information to government, business, and science.

_____
_____
_____
_____
_____

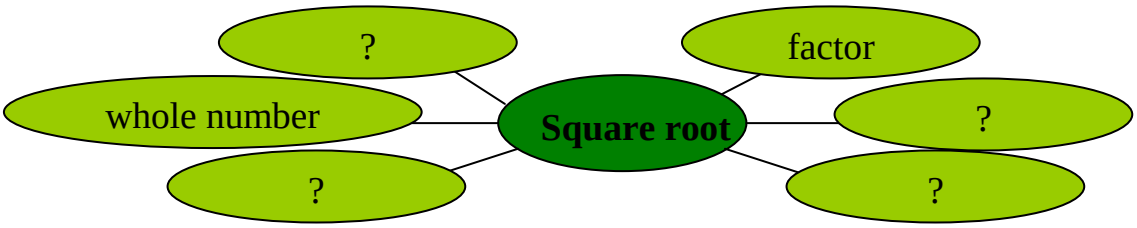
- A ray has indefinite length and only one endpoint.

_____
_____
_____
_____

- A mixed fraction contains an integer and a proper fraction.

_____
_____
_____
_____
_____

5. Give your associations with the word "Square root":



Notes on the topic studied:

Notes on the topic studied:

Notes on the topic studied:

Unit Two

Task 1. Think and answer:

☺ Will you continue your education after graduating from this university? Where?

☺ Where do you want to work? Will you teach mathematics at school? Give your motives.

☺ A person who knows mathematics has a lot of possibilities to find a good job. Do you agree with it?

Task 2. Read the phonetic transcription. Practise your pronunciation:

[kə'rɪə] [ˌmæθɪ'mætɪks] [ˌmæθɪmə'tɪʃən] ['bækgraund] ['bætʃələ] [ɪn'ʃuərəns] [ˌmʌltɪplɪ'keɪʃən] [dɪ'vɪʒən] [ˌsəb'trækʃən] [ə'dɪʃən] [əˌprɔksɪ'meɪʃən] ['æŋgl] ['bra:ntʃ] [kən'klu:ʒən] ['steɪtmənt] [ɪ'kweɪʃən] ['fɔ:mjulə] [dʒɪ'ɔmɪtrɪ] ['ældʒɪbrə]

Task 3. Practise saying the following words. Pay attention to the pronunciation:

careers, bachelor's degree, doctor's degree, mathematicians, physics, background, insurance companies, statisticians, differential equations, abstract algebra, real and complex variables, efficient use, to prepare exact statements, essential tools, diagonal lines, numerical predictions, octagon, design policies.

Task 4. Read the text and make a list of professions available to a person who masters mathematics.

Careers

A strong background in mathematics is excellent preparation for a wide variety of careers. Students who wish to study mathematics at the universities should take high school courses in algebra, geometry, trigonometry, and calculus, if available. These courses also are useful for study in architecture, engineering, and physics.

At the university, the basic courses for a major in mathematics include advanced calculus, differential equations, abstract algebra, numerical analysis, number theory, theories of real and complex variables, probability, and statistics. Courses in logic and computer programming also are useful in preparing for many careers.

Mathematicians teach at all levels. High school mathematics teachers must have at least a bachelor's degree in mathematics. Many mathematicians with a doctor's degree teach at colleges and universities.

Large numbers of mathematicians work in business, government, or industry. Those with a bachelor's degree may find work as accountants, computer operators, and statisticians. Many people who have earned a master's or doctor's degree in mathematics conduct research for the communications, energy, manufacturing, or transportation industries. Mathematicians also work in the computer industry as programmers or as systems analysts who determine the most efficient use of a computer in any given situation. Insurance companies employ mathematicians as actuaries to calculate risks and help design policies.

Glossary:

career [kə'rɪə] *n* – кар'єра, успіх, професія

mathematician [ˌmæθɪmə'tɪʃən] *n* – математик

background ['bækgraund] *n* – підготовка, кваліфікація

bachelor ['bætʃələ] *n* – бакалавр

insurance [ɪn'ʃuərəns] *n* – страхування

Exercises

Work in pairs

1. Make up sentences of your own using the words and expressions given below:

a wide variety of careers, to work as accountants, computer operators and statisticians, high school courses, computer industry

_____
_____
_____
_____
_____
_____
_____

Discuss the sentences together, then tell others in your group what you think.

2. Express your agreement or disagreement with the following statements. If you disagree, say why.

1. Large numbers of mathematicians work in business, government, or industry.
2. The appreciation of the connection between man's classifying instinct and mathematics was recognized many centuries ago.
3. Ordering mathematical objects is not important in mathematics.
4. Generally we denote sets by small letters and members of sets by capital letters.
5. The gravitational field is rotational.
6. The theory of universal gravitation was formulated by Galileo.

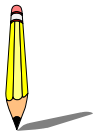
3. Translate into Ukrainian. Compare your translation in groups.

1. Mathematics and logic are not based on experimental testing. But they can be considered part of science because they are essential tools in almost all scientific study.
2. Mathematics enables scientists to prepare exact statements of their findings and theories and to make numerical predictions about what will happen in the future.
3. Logic provides the basis for all scientific reasoning.

_____
_____
_____
_____
_____
_____

4. Draw the following shapes. Discuss it in pairs.

1. A right-angled triangle with two equal sides of about two centimetres in length. Draw a small circle at the centre of the triangle and then draw lines from the centre of the circle to each of the angles of the triangle.
2. A rectangle with diagonal lines joining opposite angles.
3. An octagon with equal sides. Draw an oval in the middle of the octagon.
4. A cube of roughly 3 cm by 3 cm by 3 cm.



- Follow-up: Write down some numbers that are important for you - your age, any numbers in your address, your telephone number and similar numbers for any *of your* friends, any other numbers that are significant for you at work *or* in your study,. Make up your sentences using these numbers.

5. Match two columns:

0.34	half
5	mixed number
½	improper fraction
3¾	proper fraction
7/6	decimal fraction
¼	whole number
8/9	quarter

- Compare your answers.

Check your grammar

1. Change the following according to the model:

A. It is important to know these rules.

B. Yes, knowing these rules is important.

1. It is serious to solve this problem. 2. It was necessary to produce that information. 3. It would be interesting to find the sum. 4. It is important to locate the point in space.

_____

_____

_____

_____

Modal Verbs.

2. Choose the correct form from the brackets:

1. Branches of mathematics (may, cannot, must) _____differ in the types of problems involved and in the practical application of their results.
2. If you (can, cannot) add these fractions today, you (can, cannot, will be able) _____ to do it next time.
3. Careful analysis and reasoning (can, must) _____help us solve some of the deepest puzzles we (can, must) _____ face.
4. Using trigonometric ratios, a person (must, should, can) _____calculate the unknown angles.
5. Pythagoras explored the nature of numbers, believing that everything (can, could) _____be understood in terms of whole numbers or their ratios.
6. High school mathematics teachers (can, may, must) _____ have at least a bachelor's degree in mathematics.
7. Many years ago scientists (cannot, could not, may not) _____discover new knowledge without the aid of arithmetic in experiments and research.
8. When a set gets larger, you (can, could, have to) _____count to find its number.
9. You (must, ought to, can) _____easily learn the rules for changing fractions.
10. You (can, may, must) _____learn how to add, subtract and multiply before you begin to study division.

