МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное бюджетное образовательное учреждение высшего образования «Кабардино-Балкарский государственный университет им. Х.М. Бербекова» (КБГУ)

ИНСТИТУТ ИСТОРИИ, ФИЛОЛОГИИ И СРЕДСТВ МАССОВОЙ ИНФОРМАЦИИ

КАФЕДРА ИНОСТРАННЫХ ЯЗЫКОВ

СОГЛАСОВАНО	**УТВЕРЖДАЮ**
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«12» ____04____ 2023г.	**«12» ____04____ 2023г.**

ФОНД ОЦЕНОЧНЫХ СРЕДСТВ (ОЦЕНОЧНЫХ МАТЕРИАЛОВ) ПО ДИСЦИПЛИНЕ (МОДУЛЮ)
«ИНОСТРАННЫЙ ЯЗЫК (АНГЛИЙСКИЙ)»

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(код и наименование направления подготовки)

«Проектирование систем искусственного интеллекта»
(наименование профиля подготовки)

Бакалавр
Квалификация (степень) выпускника

Очная
Форма обучения

Нальчик - 2023

СОДЕРЖАНИЕ

1. Перечень компетенций и этапы их формирования

Карта компетенции

Результаты обучения (компетенции)	Индикаторы достижения компетенции	Основные показатели оценки результатов обучения	Вид оценочного материала, обеспечивающий формирование компетенций
УК-4 Способен осуществлять деловую коммуникацию в устной и письменной формах на государственном языке Российской Федерации и иностранном (ых) языке(ах)	**УК-4.1.** Способен воспринимать и создавать устную и письменную речь в сфере деловой коммуникации на государственном языке Российской Федерации	**УК- 4.1.** З-1. литературную форму государственного языка, основы устной и письменной коммуникации на иностранном языке, функциональные стили родного языка, требования к деловой коммуникации. **УК- 4.1.** У-1. выражать свои мысли на государственном, родном и иностранном языке в ситуации делового взаимодействия **УК-4.1.** В-1. опытом составления текстов на государственном и родном языках, опыт перевода текстов с иностранного языка на родной и с родного на иностранный, а также опыт бесед на	Типовые оценочные материалы для устного опроса *(раздел 5.1.1);* Типовые тестовые задания *(раздел 5.1.2);* Типовые задания для письменного опроса *(раздел 5.1.2)* Типовые оценочные материалы для выполнения эссе *(раздел 5.1.2.8);* Типовые оценочные материалы для аудирования *(раздел 5.1.3);* Типовые оценочные материалы к зачету *(раздел 5.2.1.)* Типовые оценочные материалы к экзамену *(раздел 5.2.2.)*
	УК-4.2. Способен осуществлять перевод и анализ профессионально-ориентированного текста, вести деловую переписку, диалог и дискуссию на иностранном языке	**УК- 4.2.** З-1. Особенности стилистики официальной неофициальной переписки на русском языке. **УК- 4.2.** У-1. учитывать особенности стилистики официальной и неофициальной переписки на русском языке. **УК-4.2.** В-1. способностью вести деловую переписку на русском языке.	

2. Показатели и критерии оценивания компетенций на различных этапах их формирования, описание шкал оценивания

Первый этап (уровень)	Второй этап (уровень)	Третий этап (уровень)
36-50 баллов	***51-60 баллов***	***61-70 баллов***
На данном уровне обучающийся	На данном этапе обучающийся понимает	Этот уровень обозначает умение использовать

запоминает и воспроизводит изученный материал. Студент: знает (запоминает и воспроизводит) употребляемые термины; знает конкретные факты; знает методы и процедуры; знает основные понятия; знает правила и принципы.	значение изученного материала, может преобразовать материал из одной формы выражения в другую. В качестве показателя понимания может также выступать интерпретация материала студентом (объяснение, краткое изложение) или же предположение о дальнейшем ходе явлений, событий (предсказание последствий, результатов). Обучающийся: понимает факты, правила и принципы; интерпретирует словесный материал, схемы, графики, диаграммы; преобразует словесный материал в математические выражения; предположительно описывает будущие последствия, вытекающие из имеющихся данных.	изученный материал в конкретных условиях и в новых ситуациях. Сюда входят применение правил, методов, понятий, законов, принципов, теорий. Соответствующие результаты обучения требуют более высокого уровня владения материалом, чем понимание. Студент: использует понятия и принципы в новых ситуациях; применяет законы, теории в конкретных практических ситуациях; демонстрирует правильное применение метода или процедуры.

3. Критерии формирования оценок на различных этапах их формирования

Распределение баллов текущего и рубежного контроля

Вид работы	Трудоемкость, часы				
	1 семестр	**2 семестр**	**3 семестр**	**4 семестр**	**Всего**
Общая трудоемкость (в часах)	**72**	**72**	**72**	**72**	**288**
Контактная работа (в часах)	**34**	**36**	**34**	**34**	**138**
Лекции (Л)	**-**	**-**	**-**	**-**	**-**
Практические занятия (ПЗ)	34	36	34	34	138
Семинарские занятия (СЗ)	-	-	-	--	-
Лабораторные работы (ЛР)	-	-	-		-
Самостоятельная работа (в часах), в том числе контактная работа (вне аудиторная):	**29**	**27**	**29**	**11**	**96**
Расчетно-графическое задание (РГЗ)	**-**	**-**	**-**	**-**	**-**
Реферат (Р)	**-**	**-**	**-**	**-**	**-**
Эссе (Э)	**-**	**-**	**-**	**-**	**-**
Контрольная работа (К)	**-**	**-**	**-**	**-**	**-**
Самостоятельное изучение разделов	29	27	29	11	96
Курсовой проект (КП), курсовая работа (КР)	-	-	-	-	-
Подготовка и прохождение	9	9	9	27	54

промежуточной аттестации					
Вид промежуточной аттестации	**зачёт**	**зачёт**	**зачёт**	**экзамен**	**экзамен**

Промежуточная аттестация (зачет)

Оценка	**Незачтено**	**Зачтено**
Баллы	**36-60**	**61-70**
Характеристика	Студент имеет 36-60 баллов по итогам текущего и рубежного контроля, на зачёте не ответил ни на один вопрос.	Студент имеет 36-45 баллов по итогам текущего и рубежного контроля, на зачете представил полный ответ на один вопрос и частично (полностью) ответил на второй. Студент имеет 46-60 баллов по итогам текущего и рубежного контроля, на зачете дал полный ответ на один вопрос или частично ответил на оба вопроса. Студенту, имеющему 61-70 баллов по итогам текущего и рубежного контроля, выставляется отметка «зачтено» без сдачи зачёта.