3. Ask questions using the words in brackets:

1. He has to come back next week. (who, when).

_____

_____

2. We must avoid discussing the situation with her. (who, with whom, what).

_____

_____

_____

3. These ideas were reflected in a recent article. (where, what).

_____

_____

4. An electronic computer is known to be complicated device. (what, what kind of).

_____

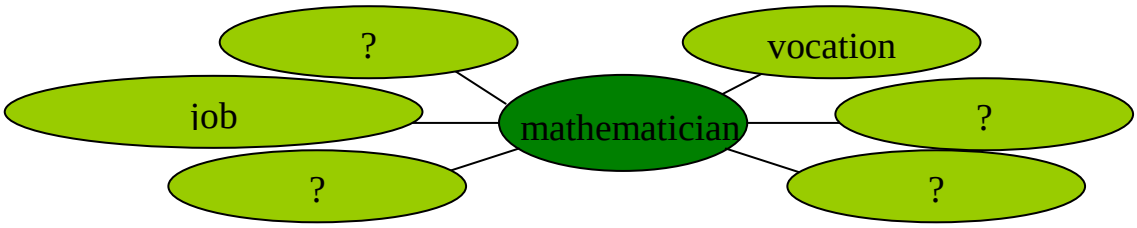
_____

5. For the problem to be solved it must be stated clearly. (what, how)

_____

_____

4. Complete the diagram with your own ideas:



- Read and Smile:

***

Teacher — "Well, how stupid you are, to be sure! Can't multiply eighty-eight by twenty-five! I'll wager that Charles can do it in less than no time." Abused Pupil —"I shouldn't be surprised. They say that fools multiply very rapidly these days."

Notes:

wager – битися об заклад

… in less than no time – за мить

to abuse – кривдити

Answer the questions:

a) Was the pupil's point of view correct? Do you know any examples to support your point?

b) How can a person multiply eighty-eight by twenty-five quickly?

***

Read the joke and say:

a) Why wasn't Mawruss diligent in reality?

b) Do you think he is a promising businessman or lazy pupil?

The arithmetic teacher said, "Now boys, I want you to figure what interest of one percent on a million dollars for two years would come to." The whole class set to work diligently with the exception of little Mawruss in the front row. "What's the matter, Mawruss?" said the teacher. "One percent doesn't interest me," said Mawruss.

****

The Professor put this notice on the college notice-board: "Professor Bateson will be unable to meet his classes tomorrow."

A bright young spark deleted the "c" from the word "classes" and, since the college was not coeducational, the notice raised many appreciative laughs.

But the Professor had the last word — when he saw what had happened he rubbed off the first letter of "lasses."

Notes:

… the notice raised many appreciative laughs – записка викликала чимало іронічних смішків.

… to have the last word – досягти свого; перехитрити когось.

Ask and answer:

Can you say how the professor taught his students not to play silly jokes?

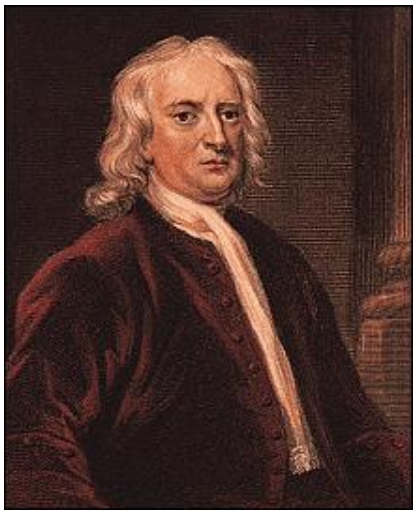
Notes on the topic studied:

Notes on the topic studied:

Texts for additional reading:

Text 1

Sir Isaac Newton



Newton, Sir Isaac (1642-1727), an English scientist, astronomer, and mathematician, invented a new kind of mathematics, discovered the secrets of light and color, and showed how the universe is held together. He is sometimes described as "one of the greatest names in the history of human thought " because of his great contributions to mathematics, physics, and astronomy.

Newton discovered how the universe is held together through his theory of gravitation. He discovered the secrets of light and color. He invented a branch of mathematics, calculus, also invented independently by Gottfried Leibniz, a German mathematician Newton made these three discoveries within 18 months from 1665 to 1667.

The theories of motion and gravitation. Newton said the concept of a universal force came to him while he was alone in the country. He had been forced to flee there because of the outbreak of plague in the city of Cambridge. During this time, Newton suddenly realized that one and the same force pulls an object to earth and keeps the moon in its orbit. He found that the force of universal gravitation makes every pair of bodies in the universe attract each other. The force depends on (1) the amount of matter in the bodies being attracted and (2) the distance between the bodies. The force by which the earth attracts or pulls a large rock is greater than the pull on a small pebble because the rock contains more matter. The earth's pull is called the weight of the body. With this theory, Newton explained why a rock weighs more than a pebble.

One day in 1684, Edmond Halley, an English astronomer, Robert Hooke, an English scientist, and Christopher Wren, the architect, were discussing what law of force produced the visible motion of the planets around the sun. They could not solve this problem. Halley went to Cambridge to ask Newton about it. He found Newton in possession of complete proof of the law of gravity. Halley persuaded Newton to publish his findings. Halley paid all the expenses, corrected the proofs, and laid aside his own work to publish Newton's discoveries. Newton's discoveries on the laws of motion and theories of gravitation were published in 1687 in Philosophiae Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy). This work, usually called Principia or Principia Mathematica, is considered one of the greatest single contributions in the history of science. It includes Newton's laws of motion and theory of gravitation. It was the first book to contain a unified system of scientific principles explaining what happens on earth and in the heavens.

Early life. Newton was born at Woolsthorpe, Lincolnshire, on Dec. 25, 1642. He attended Grantham grammar school. As a boy, he was more interested in making mechanical devices than in studying. His youthful inventions included a small windmill that could grind wheat and corn, a water clock run by the force of dropping water, and a sundial. He left school when he was 14 to help his widowed mother manage her farm. But he spent so much time reading, he was sent back to school.

He entered Trinity College, Cambridge University, in 1661. He showed no exceptional ability during his college career and graduated in 1665 without any particular distinction. He returned to Cambridge as a fellow of Trinity College in 1667.

Newton became professor of mathematics at Cambridge in 1669. He lectured once a week on arithmetic, astronomy, geometry, optics, or other mathematical subjects. He was elected to the Royal Society in 1672.

He was elected to Parliament again from the university in 1701. He left Cambridge and settled permanently in London in 1701. He became president of the Royal Society in 1703 and was reelected annually until his death. Queen Anne knighted Newton in 1705. He died in 1727 and was buried in Westminster Abbey.