Промежуточная аттестация (экзамен)

Оценка	**Удовлетворительно**	**Хорошо**	**Отлично**
Баллы	**61 – 80**	**81 – 90**	**91 – 100**
Характеристика	Знает отдельные перспективные задачи в соответствующем научном направлении Неуверенно докладывает известные результаты в данной предметной области Готов изложить свои результаты в письменной форме	Может указать некоторые научные направления, представляющие теоретический и практический интерес Хорошо представляет известные научные результаты по профилю подготовки Может устно и письменно изложить свои результаты	Хорошо ориентируется в современных научных направлениях, соответствующих профильной предметной области Доказательно и аргументировано представляет собственные и известные научные результаты в данной предметной области Убедительно и аргументировано излагает свои собственные результаты, как в устной, так и в письменной форме

Оценочные материалы для проведения промежуточной аттестации (контролируемая компетенция УК-4)

Оценочные материалы для проведения зачета (контролируемая компетенция УК-4)

1. Переведите следующие слова с русского на английский язык:

algebraic(al) [ˌælʤɪ'breɪk((ə)l)] алгебраический

equation [ɪ'kweɪʒ(ə)n] 1) выравнивание; стабилизация; 2) уравне- ние; равенство

erase [ɪ'reɪz] 1) стирать, соскабливать, подчищать

factor ['fæktə] 1) фактор, движущая сила; 2) множитель

generic [ʤɪ'nerɪk] 1) родовой; характерный для определённого класса, вида 2) общий;

power ['pauə] сила, мощь; могущество, степень;

opaque [ə'peɪk] 1. 1) непрозрачный; непроницаемый, тёмный Syn: foggy , lightproof; 2) не проводящий, не пропускающий (энергию, свет, тепло, радиацию); 3) тусклый, матовый, без блеска;

parenthesis [pə'renθəsɪs] ; parentheses – круглые, простые скобки represent [ˌreprɪ'zent] 1) а) изображать; представлять (в виде кого-л. / чего-л.) в) означать; символизировать; олицетворять; restriction [rɪ'strɪkʃ(ə)n] ограничение;

stuff [stʌf] 1. 1) а) материал, состав, вещество (из чего что-л. состоит); tempt [tempt] 1) соблазнять, искушать; прельщать, привлекать, притягивать;

value ['væljuː] 1. 1) а) ценность; важность; величина, значение

2. Прочитайте, переведите и перескажите текст

ALGEBRAIC EXPRESSIONS

The symbols of algebra include numbers, letters, and signs that indi- cate various arithmetic operations.

Variables

Letters represent an unknown or generic real number

Sometimes with restrictions, such as a member of a certain set, or the set of values that makes an equation true

Often a letter from the end of the alphabet: x, y, z

Or a letter that stands for a physical quantity: d for distance, t for time, etc.

Constants

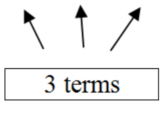
Fixed values, like 2 or 7.

Can also be represented by letters: a, b, c, □, e, k

Terms

Terms are separated by + or –

$2x^2$ □ $3x$ □ 4



Factors

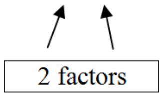
Factors are multiplied together.

Coefficients

Coefficients are constant factors that multiply a variable or powers of a variable

The middle term has 2 factors, – 3 and x. we say that the coefficient of x is – 3.

$2x^2$ □ $3x$ □ 4



The first term has three factors, 2 and two factors of x. we say that 2 is the coefficient of x2.

$2x^2$ □ $3x$ □ 4

3 factors

The last term is factor all by itself (although the number 4 could be factored into 2 × 2)

$2x^2$ □ $3x$ □ 4

1 factor

Simplifying an algebraic expression

By «simplifying» an algebraic expression, we mean writing it in the most compact or efficient manner, without changing the value of the ex- pression. This mainly involves collecting like terms, which means that we add together anything that can be added together. The rule here is that only like terms can be added together.

Like (or similar) terms

Like are those terms which contain the same powers of same vari- ables. They can have different coefficients, but that is the only difference.

Examples:

3x, x, and – 2x are like terms.

$2x^2$, $-5x^2$, and ½ x^2 are like terms.

xy^2, $3y^2x$, and $3xy^2$ are like terms.

xy^2 and x2y are NOT like terms, because the same variable is not raised to the same power.

Combining like terms

Combining like terms is permitted because of the distributive law.

For example,

3x2+5x2 = (3+5)x2 = 8x2

What happened here is that the distributive law was used in reverse – we «undistributed» a common factor of x2 from each term. The way to think about this operation is that if you have three x – squared, and then you get five more x – squared, you will then have eight x – squared.

Example: x2 +2x+3x2+2+4x+7

Starting with the highest power of x, we see that there are four x – squared in all (1x2+3x2). Then we collect the first powers of x, and see that there are six of them (2x+4x). The only thing left is the constants 2+7=9.

Putting this all together we get

x2 +2x+3x2+2+4x+7 = 4x2+6x+9

Parentheses

Parentheses must be multiplied out before collecting like terms.

(You cannot combine things in parentheses (or other grouping sym- bols) with things outside the parentheses). Think of parentheses as opaque – the stuff inside the parentheses can't «see» the stuff outside the parentheses. If there is some factor multiplying the parentheses, then the only way to get rid of the parentheses is to multiply using the distributive law.

Example: $3x+2(x–4) = 3x+2x–8 = 5x–8$

Minus Signs: Subtraction and Negatives

Subtraction can be replaced by adding the opposite.

$$3x – 2 = 3x + (–2)$$

Negative signs in front of parentheses

A special case is when a minus sign appears in front of parentheses. At first glance, it looks as though there is no factor multiplying the paren- theses, and you may be tempted to just remove the parentheses. What you need to remember is that the minus sign indicating subtraction should al- ways be thought of as adding the opposite. This means that you want to add the opposite of the entire thing inside the parentheses, and so you have to change the sign of each term in the parentheses. Another way of looking at it is to imagine an implied factor of one in front of the parentheses. Then the minus sign makes that factor into a negative one, which can be multiplied by the distributive law:

$$3x– (2–x) = 3x+ (–1)[2+(–x)] = 3x+(–1)(2)+(–1)(–x)=3x–2+x = 4x–2$$

However, if there is only a plus sign in front of the parentheses, then you can simply erase the parentheses:

$$3x+(2–x) = 3x+2–x$$

A comment about subtraction and minus signs

Although you can always explicitly replace subtraction with adding the opposite, as in this previous example, it is often tedious and inconvenient to do so. Once you get used to thinking that way, it is no longer necessary to actually write it that way. It is helpful to always think of minus signs as being «stuck» to term directly to their right. That way, as you rearrange terms, collect like terms, and clear parentheses, the «adding the opposite» business will be taken care of because the minus signs will go with whatever was to their right. If what is im- mediately to the right of a minus sign happens to be a parentheses, and then the minus sign attaches every term inside the parentheses.