Personal characteristics. Newton did not enjoy the scientific arguments that arose from his discoveries. Many new scientific theories are opposed violently when they are first announced, and Newton's did not escape criticism. He was so sensitive to such criticism that his friends had to plead with him to publish his most valuable discoveries.

As a professor, he was very absent-minded. He showed great generosity to his nephews and nieces and to publishers and scientists who helped him in his work.

He was modest in his character. He said of himself shortly before his death, "I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."

Albert Einstein, the German-born American physicist, rejected Newton's explanation of universal gravitation but not the fact of its operation. He said that his own work would have been impossible without Newton's discoveries. He also said that the concepts Newton developed "are even today still guiding our thinking in physics."

Text 2

History

Early civilization. Prehistoric people probably first counted with their fingers. They also had various methods for recording such quantities as the number of animals in a herd or the days since the full moon. To represent such amounts, they used a corresponding number of pebbles, knots in a cord, or marks on wood, bone, or stone. They also learned to use regular shapes when they molded pottery or carved arrowheads.

By about 3000 B.C., mathematicians of ancient Egypt used a decimal system (a system of counting in groups of 10) without place values. The Egyptians pioneered in geometry, developing formulas for finding the area and volume of simple figures. Egyptian mathematics had many practical applications, ranging from surveying fields after the annual floods to making the intricate calculations necessary to build the pyramids.

By 2100 B.C., the people of ancient Babylonia had developed a sexagesimal system--a system based on groups of 60. Today, we use such a system to measure time in hours, minutes, and seconds. Historians do not know exactly how the Babylonian system developed. They think it may have arisen from the use of weights and measures based on groups of 60. The system had important uses in astronomy, and also in commerce, because 60 can be divided easily. The Babylonians went well beyond the Egyptians in algebra and geometry.

The Greeks. Ancient Greek scholars became the first people to explore pure mathematics, apart from practical problems. They made important advances by introducing the concepts of logical deduction and proof to create a systematic theory of mathematics. According to tradition, one of the first to provide mathematical proofs based on deduction was the philosopher Thales, who worked in geometry about 600 B.C.

The Greek philosopher Pythagoras, who lived about 550 B.C., explored the nature of numbers, believing that everything could be understood in terms of whole numbers or their ratios. However, about 400 B.C., the Greeks discovered irrational numbers (numbers that cannot be expressed as a ratio of two whole numbers), and they recognized that Pythagorean ideas were incomplete. About 370 B.C., Eudoxus of Cnidus, a Greek astronomer, formulated a theory of proportions to resolve problems associated with irrational numbers. He also developed the method of exhaustion, a way of determining areas of curved figures, which foreshadowed integral calculus.

Chinese mathematics originally developed to aid record keeping, land surveying, and building. By the 100's B.C., the Chinese had devised a decimal system of numbers that included fractions, zero, and negative numbers. They solved arithmetic problems with the aid of special sticks called counting rods. The Chinese also used these devices to solve equations--even groups of simultaneous equations in several unknowns.

Perhaps the best-known early Chinese mathematical work is the Jiu Zhang Suan Shu (Nine Chapters on the Mathematical Art), a handbook of practical problems that was compiled in the first two centuries B.C. In 263 A.D., the Chinese mathematician Liu Hui wrote a commentary on the book. Among Liu Hui's greatest achievements was his analysis of a mathematical statement called the Gou-Gu theorem. The theorem, known as the Pythagorean theorem in the West, describes a special relationship that exists between the sides of a right triangle. Liu Hui also calculated the value of pi more accurately than ever before. He did so by using a figure with 3,072 equal sides to approximate a circle.

Arab mathematics. Scholars in the Arab world translated and preserved the works of ancient Greek mathematicians and made their own original contributions as well. A book written about 825 by the Arab mathematician al-Khowarizmi described a numeration system developed in India. This decimal system, which used place values and zero, became known as the Hindu-Arabic numeral system. Al-Khowarizmi also wrote an influential book about algebra. The word algebra comes from the Arabic title of this book.

In the mid-1100's, a Latin translation of al-Khowarizmi's book on arithmetic introduced the Hindu-Arabic numeral system to Europe. In 1202, Leonardo Fibonacci, an Italian mathematician, published a book on algebra that helped promote this system. Hindu-Arabic numerals gradually replaced Roman numerals in Europe.

Arab astronomers of the 900's made major contributions to trigonometry. During the 1000's, an Arab physicist known as Alhazen applied geometry to optics. The Persian poet and astronomer Omar Khayyam wrote an important book on algebra about 1100. In the 1200's, Nasir al-Din al-Tusi, a Persian mathematician, created ingenious mathematical models for use in astronomy.

The Renaissance. During the 1400's and 1500's, European explorers sought new overseas trade routes, stimulating the application of mathematics to navigation and commerce. Artists created a system of mathematical perspective that gave their paintings an illusion of depth and distance. The invention of printing with movable type in the mid-1400's resulted in speedy and widespread communication of mathematical knowledge.

The Renaissance also brought major advances in pure mathematics. In a book published in 1533, a German mathematician known as Regiomontanus established trigonometry as a field separate from astronomy. French mathematician Francois Viete made advances in algebra in a book published in 1591.

Text 3

Mathematics and the scientific revolution.

By 1600, the increased use of mathematics and the growth of the experimental method were contributing to revolutionary advances in knowledge. In 1543, Nicolaus Copernicus, a Polish astronomer, published an influential book in which he argued that the sun, not the earth, is the center of the universe. In 1614, John Napier, a Scottish mathematician, published his discovery of logarithms, numbers that can be used to simplify such complicated calculations as those used in astronomy. Galileo, an Italian astronomer of the late 1500's and early 1600's, found that many types of motion can be analyzed mathematically.

In 1637, French philosopher Rene Descartes proposed mathematics as the perfect model for reasoning. He invented analytic geometry. Another French mathematician of the 1600's, Pierre de Fermat, founded modern number theory. He and French philosopher Blaise Pascal

explored probability theory. Fermat's work with infinitesimals helped lay a foundation for calculus.

The English scientist Sir Isaac Newton invented calculus in the mid-1660's. He first mentioned his discovery in a book published in 1687. Working independently, the German philosopher and mathematician Gottfried Wilhelm Leibniz also invented calculus in the mid-1670's. He published his findings in 1684 and 1686.

Developments in the 1700's. A remarkable family of Swiss mathematicians, the Bernoullis, made many contributions to mathematics during the late 1600's and the 1700's. Jakob Bernoulli did pioneering work in analytic geometry and wrote about probability theory. Jakob's brother Johann also worked in analytic geometry and in mathematical astronomy and physics. Johann's son Nicolaus helped advance probability theory. Johann's son Daniel used mathematics to study the motion of fluids and the properties of vibrating strings.

During the mid-1700's, Swiss mathematician Leonhard Euler advanced calculus by showing that the operations of differentiation and integration were opposites. Beginning in the late 1700's, French mathematician Joseph L. Lagrange worked to develop a firmer foundation for calculus. He was suspicious of relying on assumptions from geometry and, instead, developed calculus entirely in terms of algebra.