3. Ответьте на вопросы, используя информацию текста.

1. What do letters represent?
2. How do we represent algebraic expressions?
3. What do the given algebraic expressions have in common?
4. What do we mean by «simplifying» an algebraic expressions?
5. What is meant by the phrase «collecting like terms»?
6. Is it possible to combine things in parentheses with things outside them?
7. What law is used in combining like terms?
8. Can subtraction be replaced by adding the opposite?
9. In what cases can we simply erase the parentheses?
10. Is there any difference between «like terms» and «similar terms»?

Задания, выносимые на экзамен (контролируемые компетенции УК-4)

Задание №1. Прочитайте, переведите отрывок из профессионально-ориентированного текста английского языка на русский и передайте основную идею в устной форме (не менее 5 предложений). Задайте к нему четыре типа вопросов в письменной форме.

Numerals

Numerals, signs or symbols for graphic representation of numbers. The earliest forms of number notation were simply groups of straight lines, either vertical or horizontal, each line corresponding to the number 1. Such a system is inconvenient when dealing with large numbers, and as early as 3400 BC in Egypt and 3000 BC in Mesopotamia a special symbol was adopted for the number 10. The addition of this second number symbol made it possible to express the number 11 with 2 instead of 11 individual symbols and the number 99 with 18 instead of 99 individual symbols. Later numeral systems introduced extra symbols for a number between 1 and 10, usually either 4 or 5, and additional symbols for numbers greater than 10. In Babylonian cuneiform notation the numeral used for 1 was also used for 60 and for powers of 60; the value of the numeral was indicated by its context. This was a logical arrangement from the mathematical point of view because 600 = 1, 601 = 60, and 602 = 3600. The Egyptian hieroglyphic system used special symbols for 10, 100, 1000, and 10,000.

The ancient Greeks had two parallel systems of numerals. The earlier of these was based on the initial letters of the names of numbers: The number 5 was indicated by the letter pi; 10 by the letter delta; 100 by the antique form of the letter H; 1000 by the letter chi; and 10,000 by the letter mu. The later system, which was first introduced about the 3rd century BC, employed all the letters of the Greek alphabet plus three letters borrowed from the Phoenician alphabet as number symbols. The first nine letters of the alphabet were used for the numbers 1 to 9, the second nine letters for the tens from 10 to 90, and the last nine letters for the hundreds from 100 to 900. Thousands were indicated by placing a bar to the left of the appropriate numeral, and tens of thousands by placing the appropriate letter over the letter M. The late Greek system had the advantage that large numbers could be expressed with a minimum of symbols, but it had the disadvantage of requiring the user to memorize a total of 27 symbols.

Four Basic Operations of Arithmetic

There are four basic operations of arithmetic. They are: addition, subtraction, multiplication and division. In arithmetic, an operation is a way of thinking of two numbers and getting one number. An equation like 3 + 5 = 8 represents an operation of addition. Here you add 3 and 5 and get 8 as a result. 3 and 5 are addends (or summands) and 8 is the sum. There is also a plus (+) sign and a sign of equality (=). They are mathematical symbols.

An equation like 7 – 2 = 5 represents an operation of subtraction. Here 7 is the minuend and 2 is the subtrahend. As a result of the operation, you get the difference. There is also the mathematical symbol of the minus (-) sign. We may say that subtraction is the inverse operation of addition since 5 + 2 = 7 and 7 – 2 = 5.

The same may be said about division and multiplication, which are also inverse operations.

In multiplication, there is a number that must be multiplied. It is the multiplicand. There is also a multiplier. It is the number by which we multiply. If we multiply the multiplicand by the multiplier, we get the product as a result. In the equation 5 × 2 = 10 (five multiplied by two is ten) five is the multiplicand, two is the multiplier, ten is the product; (×) is the multiplication sign.

In the operation of division, there is a number that is divided and it is called the dividend and the number by which we divide that is called the divisor. When we are dividing the dividend by the divisor, we get the quotient. In the equation 6:2 = 3, six is the dividend, two is the divisor and three is the quotient; (:) is the division sign.

But suppose you are dividing 10 by 3. In this case, the divisor will not be contained a whole number of times in the dividend. You will get a part of the dividend left over. This part is called the remainder. In our case, the remainder will be 1. Since multiplication and division are inverse operations, you may check division by using multiplication.

Mathematics – the Language of Science

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

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

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

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

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

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

The history of geometry

Geometry is the Greek name for the science which the early Egyptians began and developed about 5000 years ago. The word *geometry* is derived from two Greek words: geo meaning *earth* and metron meaning *measure.*

For erecting pyramids the early Egyptians needed professional geometers who were able to locate a line running north .and south.

The geometry known to the Egyptians consisted principally of rules and formulas for finding areas and volumes. The Egyptians were principally interested in the practical application of their rules.

After a time Greek philosophers and teachers developed and perfected the proofs of the Egyptians. The most important of the early Greek teachers was Pythagoras who was born about 569 before our era. He founded a school in Italy. The students were divided into two classes - beginners and Pythagorians.

Plato, who lived more than a hundred years later than Pythagoras, was primarily a philosopher. His interest in geometry was not because of its practical use, but because of the logic contained in the proofs.

The best known name in connection with geometry is Euclid. Euclid was a teacher of geometry in Alexandria. He used to say that geometry trained the habits of expressing thoughts accurately. One of his most important textbooks is called *The Elements*. *The Elements* of Euclid has been used as a basis for all textbooks on geometry since his time.

Another famous scientist of ancient, times was Archimedes who lived in Sicily. Archimedes discovered many laws of mathematics.

For over twenty centuries Euclidean geometry was the ruling theory. In the 19th century the Russian mathematician Lobatchevsky founded non-Euclidean geometry of two dimensions.

Such kind of geometry is called hyperbolic. It is based on the assumption that the axiom on parallels is not true, and through a point any number of straight lines can be drawn parallel to a given straight line.

The third system of geometry was developed by Riemann and is called elliptic geometry. Riemann assumes that no straight line can be drawn which will not meet any other straight line.

Thus we have three systems of geometry.

Vertical and horizontal lines and planes

Surface intersected in lines are bounded by lines. Lines are either straight or curved. Examine the model of a rectangular prism. When two surfaces intersect, they do so in a straight line, called an edge of the prism. The curved surface of a cylinder and either of the plane surfaces intersect in a curved line. The trace made on paper by a fine pencil point may represent a line, but even the finest trace will be a geometrical solid, since it has length, breadth, and thickness, and a line has length, but no breadth and no thickness.

If an object is suspended by a string, the line of the string would pass through the center of the earth; the line is called a vertical line. Any plane which contains a vertical line, e. g. the surface of the wall of a room, is called a - vertical plane. When a bricklayer is building a wall, he uses a plumb-line, which consists of a small lump of lead at the end of a string to test whether the surface of the wall is a vertical plane.

Any straight line which is perpendicular to a vertical line is called a horizontal line, and if all the lines that can be drawn in a plane are horizontal, the plane is called a horizontal plane, e. g. the surface of still water in a tank.

A surface is called level if it is part of a horizontal plane. You can test whether the floor of this room is a horisontal plane by using an instrument called a spirit-level, in which the adjustment to the horizontal is shown] by the position of a bubble in a glass tube containing (alcohol. If a line or plane is neither vertical, nor horizontal, it is called oblique. The words *perpendicular* and *vertical* must not be confused.

Two intersecting lines are perpendicular if they form a right-angled corner; a line is vertical if it points to the center of the earth.

N. I. Lobachevsky (1792-1856)

N. I. Lobachevsky was born on December 1, 1792 near Nizhni Novgorod. When he was a child, his family moved to Kazan where Lobachevsky entered the gymnasium. His progress in mathematics was extremely rapid there.

When he was only 14 years old, he entered the University of Kazan.

At the age of 19 Lobachevsky was awarded a Master's Degree. At the age of 24 he became a professor of mathematics at Kazan University. In 1827 Lobachevsky was appointed rector of the University and later re-elected six times. So he was at the head of the University for 19 years.

I 1826 when Lobachevsky was 34 years old, he succeeded in solving the problem which the mathematicians of the world had failed to solve for more than 2,000 years - he created non-Euclidean geometry, one of the greatest masterpieces of mathematics.

In spite of Lobachevsky's great contribution to science the scientists of Russian Academy did not support him. They even laughed at him and his geometry. The scientists of Europe didn't support him either. In 1846 he was dismissed from his office. In spite of this he continued his work and when he got blind, he dictated his new masterpiece Pan-geometry to his pupils.

Lobachevsky died in 1856 at the age of 63. He was both an outstanding mathematician and philosopher-materialist. His non-Euclidean geometry had a great influence on the development of mathematical sciences.

Today Lobachevsky's name is known all over the world and as he was a revolutionary in science, he is often called *Copernicus of geometry.*

Geometry

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

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

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

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

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

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

Their works influenced later researchers, including Riemann and Einstein.

Algebra

The earliest records of advanced, organized mathematics date back to the ancient Mesopotamian country of Babylonia and to the Egypt of the 3rd millennium BC.

Ancient mathematics was dominated by arithmetic, with an emphasis on measurement and calculation in geometry and with no trace of later mathematical concepts such as axioms or proofs.

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

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

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

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

An important development in algebra in the 16th century was the introduction of symbols for the unknown and for algebraic powers and operations. As a result of this development, Book 3 of *La geometria* (1637) written by the French philosopher and mathematician Rene Descartes looks much like a modern algebra text. Descartes' most significant contribution to mathematics, however, was his discovery of analytic geometry, which reduces the solution of geometric problems to the solution of algebraic ones.

SOME FACTS ON THE DEVELOPMENT OF THE NUMBER SYSTEM

Our present number system has not always been so fully developed as it is today. The number system is closely connected with early prehistoric man and with the most recent discoveries in atomic science.

But there was a time when man did not know how to count. The origin of number and counting is hidden behind countless prehistoric ages. No one knows when counting first began. Before man learned to count, he probably used names or signs for each person or thing. It is believed that the early shepherds would call their sheep by name in order to determine if any of them were missing. Counting represents a very important milestone in the progress of civilization. Of course, there were no number names at first; so *counters* were used. For *counters* man used sticks, pebbles, his fingers, and in some instances his toes also. In fact, the word *calculus* comes from the Latin, meaning *pebble*; our numerals are called *digits* from the Latin, meaning *finger*.

It is possible to mention only a few important achievements in the history of mathematics. Historical records give evidence of the astronomical and arithmetical achievements of the early Babylonians, Sumerians, and Chinese. Somewhere in the distant past man learned that number was useful for civilized living. As early as 5,700 B. C. predecessors of the Babylonians had calendar and a type of practical arithmetic.

One of the greatest mathematicians of recorded history was the Greek Archimedes (287 - 212 B. C.) who developed a dynamic mathematics which could be applied to the laws of nature.

The practical civilization of ancient Rome, great in many other fields, contributed little to mathematics.

Going to the Renaissance period, we find the tribes of Moslems coming to Europe, bringing with them the culture of many civilizations, including a strange number system acquired from the Hindus.

Only about 300 years ago a great mathematician and philosopher Rene Descartes (1596 - 1650) represented number pairs by points. This creation made possible the great advance in science and mathematics during the eighteenth century. In 1642 one of the greatest minds of all time Isaac Newton was born (1642 - 1727). Newton was one of the inventors of the calculus which is now studied by college students who are seriously interested in mathematics or physical science.

Few discoveries in world science can equal the discovery of Lobachevsky (1792 -1 856). Like Archimedes, Galileo, Copernicus and Newton, he is one of those who laid the foundations of science. Lobachevsky created one of the greatest masterpieces of mathematics - non- Euclidean geometry.

Development of calculus

In the 17th century, Isaac Newton and Gottfried Leibniz independently developed the foundations for calculus. Calculus development went through three periods: anticipation, development and rigorization. In the anticipation stage, mathematicians were attempting to use techniques that involved infinite processes to find areas under curves or maximize certain qualities. In the development stage, Newton and Leibniz brought these techniques together through the derivative and integral. Though their methods were not always logically sound, mathematicians in the 18th century took on the rigorization stage, and were able to justify them and create the final stage of calculus. Today, we define the derivative and integral in terms of limits.

In contrast to calculus, which is a type of continuous mathematics, other mathematicians have taken a more theoretical approach. Discrete mathematics is the branch of math that deals with objects that can assume only distinct, separated value. Discrete objects can be characterized by integers, whereas continuous objects require real numbers. Discrete mathematics is the mathematical language of computer science, as it includes the study of algorithms. Fields of discrete mathematics include combinatorics, graph theory, and the theory of computation.

People often wonder what relevance mathematicians serve today. In a modern world, math such as applied mathematics is not only relevant, it's crucial. Applied mathematics is the branches of mathematics that are involved in the study of the physical, biological, or sociological world. The idea of applied math is to create a group of methods that solve problems in science. Modern areas of applied math include mathematical physics, mathematical biology, control theory, aerospace engineering, and math finance. Not only does applied math solve problems, but it also discovers new problems or develops new engineering disciplines. Applied mathematicians require expertise in many areas of math and science, physical intuition, common sense, and collaboration. The common approach in applied math is to build a mathematical model of a phenomenon, solve the model, and develop recommendations for performance improvement.