In the 1800's, public education expanded rapidly, and mathematics became a standard part of university education. Many of the great works in mathematics of the 1800's were written as textbooks. In the 1790's and early 1800's, French mathematician Adrien Marie Legendre wrote particularly influential textbooks and did work in calculus, geometry, and number theory. Important calculus textbooks by French mathematician Augustin Louis Cauchy were published in the 1820's. Cauchy and Jean Baptiste Fourier, another French mathematician, made significant advances in mathematical physics.

Carl Friedrich Gauss, a German mathematician, proved the fundamental theorem of algebra, which states that every equation has at least one root. His work with imaginary numbers led to their increased acceptance. In the 1810's, Gauss developed a non-Euclidean geometry but did not publish his discovery. Working separately, Janos Bolyai of Hungary and Nikolai Lobachevsky of Russia also developed non-Euclidean geometries. They published their discoveries about 1830. In the mid-1800's, Georg Friedrich Bernhard Riemann of Germany developed another non-Euclidean geometry.

During the early 1800's, the works of German mathematician August Ferdinand Mobius helped develop a study in geometry that became known as topology. Topology explores the properties of a geometrical figure that do not change when the figure is bent or stretched.

In the late 1800's, German mathematician Karl Theodor Weierstrass worked to establish a more solid theoretical foundation for calculus. In the 1870's and 1880's, his student Georg Cantor developed set theory and a mathematical theory of the infinite.

Much exciting work in applied mathematics was performed in the 1800's. In Britain, Charles Babbage developed early mechanical computing machines, and George Boole created a system of symbolic logic. During the late 1800's, French mathematician Jules Henri Poincare contributed to probability theory, celestial mechanics, and the study of electromagnetic radiation.

Many mathematicians of the 1900's have shown concern for the philosophical foundations of mathematics. To eliminate contradictions, some mathematicians have used logic to develop mathematics from a set of axioms.

Text 4

Philosophies of mathematics in the 1900's.

Two British philosophers and mathematicians, Alfred North Whitehead and Bertrand Russell, promoted a philosophy of mathematics called logicism. In their three-volume work, Principia Mathematica (1910-1913), they argued that all propositions (statements) in mathematics can be derived logically from just a few axioms.

David Hilbert, a German mathematician of the early 1900's, was a formalist. Formalists consider mathematics to be a purely formal system of rules. Hilbert's work led to the study of imaginary spaces with an infinite number of dimensions.

Beginning in the early 1900's, Dutch mathematician Luitzen Brouwer championed intuitionism. He believed people understand the laws of mathematics by intuition (knowledge not gained by reasoning or experience).

In the early 1930's, Austrian mathematician Kurt Godel demonstrated that for any logical system, there are always theorems that cannot be proved either true or false by the axioms within that system. He found this to be true even of basic arithmetic.

Mathematicians have made major advances in the study of abstract mathematical structures during the 1900's. One such structure is the group. A group is a collection of items, which may be numbers, and rules for some operation with these items, such as addition or multiplication. Group theory is useful in many areas of mathematics and such fields as subatomic physics.

Since 1939, a group of mathematicians, most of whom are French, have published an influential series of books under the pen name Nicolas Bourbaki. This series takes an abstract approach to mathematics, using axiom systems and set theory.

New areas of mathematical specialization have arisen during the 1900's, including systems analysis and computer science. Advances in mathematical logic have been essential to the development of electronic computers. Computers, in turn, enable mathematicians to complete long and complicated calculations quickly. Since the 1970's, computer-based mathematical models have become widely used to study weather patterns, economic relationships, and many other systems.

Other new areas of mathematical specialization in the late 1900's included fractal geometry and chaos theory. Fractal geometry deals with complex shapes called fractals. These shapes consist of small-scale and large scale structures that resemble one another. Certain fractals are also similar to natural objects, such as coastlines or branching trees. Although fractals seem irregular, they have a simple organizing principle. Chaos theory attempts to find underlying patterns in what seem to be random variations, such as changes in the weather or the stock market.

Text 5

Infinity

Infinity is a term commonly used to refer to a quantity or distance that is so large it cannot be counted or measured. In mathematics, the idea of infinity forms an important part of set theory.

A set of objects or numbers is called finite if the objects or numbers can be paired with the positive integers (whole numbers) less than some positive integer. For example, a set of playing cards of one suit, which consists of 13 members, is finite. The cards can be paired with the positive integers less than 14.

An infinite set is defined as one that is not finite. Its members cannot be paired with the positive integers less than some positive integer, because the set continues without end. For example, the set of all positive integers-1, 2, 3, 4, and so on-is infinite, as is the set of all fractions. Both sets have an unlimited number of members.

Infinite sets may be represented by placing three dots after the last member noted. For example, the set of even numbers above zero may be written 2, 4, 6, ...

The idea of infinity has other applications in mathematics in addition to set theory. In projective geometry, for example, the point at infinity is defined as the intersection of all parallel lines.

Appendix I.

Final Test

1. Mathematics is based upon…
    a) arithmetic;
    b) statistics;
    c) logic;
    d) calculus.
2. Certain relations between the lengths of two sides of a right triangle are called…
    a) trigonometric rate;
    b) trigonometric ratios;
    c) trigonometric relations;
    d) trigonometric changes.
3. … is the mathematical study of the likelihood of events.
    a) mathematics;
    b) logic;
    c) statistics;
    d) probability.
4. Plane geometry deals with…
    a) points and lines;
    b) cubes and spheres;
    c) squares and circles;
    d) all three variants.
5. Ancient… scholars became the first people to explore pure mathematics, apart from practical problems.
    a) Roman;
    b) Greek;
    c) Egyptian;
    d) Babylonian.
6. Arithmetic is sometimes called …
    a) “the queen of numbers”;
    b) “the queen of calculation”;
    c) “the science of calculation”;
    d) “the science of numbers”.
7. The Romans used such numerals as…
    a) ABE;
    b) ABDM;
    c) BEXXV;
    d) MDCCL.
8. Decimal system of numbers was brought to Europe by the…
    a) Greeks;
    b) Hindus;
    c) Arabs;
    d) Babylonians.

9. We use … basic operations to solve arithmetic problems.
    a) two;
    b) three;
    c) four;
    d) five.
10. The word digit means…
    a) numeral;
    b) letter;
    c) quantity;
    d) finger.
11. Percentages are fractions expressed in…
    a) tenths;
    b) hundredths;
    c) thousandths;
    d) millionths.
12. Who developed the system of measuring angles in degrees, minutes and seconds?
    a) the Greeks;
    b) the Hindus;
    c) the Arabs;
    d) the Babylonians.
13. What does ***geo*** mean?
    a) figure;
    b) digit;
    c) earth;
    d) square.
14. Hexagons are…
    a) four-sided figures;
    b) five-sided figures;
    c) six-sided figures;
    d) seven-sided figures.
15. The number from which the subtrahend is taken is called…
    a) remainder;
    b) addend;
    c) difference;
    d) minuend.
16. Undefined terms of geometry are…
    a) point, line;
    b) point, line segment;
    c) point, line and plane;
    d) point, plane.
17. Congruent figures are figures that have … size and shape.
    a) different;
    b) various;
    c) the same;
    d) unlike.