Задание № 2. Переведите устно термины по специальности с русского языка на английский

1

1. algorisem=algorithem	1. алгоритм
2. assumption	2. допущение
3. comma	3. запятая
4. determinant	4. детерминант, определитель
5. exact	5. точный
6. lemma	6. лемма
7. ordinate	7. ордината
8. system	8. система
9. subset	9. подмножество
10. abbreviate	10. сокращать, укорачивать
11. abstract	11. абстракция, абстрактный
12. axiom	12. аксиома
13. cancel	13.сокращать
14. circumference	14.окружность
15. cotangent	15.котангенс
16. arc	16. арка
17. define	17.определять
18. double	18.двойной, сдвоенный, парный
19. equation	19.уравнение
20. flat	20.плоский

2

1. account	считать
2. account for	объяснять
3. arithmetic	арифметика
4. theorem	теорема
5. carry over	переносить
6. column	столбец, колонка
7. count	считать
8. definition	определение
9. duplex	двухсторонний, спаренный
10. equilateral	равносторонний
11. flat angle	угол в 180
12. group	группа
13. index	показатель, порядок степени
14. inverse	обратный, противоположный

15. linear	линейный, линейчатый
16. mean	среднее значение, означать, иметь ввиду
17. negation	отрицание
18. parallelogram	параллелограмм
19. polygon	многоугольник, полигон
20. radical	знак корня

3

1. accumulation factor	множитель
2. aggregate	составной, общий; множество
3. area	площадь
4. binary	двоичный
5. case	случай, пример, ситуация
6. commutative	коммутативный, перестановочный
7. curve	кривая, график
8. denominator	знаменатель
9. ellipse	эллипс
10. equivalent	равносильный, эквивалентный
11. formula (pl.formulae, formulas)	формула, формулы
12. hence	следовательно
13. indicate	указывать
14. iterant	итерант
15. linear equation	линейное уравнение
16. measure	мера, измерять
17. negative	отрицательный
18. part	часть
19. positive	положительный
20. random	беспорядочный

4

1. abbreviation	сокращение
2. add up	складывать, находить сумму
3. amount	количество, сумма
4. binomial	двучлен
5. category	категория
6. complex action	сложное действие
7. cybernetics	кибернетика
8. diagonal	диагональ
9. endpoint	конечная точка
10. even	четный
11. fraction	дробь
12. horizontal	горизонтальный
13. infinity	бесконечность
14. irrational	иррациональное число; иррациональный
15. logarithm	логарифм
16. median	медиана
17. non-linear	нелинейный
18. perimeter	периметр
19. postulate	постулат
20. rational	рациональный

5

1. additional	добавочный, дополнительный
2. align	ставить в ряд
3. altitude	высота

4. action	действие
5. algebra	алгебра
6. center (centre)	центр
7. assume	предполагать, допускать
8. blank	пробел, пустое место (между цифрами)
9. complex fraction	четырехэтажная дробь
10. cycloid	циклоид
11. diagram	диаграмма
12. encode	кодировать
13. exponent	показатель степени
14. function	функция; действовать, функционировать
15. hyperbola	гипербола
16. inequality	идентичность, тождество
17. jog	отрезок (кривой)
18. map	карта, отображение
19. mental arithmetic	вычисления в уме
20. number	число, количество

6

1. action	действие
2. algebra	алгебра
3. assume	предполагать, допускать
4. body	тело, масса, совокупность
5. centimeter	сантиметр
6. cylinder	цилиндр
7. compute	считать, подсчитывать, вычислять
8. computation	вычисление
9. difference	разность
10. enter	входить, поступать
11. exact	точный
12. fundamental	основной, фундаментальный
13. hypotenuse	гипотеза
14. integer	интеграл, целое число
15. law	закон, правило, принцип, формула, теорема
16. mathematical	математический
17. metric system	метрическая система
18. numeration	счет, счисление
19. period	период
20. prism	призма

7

1. abacus (abaci)	счёты
2. algebraic(al)	алгебраический
3. analysis(pl. analyses)	анализ
4. bound	грань, граница
5. chance	случай, случайность, вероятность
6. data	данные
7. concept	понятие, идея
8. differential	дифференциальный
9. enumerate	перечислять, нумеровать
10. face	грань, лицо, лицевая сторона
11. geometry	геометрия
12. hypothesis	гипотеза
13. integrable	интегрируемый, суммируемый

14. leg	сторона, катет; ножка циркуля
15. mathematician	математик
16. minimum	минимум
17. obtuse angle	тупой угол
18. periodic (al)	периодический
19. problem	проблема, задача
20. real	реальный, действительный

8

1. abscissa (abscissae)	абсцисса
2. additive	аддитивный
3. application	применение
4. bracket	скобка, квадратная скобка
5. check	проверка, контроль, сверка
6. decimal	десятичный
7. constant	постоянная величина
8. distributive	распределительный, дистрибутивный
9. enumeration	перечисление, нумерация
10. factor	множитель; разлагать на множители
11. globe	шар, сферическое тело
12. image	образ, отражение
13. increment	приращение
14. integral	целое число
15. length	длина
16. mathematics	математика
17. minus	минус
18. operation	действие, операция
19. perpendicular	перпендикулярный
20. program	программа

9

1. adjacent	примыкающий, смежный
2. addition	сложение
3. angle	угол
4. calculate	вычислять, рассчитывать, подсчитывать
5. cipher	нуль (число), символ, цифра, код, шифр
6. deduct	Вычитать, отнимать
7. contain	содержать, вмещать, делиться
8. division	деление
9. equal	равный, одинаковый
10. equality	равенство
11. final element	концевой элемент
12. gradient	градиент
13. increment of argument	приращение аргумента
14. integral from a to b	интеграл в пределах от а до б
15. limit(ed)	предел, предельный
16. matrix (pl. matrices)	матрица
17. multiplication	умножение
18. opposite	противоположный
19. plane	плоскость, проекция
20. progression	прогрессия

10

1. acute angle	острый угол
2. angular	угловой

3. argument доказательство; аргумент (функции)
4. calculus исчисление
5. circle круг
6. cosine косинус
7. deduction вычитание; дедукция, выведение, вывод
8. proof доказательство
9. breadth ширина
10. graph диаграмма, график
11. increment of function приращение функции
12. integrate интегрировать, объединять
13. line линия, строка; проводить линию, ставить в линию
14. maximum предельный, максимум
15. multiply умножать
16. parallel параллельный
17. point точка
18. property свойство
19. right angle прямой угол
20. set множество

Задание №3. Переведите предложения с русского языка на английский, используя терминологию пройденных разделов.