18. Square root of a number is a second number whose … with itself gives the original number.
    a) quotient;
    b) sum;
    c) difference;
    d) product.
19. The symbol of … is {}.
    a) brackets;
    b) braces;
    c) parentheses;
    d) quotient.
20. Mathematics comes from a Greek word meaning … .
    a) “inclined to remember”;
    b) “inclined to calculate”;
    c) “inclined to learn”;
    d) “inclined to teach”.

Appendix II.

Irregular Verbs

Infinitive	Past Indefinite	Past Participle	
be	was,were	been	бути
bear	bore	borne	нести, переносити
become	became	become	ставати, робитися
begin	began	begun	починати
bind	bound	bound	зв'язувати
break	broke	broken	ламати
bring	brought	brought	приносити
broadcast	broadcast broadcasted	broadcast broadcasted	поширювати, передавати по радіо
build	built	built	будувати
burn	burnt	burnt	горіти
buy	bought	bought	купувати
catch	caught	caught	ловити
choose	chose	chosen	вибирати, обирати
come	came	come	приходити
cost	cost	cost	коштувати
cut	cut	cut	різати
deal	dealt	dealt	розглядати питання (with)
do	did	done	робити, виконувати
draw	drew	drawn	креслити,малювати, добувати (інформ.)
dream	dreamt	dreamed	мріяти, уявляти
drink	drank	drunk	пити
fall	fell	fallen	падати, спускатися
feed	fed	fed	годувати, постачати
feel	felt	felt	почувати, відчувати, вважати
fight	fought	fought	битися, боротися
find	found	found	знаходити, вважати
forbid	forbade	forbidden	забороняти, не дозволяти
forget	forgot	forgotten	забувати
forgive	forgave	forgiven	прощати
freeze	froze	frozen	заморожувати
get	got	got	одержувати, діставати
give	gave	given	давати, віддавати
go	went	gone	йти, ходити, рухатися
grow	grew	grown	рости, збільшуватися
have	had	had	мати, володіти
hear	heard	heard	чути, слухати
hide	hid	hid hidden	ховати, приховувати
hold	held	held	тримати, мати, володіти
keep	kept	kept	зберігати, берегти
know	knew	known	знати, уміти
lay	laid	laid	класти, покласти
lead	led	led	вести, керувати
learn	learnt learned	learnt learned	учитися, учити, навчатися

leave	left	left	залишати, покидати
let	let	let	дозволяти
lie	lay	lain	лежати, бути розташованим
light	lit	lit	запалювати, світити
	lighted	lighted	
lose	lost	lost	утрачати (властивість, якість), втратити
make	made	made	робити, виробляти, створювати
mean	meant	meant	мати намір, означати, значити
meet	met	met	зустрічати
pay	paid	paid	платити
put	put	put	класти, ставити
read	read	read	читати
ring	rang	rung	дзвонити
rise	rose	risen	піднімати
run	ran	run	бігти
say	said	said	сказати
see	saw	seen	бачити
seek	sought	sought	шукати
sell	sold	sold	продавати
send	sent	sent	посилати
set	set	set	ставити
shoot	shot	shot	стріляти
show	showed	shown	показувати
shut	shut	shut	закривати
sing	sang	sung	співати
sit	sat	sat	сидіти
sleep	slept	slept	спати
speak	spoke	spoken	говорити
speed	sped	sped	поспішати
spell	spelt	spelt	писати або вимовляти по літерах
	spelled	spelled	
spend	spent	spent	витрачати, проводити (час)
spoil	spoilt	spoilt	псувати
	spoiled	spoiled	
spread	spread	spread	розгортати, поширювати
stand	stood	stood	стояти, ставити
strike	struck	struck	ударяти, бити
swim	swam	swum	плавати
take	took	taken	брати
teach	taught	taught	учити, навчати, викладати
tell	told	told	говорити, повідомляти
think	thought	thought	думати, вважати
understand	understood	understood	розуміти, мати на увазі
wake	woke	woken	будити, прокидатися
	waked	waked	
win	won	won	виграти, перемогти
write	wrote	written	писати

Appendix III.

LIST OF MATHEMATICAL SYMBOLS

+ plus, a+b=c a plus b is equal to c
— minus, 15 — 5 = 10 fifteen minus five is equal to ten
= equals or is equal to
± plus or minus
x multiplied by, times
a x b = d a multiplied by b equals d
or a times b is equal to d.
a : b a divided by b
≠ is not equal to, a ≠ b a is not equal to b
> is greater than, a > b a is greater than b
< is less than, a < b a is less than b
a' a prime
a" a second prime
$\mathbf{b^2}$ b square (squared)
$\mathbf{a_1}$ a sub one, a first
$\mathbf{d_k}$ d sub k
$\mathbf{n_3}$ n sub three
$\mathbf{10^{-11}}$ ten to the minus eleventh (power)
$\mathbf{10^7}$ ten to the seventh (power)
[ ] brackets, square brackets
( ) round brackets, parentheses
{ } braces
$\sqrt{a}$ the square root of a
$\sqrt[n]{a}$ the n-th root of a
$\sqrt[3]{a}$ the cube roof of a
$\frac{d}{dt}$ d over dt
$\frac{dy}{dx}$ dy over dx or the first derivative of y with respect to x
$\frac{a+b}{a-b}=\frac{c+d}{c-d}$ a plus b over a minus b is equal to c plus d over c minus d
0.51 0 point five one
0,014 0 point 0 one four
255,604 two hundred and fifty — five thousand six hundred and four
$2\frac{1}{2}$ two and a half
$\frac{1}{3}$ one third, a third
$\frac{2}{7}$ two sevenths
$\frac{3}{5}$ three fifths
a dozen = 12
a score = 20
a quarter = ¼
a half = ½

Appendix IV.

Numerals

Cardinal *(how many?)*	Ordinal *(which?)*
1 – one	1 – the first
2 – two	2 – the second
3 – three	3 –the third
4 – four	4 – the fourth
5 – five	5 – the fifth
6 – six	6 – the sixth
7 – seven	7 – the seventh
8 – eight	8 – the eighth
9 – nine	9 – the ninth
10 – ten	10 – the tenth
11 – eleven	11 – the eleventh
12 – twelve	12 –the twelfth
21 – twenty-one	21 – the twenty-first
22 – twenty-two	22 – the twenty-second
25 – twenty-five	25 – the twenty-fifth
30 – thirty	30 – the thirtieth
40 – forty	40 – the fortieth
50 – fifty	50 – the fiftieth
55 – fifty-five	55 – the fifty-fifth
100 – a (one) hundred	100 – the hundredth
368 – three hundred and sixty-eight	368 – the three hundred and sixty-eighth
1000 – a (one) thousand	1000 – the thousandth
2569 –twenty-five hundred and sixty-nine or the two thousand five hundred and sixty-nine	2569 – the twenty-five and sixty-ninth or the two thousand five hundred and sixty-ninth
1500 – fifteen hundred or one thousand five hundred	1500 – the fifteen hundredth or the one thousand five hundredth

1917 nineteen-seventeen
1905 nineteen-o-five
1985 nineteen-eighty-five

Appendix V.

English-Ukrainian Vocabulary

Aa

absolute['æbsəlu:t] *adv* – повний, безумовний, необмежений
absolutely ['æbsəlu:tlı] *adv* – зовсім, безумовно

acceleration [ək,selə'reıʃən] *n* – прискорення, вдосконалення
access ['ækses] *n* – доступ
add [æd] *v* – додавати, приєднувати, підсумовувати, складати
addend ['ədend] *n* – доданок

addition [ə'dıʃən] *n* – додавання

algebra ['ældʒıbrə] *n* – алгебра
algorithm ['ælgərıðəm] *n* – алгоритм
align [ə'laın] *v* – вирівнювати
allow [ə'lau] *v* – дозволяти, надавати можливість
analysis [ə'næləsıs] *n* – аналіз

analytic geometry [,ænə'lıtıc dʒı'ɔmıtrı] *n* – аналітична геометрія
angle ['æŋgl] *n* – кут
answer ['a:nsə] *n* – відповідь
appearance [ə'pıərəns] *n* – зовнішній вигляд, поява

application [,æplı'keıʃən] *n* – застосування, використання, додаток

applied mathematics [ə'plaıd,mæθı'mætıks] *n* – теоретична математика
apply[ə'plaı] *v* – застосовувати, додавати, прикладати

approximation [ə,prɔksı'meıʃən] *n* – наближення, наближене значення

arch ['ɑ:tʃ] *n* – дуга

area ['eərıə] *n* – площа, простір

arithmetic [ə'rıθmətık] *n* – арифметика

arithmetical [,ærıθ'mətıkəl] *adj* – арифметичний

argument ['ɑ:gjumənt] *n* – аргумент, довід

attach [ə'tætʃ] *v* – прикріплювати, під'єднувати
available [ə'veıləbl] *adj* – доступний
axe ['æks] *n* – вісь
axiom ['æksıəm] *n* – аксіома

Bb

bachelor ['bætʃələ] *n* – бакалавр
background ['bækgraund] *n* – підготовка, кваліфікація
basic ['beısıs] *n* – основа, базис
below [bı'ləu] *adv* – нижче, унизу
binary ['baınərı] *adj* – двійковий, бінарний
bisect [baı'sekt] *v* – поділяти навпіл
bisector [baı'sektə] *n* – бісектриса

board [bɔ:d] *n* – плата
brace ['breıs] *n* – фігурна дужка
bracket ['brækıt] *n* – дужка

branch ['bra:ntʃ] *n* – галузь, гілка
brief [bri:f] *adj* – короткий, стислий

button ['bʌtn] *n* – кнопка

Cc
calculate ['kælkjuleıt] *v* – обчислювати, підраховувати

calculation [,kælkju'leıʃən] *n* – обчислення, розрахунок
calculus ['kælkjuləs] *n* – числення
career [kə'rıə] *n* – кар'єра, успіх, професія
carry ['kærı] *v* – переносити, нести
categorize ['kætıg(ə)raız] *v* – класифікувати, розподіляти по категоріям

check ['tʃek] *v* – перевіряти
circle [sə:kl] *n* – коло, окружність
code [kəud] *n* – код

combination [,kɔmbı'neıʃ(ə)n] *n* – комбінація, поєднання, сполучення

common fraction ['kɔmən'frækʃən] *n* – простий дріб
compare [kəm'pɛə] *v* – порівнювати, зіставляти
compatible [kəm'pətəbl] *adj* – сумісний
compatibles [kəm'pətəblz] *n* – сумісні пристрої
component [kəm'pəunənt] *n* – складова,компонент, частина, деталь

composed fraction [kəm'pəuzd 'frækʃən] *n* – неправильний дріб

computation [,kɔmpju:'teıʃ(ə)n] *n* – обчислення, розрахунок
computer [kəm'pju:tə] *n* – комп'ютер

concept ['kɔnsept] *n* – поняття, ідея, концепція

conclusion [kən'klu:ʒən] *n* – висновок, умовивід, результат
cone [kəun] *n* – конус

configuration [kənfıgju'reıʃ(ə)n] *n* – форма, конфігурація
connect [kə'nekt] *v* – зв'язувати, з'єднувати, встановлювати зв'язок

connexion [kə'nekʃ(ə)n] *n* – зв'язок, з'єднання

constant ['kɔnstənt] *n* – постійна (величина), константа

constantly ['kɔnstəntlı] *adv* – постійно

contact ['kɔntækt] *n* – контакт, зв'язок
correct [kə'rekt] *adj* – правильний, точний
count ['kaunt] *v* – підраховувати
critical ['krıtıkəl] *adj* – критичний, небезпечний
cube ['kju:b] *n* – куб
cube root ['kju:b ru:t] *n* – корінь кубічний
curve [kə:v] *n* – дуга, крива

Dd
data ['deıtə] *n* – дані, інформація
data stream *n* – інформаційний потік
decimal ['desıməl] *adj* – десятковий, десяткове число
define [dı'faın] *v* – визначати, давати визначення

definition [,defı'nıʃən] *n* – визначення
delete [dı'li:t] *v* – видаляти, викреслювати, стирати

denominator [dɪ'nɔmɪrneɪtə] *n* – знаменник
design [dɪ'zaɪn] *n* – план, розробка, проект, конструкція
desktop ['desktɔp] *adj* – настільний
detect [dɪ'tekt] *v* – виявляти
determine [dɪ'tə:mɪn] *v* – визначати, встановлювати
device[dɪ'vaɪs] *n* – пристрій, апарат, механізм
diagram [daɪəgræm] *n* – діаграма, графік, схема
digit ['dɪdʒɪt] *n* – цифра, однозначне число
digital ['dɪdʒɪtl] *adj* – цифровий
degree[dɪ'gri:] *n* – ступінь, градус
dimension [dɪ'menʃən] *n* – величина, вимір
direct [dɪ'rekt] *v* – управляти, керувати, направляти, *adj* – прямий, безпосередній
directory [dɪ'rektərɪ] *n* – каталог, папка, довідник
discover [dɪs'kʌvə] *n* – виявляти
discrete [dɪ'skri:t] *adj* – дискретний
discussion[dɪs'kʌʃən] *n* – дискусія, обговорення
dividend [dɪ'vɪdend] *n* – ділене
division [dɪ'vɪʒən] *n* – ділення
division fact [dɪ'vɪʒənfækt] *n* – дія ділення
divisor [dɪ'vaɪʒə] *n* – дільник
double ['dʌbl] *adj* – подвійний, здвоєний, парний
drawback ['drɔ:bæk] *n* – недолік
dual ['dju:əl] *adj* – подвійний