Mathematics.	
1.Математика, способ описания взаимосвязей между числами и другими измеримыми количествами.	1.Mathematics, a way of describing relationships between numbers and other measurable quantities
2. Математика позволяет ученым передавать идеи с помощью общепринятой терминологии.	2. Mathematics allows scientists to communicate ideas using universally accepted terminology.
3. Наши компьютеры являются результатом миллионов часов математического анализа	3. Our computers are the result of millions of hours of mathematical analysis.
4. Прогнозирование погоды, проектирование экономичных автомобилей и самолетов, управление движением и медицинская визуализация зависят от математического анализа.	4. Weather prediction, the design of fuel-efficient automobiles and airplanes, traffic control, and medical imaging all depend upon mathematical analysis.
5. По большей части, математика остается за кулисами.	5. For the most part, mathematics remains behind the scenes
6. В конце 1800-х годов, научные исследователи начали зондировать пределы наблюдения, исследуя части атома и природу света	6. At the end of the 1800s, scientific researchers began probing the limits of observation, investigating the parts of the atom and the nature of light.
7. Электрон ученые обнаружили в 1897 году	7. Scientists discovered the electron in 1897.
8. До XVII века арифметика, алгебра и геометрия были единственными математическими дисциплинами, а математика была практически неотличима от науки и философии	8. Until the 17th century, arithmetic, algebra, and geometry were the only mathematical disciplines, and mathematics was virtually indistinguishable from science and philosophy.
9. Разработанные древними греками, эти системы для исследования мира были	9. Developed by the ancient Greeks, these systems for investigating the world were

сохранены исламскими учеными и переданы христианскими монахами в средние века.	preserved by Islamic scholars and passed on by Christian monks during the Middle Ages
10. До конца 19-го века, однако, математика использовалась в основном физиками, химиками и инженерами.	10. Until the late 19th century, however, mathematics was used mainly by physicists, chemists, and engineers.

THE HISTORY OF MATHEMATICS.

1. Математика – это наука, имеющая дело с числами и другими измеримыми количествами.	1. Mathematics is a science dealing with numbers and other measurable quantities.
2. Подсчет был самой ранней математической деятельностью.	2. Counting was the earliest mathematical activity.
3. Наши компьютеры являются результатом миллионов часов математического анализа	3. Our computers are the result of millions of hours of mathematical analysis.
4. Арифметика доминировала в их математике.	4. Arithmetic dominated their mathematics.
5 Наше знание о Вавилоне происходит от хорошо сохранившихся глиняных табличек, на которых люди писали клиновидными знаками, известными как клинописи.	5. Our knowledge of Babylonia comes from well-preserved clay tablets on which people wrote with wedge-shaped marks known as cuneiform.
6. Самые ранние таблички датируются примерно 3000 г. до н.э.	6. The earliest tablets date from about 3000 B.C.
7. Русская математика была представлена Николаем Лобачевским	7. Russian mathematics was represented by Nikolay Lobachevsky.
8. Неевклидовая геометрия была самым впечатляющим интеллектуальным творением XIX века.	8. Non-Euclidean geometry was the most impressive intellectual creation of the 19th century.
9. Кредит на создание неевклидовой геометрии дается ему и венгерскому математику Яносу Боляю.	9. Credit for the creation of non-Euclidean geometry is given to him and hungarian mathematician Janos Bolyai
10. Вавилоняне древней Месопотамии и древние египтяне оставили самые ранние записи организованной математики.	10. Babylonians of ancient Mesopotamia and the ancient Egyptians left the earliest records of organized mathematics

Arithmetic.

1. Arithmetic is a branch of mathematics that arises from most basic mathematical operation.	1. Арифметика является отраслью математики, которая возникает из самых основных математических операций.
2. Арифметика включает в себя различные способы подсчета или манипулирования числами: добавление, вычитание, умножение и деление.	2. Arithmetic encompasses various ways of counting, or manipulating numbers: addition, subtraction, multiplication, and division
3. Таким образом, арифметика означает искусство чисел.	3. Thus arithmetic means the art of numbers
4. Различные цивилизации на протяжении всей истории разработали различные виды числовых систем	4. Different civilizations throughout history have developed different kinds of number systems
5. Эта система называется десятичной или базовой системой 10.	5. This system is called the decimal or base 10 system.
6. Каждое последующее число в последовательности на один больше, чем число раньше: 1, 2, 3, 4	6. Each subsequent number in the sequence is one more than the number before: 1, 2, 3, 4 ...

7. В цифрах с двумя или более цифрами каждая цифра имеет так называемое значение места	7. In numbers with two or more digits, every digit has a so-called place value.
8. Обратите внимание, что каждый период цифр отделяется запятой	8. Note that each period of digits is separated by a comma.
9. Так ноль число?	9. So is zero a number?
10. Ну, это вопрос определения.	10. Well, that is a matter of definition..
THE REAL NUMBER SYSTEM	
1. Реальная система чисел развивалась с течением времени, расширяя понятие того, что мы подразумеваем под словом "число".	1. The real number system evolved over time by expanding the notion of what we mean by the word "number.
2. Естественные или подсчитывающие номера 1,2,3,4,5,6	2. Natural or Counting numbers: 1 ,2,3,4,5,6
3. В какой-то момент пришла идея «нулевого» которые должны рассматриваться как число.	3.At some point, the idea of zero came to be considered as a number.
4. Если у фермера нет овец, то количество овец, которыми владеет фермер, равно нулю	4. If the farmer does not have any sheep, then the number of sheep that the farmer owns is zero
5. Еще более абстрактной, чем ноль, является идея отрицательных чисел	5. Even more abstract than zero is the idea of negative numbers
6. Обратите внимание, что отрицательный знак перед номером является частью символа для этого числа.	6. Note that the negative sign in front of the number is part of the symbol for that number.
7. Следующее обобщение, которое мы можем сделать, это включить идею фракции	7. The next generalization that we can make is to include the idea of fraction
8. Если мы добавим фракцию к набору множество малых чисел, мы получим набор рациональных чисел.	8 If we add fraction to the set of integers, we get the set of rational numbers.
9. Все целые числа также можно рассматривать как рациональные числа, с знаменателем 1.	9. All integers can also be thought of as rational numbers, with a denominator of 1.
10. Теперь может показаться, как через, как будто набор рациональных чисел будет охватывать все возможные дела, но это не так.	10. Now it might seem as through as though the set of rational numbers would cover every possible case, but that is not so.
ADDING AND SUBTRACTING POSITIVE INTEGERS	
1. Арифметическая операция Сложение в основном является средством быстрого подсчета и указывается знаком плюс (+).	1.The arithmetic operation of addition is basically a means of counting quickly and is indicated by the plus sign (+).
2. Простейшие суммы обычно запоминаются.	2. The simplest sums are usually memorized.
3. Номера, которые будут добавлены, называются сложениями.	3. The numbers to be added are called addends.
4. Мы могли бы разместить 4 яблока и еще 5 яблок в ряд, а затем считать их индивидуально от 1 до 9.	4. We could place 4 apples and 5 more apples in a row, then count them individually from 1 to 9.
5. Сложение, однако, позволяет считать все яблоки в один шаг (4 + 5 = 9).	5. Addition, however, makes it possible to count all of the apples in a single step (4 + 5 = 9).
6. Сначала добавьте единицы (7+2+9); всего	6. First add the units (7+2+9); the total 18

18	
7. Результат 108.	7. The result is 108.
8. Арифметическая операция вычитания является противоположностью добавления и указывается знаком минуса (-).	8. The arithmetic operation of subtraction is the opposite of addition and is indicated by the minus sign(-).
9. Вычитание немного сложнее, если необходимо вычесть большую цифру из меньшего	9. Subtraction is a bit more complicated if we need to subtract a larger digit from a smaller one
10. Ответ, или разница, 45.	10. The answer, or difference , is 45.