Ee

electronic [ɪlek'trɔnɪk] *adj* – електронний
element ['elɪmənt] *n* – елемент
ellipse [ɪ'lɪps] *n* – еліпс, овал
enable [ɪ'neɪbl] *v* – давати право, можливість, полегшувати
environment [ɪn'vaɪrənmənt] *n* – режим роботи, умови експлуатації, обладнання, зовнішні фактори
equal ['i:kwəl] *adj* – рівний, однаковий; v – вирівнювати
equation [ɪ'kweɪʃən] *n* – рівняння
equipment [ɪ'kwɪpmənt] *n* – устаткування, апаратура
equivalent [ɪ'kwɪvələnt] *n* – еквівалент; *adj* – рівноцінний, рівнозначний
error ['erə] *n* – помилка, похибка
essential [ɪ'senʃəl] *adj* – істотний, невід'ємний; *n* – невід'ємна частина
estimate ['estɪmɪt] *n* – оцінка; *v* – оцінювати, підраховувати приблизно
example [ɪg'za:mpl] *n* – приклад, зразок
execute ['eksɪkju:t] *v* – виконувати
exist [ɪg'zɪst] *v* – існувати, знаходитися
expansion [ɪks'pænʃən] *n* – розширення, збільшення
expression [ɪks'preʃən] *n* – вираз
external [ɪks'tə:n)l] *adj* – зовнішній
extract ['ekstrækt] *v* – добувати (корінь)

Ff

factor ['fæktə] *n* – множник
fashion ['fæʃən] *n* – модель, форма

fiberglass ['faɪbəglɑ:s] *n* – скловолокно
figure ['fɪgə] *n* – малюнок, зображення, ілюстрація

form ['fɔ:m] *n* – форма, вид; *v* – надавати форми, складати, утворювати

formula ['fɔ:mjulə] *n* – формула

fraction ['frækʃən] *n* – дріб

fractional ['frækʃənl] *adj* – дробовий, частковий

function ['fʌŋkʃən] *n* – функція, призначення

Gg
gear [gɪə] *n* – знак, «зірочка»

general ['dʒenərəl] *ad j*– загальний, головний

generate ['dʒenəreɪt] *v* – викликати, робити, генерувати
geometry [dʒɪ'ɔmɪtrɪ] *n* – геометрія
gun [gʌn] *v* – переривати (процес)

Hh

half ['hɑ:f] *n* – половина, частина, ½
height ['haɪt] *n* – висота
hemisphere ['hemɪsfɪə] *n* – півкуля
horizontal [ˌhɔ:rɪ'zɔnt(ə)l] *adj* – горизонтальний

hybrid ['hɑɪbrɪd] *adj* **–** гібридний, змішаний

hyperbola [hɑɪ'pəbələ] *n* – гіпербола

Ii

identify [ɑɪ'dentɪfɑɪ] *v* – установлювати тотожність (with), ототожнювати
illustrate ['ɪlə,streɪt] *v* – ілюструвати, пояснювати

image ['ɪmɪdʒ] *n* – образ, зображення; *v* – відображати, створювати зображення

implementation [ˌɪmplɪmen'teɪʃən] *n* – виконання, реалізація, етап в технологічному процесі розробки
incorrect [ˌɪnkə'rekt] *adj* – неправильний, неточний
increase ['ɪnkri:s] *v* – збільшувати, підсилювати
indefinite[ɪn'defɪnɪt] *adj* – невизначений
indefinitely [ɪn'defɪnɪtlɪ] *adv* – невизначено

information [ˌɪnfə'meɪʃən] *n* – інформація, дані, повідомлення

inside [ɪn'sɑɪd] *n* – внутрішня сторона; *adj* – внутрішній; *adv* – усередині

instruction [ɪn'strʌkʃən] *n* – команда, інструкція, програма дій
instrument ['ɪnstrumənt] *n* – інструмент, прилад, апарат

insurance [ɪn'ʃuərəns] *n* – страхування
internal [ɪn'tə:nəl] *adj* – внутрішній
item ['aɪtem] *n* – окремий предмет, елемент, одиниця

Kk
key ['kɪ:] *n* – клавіша, кнопка, перемикач

keyboard ['kɪ:ˌbɔ:d] *n* – клавіатура, комутаційна панель

knowledge ['nɔlɪdʒ] *n* – знання

Ll

length ['leŋθ] *n* – довжина
limit ['lımıt] *n* – границя, межа, *v* – обмежувати

logarithm ['lɔgərıðəm] *n* – логарифм

logic ['lɔdʒık] *n* – логіка

Mm

major ['meıdʒə] *adj* – головний

match [mætʃ] *v* – відповідати, підбирати під пару, поєднати

mathematics [ˌmæθı'mætıks] *n* – математика

mathematician [ˌmæθımə'tıʃən] *n* – математик

measure ['meʒə] *n* – міра, критерій, показник, масштаб, форма; *v* – вимірювати, оцінювати

measurement ['meʒəmənt] *n* – вимірювання, (pl) розміри
memory ['memərı] *n* – пам'ять, запам’ятовувальний пристрій, машинна пам'ять

message ['mesıdʒ] *n* – повідомлення; *v* – посилати повідомлення
minus ['maınəs] *n* – знак мінуса; *prep* – мінус
minute ['mınıt] *n* – 160 частина градуса

module ['mɔdju:l] *n* – модуль

modular ['mɔdjulə] *adj* – модульний

monitor ['mɔnıtə] *n* – монітор, дисплей, програмний засіб синхронізації
mouse [maus] *n* – миша (маніпулятор для управління курсором)

multiplicand [ˌmʌltıplı'kænd] *n* – множене

multiplication [ˌmʌltıplı'keıʃən] *n* – множення

multiplication fact [ˌmʌltıplı'keıʃən'fækt] *n* – дія множення

multiplier ['mʌltıplaəı] *n* – множник

multiply ['mʌltıplaı] *v* – множити

Nn
need [ni:d] *n* – потреба; *v* – потребувати
notebook ['nəutbuk] *n* – ноутбук, портативний комп’ютер

number ['nʌmbə] *n* – число, кількість; *v* – нараховувати
numerator ['nju:məreıtə] *n* – чисельник

Oo

order ['ɔ:də] *n* – порядок, ступінь

operate ['ɔpəreıt] *v* – працювати, приводити у рух

operation [ˌɔpə'reıʃən] *n* – робота, дія, процес

opposite ['ɔpəzıt] *adj* – протилежний, зворотний

original [ə'rıdʒənl] *adj* – справжній, новий, первісний

outside ['aut'sɑıd] *n* – зовнішня частина, поверхня; *adj* – зовнішній; *adv* – зовні