EUCLID AND HIS ELEMENTS

Евклид, один из самых влиятельных математиков древней Греции, его расцвет пришёлся на 300 г. до н.э.	One of the most influential mathematicians of ancient Greece, Euclid flourished around 300 B.C.
Фактически было сказано, что помимо Библии, «Элементы» - самая читаемая и изучаемая книга в мире.	In fact, it has been said that apart from the Bible, the Elements is the most widely read and studied book in the world.
Вероятно, каждый великий западный математик, родившийся за последние две тысячи лет, изучал «Евклидовы элементы».	Probably every great Western mathematician to arise in the last two thousand years has studied Euclid's Elements.
При написании Элементов Евклид собрал и расширил многие идеи других греческих математиков до него.	In writing the Elements Euclid collected and extended many of the ideas of other Greek mathematicians before him.
Две точки определяют прямую линию.	Two points determine a straight line.
Сегмент линии, простирающийся бесконечно в обоих направлениях, создает прямую линию.	A line segment extended infinitely in both directions produces a straight line.
Круг определяется центром и расстоянием.	A circle is determined by a center and distance.
Все прямые углы равны друг другу.	All right angles are equal to one another.
Гиперболическая геометрия была изобретена русским математиком Николаем Ивановичем Лобачевским.	Hyperbolic geometry was invented by the Russian mathematician Nicolai Ivanovitch Lobachevsky
Зенон Сидонский в первом веке до н.э. полагал, что список постулатов Евклида был неполным.	Zeno of Sidon in the first century B.C. believed that Euclid' s list of postulates was incomplete.
Например, набор всех целых чисел не больше, чем набор всех четных чисел.	For example, the set of all integers is not larger than the set of all even integer.

GEOMETRY

Геометрия, отрасль математики, которая занимается формами и размерами, может рассматриваться как наука о космосе.	Geometry, branch of mathematics that deals with shapes and sizes may be thought of as the science of space.
Базовая геометрия позволяет нам определять свойства, такие как площади и периметры двумерных фигур, а также площади поверхности и объемы трехмерных фигур.	Basic geometry allows us to determine properties such as the areas and perimeters of two - dimensional shapes and the surface areas and volumes of three - dimensional shapes.
Геометрия объединяет простые концептуальные строительные блоки для построения сложных логических структур.	Geometry combines simple conceptual building blocks to construct complex logical structures .
Эти строительные блоки включают в себя неопределенные термины, определенные термины и постулаты.	These building blocks include undefined terms, defined terms, and postulates.
Объединение этих компонентов создает цепочки	Combining these components creates chains of

рассуждений, которые подтверждают выводы, называемые теоремами.	reasoning that support conclusions called theorems.
Некоторые понятия, имеющие ключевое значение для геометрии, не определены в терминах более простых понятий.	Some concepts central to geometry are not defined in terms of simpler concepts .
Наиболее знакомыми из этих неопределенных терминов являются точка, линия, и грань.	The most familiar of these undefined terms are point, line, and plane.
Неопределенные термины могут быть объединены для определения других терминов.	Undefined terms can be combined to define other terms.
Определенные термины могут быть объединены друг с другом и с неопределенными терминами, чтобы определить еще больше терминов.	Defined terms can be combined with each other and with undefined terms to define still more terms.
Постулаты, или аксиомы, являются недоказанными, но общепринятыми предположениями, такими как «есть одна и только одна линия, которая проходит через две различные точки».	Postulates, or axioms, are unproven but universally accepted assumptions, such as «there is one and only one line that passes through two distinct points».
Система, состоящая из набора непротиворечивых постулатов, касающихся неопределенных терминов: точка, линия и плоскость, вместе с теоремами, выведенными из этих постулатов, называется геометрией.	A system consisting of a set of noncontradictory postulates concerning the undefined terms point, line, and plane, together with the theorems deduced from these postulates, is called geometry.

FRACTIONS

Числа, представляющие части целого, называются дробями или рациональными числами.	Numbers that represent parts of a whole are called fractions or rational numbers.
Простые дроби знакомы: десять центов - десятая часть доллара; 1/3 пирога плюс 1/3 пирога составляет 2/3 пирога; и так далее.	Simple fractions are familiar: a dime is the tenth part of a dollar; 1/3 of a pie plus 1/3 of a pie is 2/3 of a pie; and so on.
Верхнее число дроби называется числителем, а нижнее число - знаменателем.	The top number in a fraction is called the numerator and the bottom number is called the denominator.
Правильная дробь - это та, в которой числитель меньше знаменателя: 1/2, -3/4 и 5/8 - все правильные дроби.	A proper fraction is one in which the numerator is smaller than the denominator; 1/2, - 3/4 , and 5/8 are all proper fractions.
Неправильная дробь - это та, в которой число больше знаменателя: 7/3, -3/2 и 6/5 - все неправильные дроби.	An improper fraction is one in which the numerator is larger than the denominator; 7/3, -3/2 , and 6/5 are improper fractions.
Число, деленное на себя, всегда равно 1.	Since a number divided by itself is always equal to 1.
Только дроби с равными знаменателями могут быть сложены или вычтены в том виде, в каком они есть.	Only fractions with equal denominators may be added or subtracted as they stand.
Если знаменатели добавляемых дробей неравны, мы должны найти общий знаменатель.	If the denominators of fractions to be added are unequal, we must find a common denominator.
Один быстрый способ получить общий знаменатель для двух дробей - это умножить их знаменатели.	One quick way to obtain a common denominator for two fractions is to multiply their denominators
Любое число, умноженное на ноль, равно нулю.	Any number multiplied by zero equals zero
Обратная дробь - это просто перевернутая дробь.	The reciprocal of a fraction is simply the fraction flipped upside down.