Pp
parabola [pæ'rəbələ] *n* – парабола

parentheses [pə'renθɪss] *n* – круглі дужки

partial ['pa:ʃəl] *adv* – частковий

path [pa:θ] *n* – траєкторія

pathway [pa:θweɪ] *n* – траєкторія
pattern ['pætən] *n* – модель, зразок, шаблон
pentagon ['pentəgən] *n* – п'ятикутник
per cent [pə'sent] *n* – відсоток, процент

percentage [pə'sentɪdʒ] *n* – відсоток, процентне відношення

perform [pə'fɔ:m] *v* – виконувати, робити

performance [pə'fɔ:məns] *n* – дія, виконання, продуктивність
perimeter [pə'rɪmɪtə] *n* – периметр
perpendicular [,pəpən'dɪkjulə] *n* – перпендикуляр
plane ['pleɪn] *n* – площина

plane geometry ['pleɪn dʒɪ'ɔmɪtrɪ] *n* – планіметрія

plus ['plʌs] *n* – знак «плюс»; *prep* – плюс
practical ['præktɪkəl] *adj* – практичний, реальний, доцільний
primary ['praɪmərɪ] *adj* – первинний, головний
principle ['prɪnsəpl] *n* – принцип, правило
prism ['prɪzm] *n* – призма

procedure [prə'sɪdʒə] *n* – методика проведення
process ['prəuses] *v* – обробляти

probability [,prɔbə'bɪlɪtɪ] *n* – імовірність

problem ['prɔbləm] *n* – задача

product ['prɔdʌkt] *n* – добуток
profile ['prəufaɪl] *n* – профіль, розріз, контур
program ['prəugræm] *n* – програма; *v* – програмувати

project ['prɔdʒekt] *n* – проект, план, програма

proper fraction ['prɔpə'frækʃən] *n* – правильний дріб

proportion [prə'pɔ:ʃən] *n* – пропорція, кількісне відношення

protection [prə'tekʃən] *n* – захист
prove ['pru:v] *v* – доводити, перевіряти
provide [prə'vaɪd] *v* – забезпечувати, надавати, постачати
purpose ['pə:pəs] *n* – намір, мета, призначення

pure mathematics [pjuə,mæθɪ'mætɪks] *n* – елементарна математика

Qq

quadrilateral [,kwɔdrɪ'lætərəl] *n* – чотирикутник

quantity ['kwɔntɪtɪ] *n* – кількість

quotient ['kwəuʃənt] *n* – частка, коефіцієнт

Rr

radical sign ['rædɪkəl saɪn] *n* – знак кореня, знак радикалу
rate [reɪt] *n* – коефіцієнт, ступінь, відсоток, частка; *v* – оцінювати, обчислювати, визначати

ratio ['reɪʃɪəu] *n* – відношення, пропорція, коефіцієнт

rational ['ræʃənl] *adj* – раціональний
ray [reı] *n* – промінь, радіус

record ['rek ɔ:d] *n* – запис; *v* – записувати
rectangular [rek'tæŋgjulə] *adj* – прямокутний
rectangle ['rektæŋgl] *n* – прямокутник
reduce [rı'dju:s] *v* – перетворювати, приводити до спільного знаменника

reflection [rı'flekʃən] *n* – відображення

refresh [rı'freʃ] *v* – відновлювати
regrouping ['ri;'grupıŋ] *n* – перегрупування
remainder [rı'meındə] *n* – залишок
replace [rı'pleıs] *v* – заміняти, заміщати, відновити
reasonable ['ri:znəbl] *adj* – раціональний**,** розумний, коректний
respectively [rıs'pektıvlı] *adv* – відповідно, у зазначеному порядку

respond [rıs'pɔnd] *v* – відповідати

restore [rıs'tɔ:] *v* – відновлювати

result [rı'zʌlt:] *n* – результат обчислення, підсумок
row [rəu] *n* – ряд

Ss
scheme [sk:m] *n* – схема, план, програма
screen ['skri:n] *n* – екран; *v* – демонструвати на екрані

section ['sekʃən] *n* – частина, деталь, сегмент, секція
sensible ['sensəbl] *adj* – розсудливий
separate ['seprıt] *adj* – окремий, відокремлений
set [set] *n* – набір, комплект

shape ['ʃeıp] *n* – форма

share ['ʃɛə] *n* – частка, частина; *v* – поділяти, розподіляти
sign [saın] *n* – знак
similar ['sımılə] *adj* – подібний
size [saız] *n* – розмір, величина
slide rule ['slaıd'ru:l] *n* – логарифмічна лінійка

solid geometry ['sɔlıd dʒı'ɔmıtrı] *n* – стереометрія

solve ['sɔlv] *v* – вирішувати, розв’язувати
sphere ['sfıə] *n* – сфера, куля
spiral ['spaıərəl] *n* – спіраль
square root ['skwɛə ru:t] *n* – корінь квадратний
stable ['steıbl] *adj* – стійкий, постійний
statement ['steıtmənt] *n* – твердження, формулювання
static ['stætık] *adj* – нерухомий

subtraction [,səb'trækʃən] *n* – віднімання

subtrahend ['sʌbtrəhənd] *n* – від’ємник

subset [sʌbset] *n* – підмножина
suitable ['sju:təbl] *adj* – придатний, відповідний

sum [sʌm] *n* – сума

summarize ['sʌməraız] *v* – підсумовувати

supplement ['sʌplımənt] *n* – додаток, доповнення

supply [sə'plaı] *n* – живлення; *v* – живити, подавати напругу струм
surface ['sə:fıs] *n* – поверхня
symbol ['sımbəl] *n* – символ, позначення, знак
system ['sıstım] *n* – система, метод

Tt

technology [tek'nɔlədʒı] *n* – техніка, технологія
term ['tə:m] *n* – термін, член, елемент
tightly ['taıtlı] *adj* – міцно, туго, щільно

theorem ['ɵıərəm] *n* – теорема

theory ['ɵıərı] *n* – теорія

through [ɵru:] *adv* – через, завдяки

transform [træns'fɔ:m] *v* – перетворювати, змінювати
triangle ['traıæŋgl] *n* – трикутник

trigonometry [,trıgə'nɔmıtrı] *n* – тригонометрія
tube [tju:b] *n* – електронна лампа
type [taıp] *n* – тип, вид, символ
typical ['tıpıkəl] *adj* – типовий

Uu
unit ['ju:nıt] *n* – одиниця, блок
universal [,ju:nı'və:səl] *adj* – загальний, універсальний

Vv
value ['vælju:] *n* – величина, значення
variable ['vɛərıəbl] *n* – змінна (величина)
vertex ['və:teks] *n* – вершина
vertical ['və:tıkəl] *adv* – вертикальний; *n* – вертикальна лінія, перпендикуляр
vice versa [vaısı 'və:sə] *adv* – навпаки, обернено
video ['vıdıəu] *n* – зображення, відео
visual ['vızjuəl] *adj* – візуальний, видимий

Ww

whole number ['həul'nʌmbə] *n* – ціле число

width ['wıdɵ] *n* – ширина
within [wıð'ın] *prep* – усередині, у межах

Xx

Xerox ['zıərɔks] *n* – ксерокс
X-line ['ekslaın] *n* – вісь іксів

Zz
zip –[ıp] *n* – zip-диск (дискета 100 і більше МГ байт), миттєво переміщати (напр., курсор з однієї точки екрана в іншу), файловий архів, *v* – заархівувати (файли)
zero ['zıərəu] *n* – нуль, нульова точка

Notes on the topic studied:

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