TRIANGLE

Треугольник - это трехсторонний многоугольник, который иногда (но не очень часто) называют треугольником.	A triangle is a 3-sided polygon sometimes (but not very commonly) called the trigon.
Все треугольники выпуклые.	All triangles are convex.
Острый треугольник - это треугольник, все три угла которого являются острыми.	An acute triangle is a triangle whose three angles are all acute.
Треугольник с равными сторонами называется равносторонним.	A triangle with all sides equal is called equilateral.
Треугольник с двумя равными сторонами называется равнобедренным.	A triangle with two sides equal is called isosceles.
Треугольник, имеющий тупой угол, называется тупоугольным треугольником.	A triangle having an obtuse angle is called an obtuse triangle.
Треугольник с равными сторонами называется правильным.	A triangle with a right angel is called right.
Треугольник со всеми сторонами разной длины называется разносторонним.	A triangle with all sides a different length is called scalene.
Сумма углов в треугольнике равна $180° = \pi$ радиан (по крайней мере, в евклидовой геометрии: это утверждение не выполняется в неевклидовой геометрии).	The sum of angles in a triangle is $180° = \pi$ radians (at least in Euclidean geometry: this statement does not hold in non-Euclidean Geometry).

PYTHAGOREAN THEOREM

Теорема Пифагора является одной из самых известных во всей математике.	The Pythagorean Theorem is one of the most famous in all of mathematics.
В ней говорится: Теорема: квадрат длины гипотенузы прямоугольного треугольника равен сумме квадратов катетов.	It states: Theorem: The square of the length of the hypotenuse of a right triangle is equal to the sum of the squares of the legs.
Существует много разных доказательств этой теоремы (даже одно из которых было предоставлено президентом Гарфилдом в 1876 году!), и мы знаем, что вавилоняне знали о теореме Пифагора за 1000 лет до времени Пифагора (родился в 572 году до нашей эры).	There are many different proofs of the theorem (even one supplied by President Garfield in 1876!), and we know that the Babylonians knew about the Pythagorean Theorem about 1000 years before the time of Pythagoras (born in 572 B.C.).
Тем не менее, строгое, общее доказательство теоремы требует развития дедуктивной геометрии, и поэтому считается, что Пифагор, вероятно, предоставил первое доказательство.	Nonetheless, a rigorous, general proof of the theorem requires the development of deductive geometry, and thus it is thought that Pythagoras probably supplied the first proof.
Греческий философ и математик Пифагор заметил эту связь и ему приписывают доказательство этого свойства, известное как теорема Пифагора или свойство Пифагора.	The Greek philosopher and mathematician Pythagoras noticed the relationship and is credited with the proof of this property known as the Pythagorean Theorem or the Pythagorean Property.
Каждая сторона прямоугольного треугольника, используемая в качестве стороны квадрата, сумма площадей двух меньших квадратов равна площади наибольшего квадрата.	Each side of a right triangle being used as a side of a square, the sum of the areas of the two smaller squares is the same as the area of the largest square.
Прежде чем дать доказательство, сформулируем свойство Пифагора на математическом языке.	Before giving the proof let us state the Pythagorean Property in mathematical language.
В приведенном треугольнике, с обозначает меру гипотенузы, а a и b - меру двух других сторон.	In the triangle below, c represents the measure of the hypotenuse, and a and b represent the measures of the other two sides.
Если мы построим квадраты на трех сторонах треугольника, мера площади будет a^2, b^2и c^2.	If we construct squares on the three sides of the triangle, the area-measure will be a^2, b^2, and

	c^2.
Тогда свойство Пифагора можно сформулировать следующим образом: $a^2 + b^2 = c^2$.	Then the Pythagorean Property could be stated as follows: $a^2 + b^2 = c^2$.

Критерии формировании оценок по промежуточной аттестации:

«отлично» (30 баллов) – получают обучающиеся, которые свободно ориентируются в материале и отвечают без затруднений. Обучающийся способен к выполнению сложных заданий, постановке целей и выборе путей их реализации. Работа выполнена полностью без ошибок, решено 100% задач;

«хорошо» (20 баллов) – получают обучающиеся, которые относительно полно ориентируются в материале, отвечают без затруднений, допускают незначительное количество ошибок. Обучающийся способен к выполнению сложных заданий. Работа выполнена полностью, но имеются не более одной негрубой ошибки и одного недочета, не более трех недочетов. Допускаются незначительные неточности при решении задач, решено 70% задач;

«удовлетворительно» (15 баллов) – получают обучающиеся, у которых недостаточно высок уровень владения материалом. В процессе ответа на экзамене допускаются ошибки и затруднения при изложении материала. Обучающийся правильно выполнил не менее 2/3 всей работы или допустил не более одной грубой ошибки и двух недочетов, не более одной грубой и одной негрубой ошибки, не более трех негрубых ошибок, одной негрубой. Обучающийся затрудняется с правильной оценкой предложенной задачи, дает неполный ответ, решено 55% задач;

«неудовлетворительно» (10 баллов) – получают обучающиеся, которые допускают значительные ошибки. Обучающийся имеет лишь начальную степень ориентации в материале. В работе число ошибок и недочетов превысило норму для оценки 3 или правильно выполнено менее 2/3 всей работы. Обучающийся дает неверную оценку ситуации, решено менее 50% задач.

Методические указания по подготовке к зачету/ экзамену

Работа с новым лексическим материалом

Все выделенные в уроке слова и словосочетания предназначены для активного усвоения студентом и должны быть внесены в словарь. Не рекомендуется учить отдельные слова списком. Гораздо более эффективно заучивать целые предложения, в которых встречается новая лексика.

Работа с учебным текстом

Работу с учебным текстом рекомендуется строить по следующей схеме:

1) ознакомиться с комментариями и примечаниями;
2) выписать в словарь новые лова и словосочетания;
3) выполнить предтекстовые упражнения;
4) прочитать и перевести текст;
5) ответить на вопросы, следующие за текстом;
6) несколько раз прочитать текст вслух;
7) составить план текста, предварительно выделив ключевые слова;
8) подготовить пересказ содержания прочитанного.

Работа с грамматическим материалом

Перед тем как приступить к выполнению грамматических упражнений следует повторить соответствующий раздел грамматики по грамматическим справочникам и/или пособиям кафедры. После этого необходимо выполнить тренировочные упражнения и, при необходимости, провести работу над ошибками, а также сделать дополнительные грамматические упражнения для закрепления грамматических навыков.

Процедура промежуточной аттестации

Процедура промежуточной аттестации проходит в соответствии с Положением о текущем контроле и промежуточной аттестации обучающихся в ФГБОУ ВО «КБГУ».

- Аттестационные испытания проводятся преподавателем (или комиссией преподавателей – в случае модульной дисциплины), ведущим лекционные занятия по данной дисциплине, или преподавателями, ведущими практические и лабораторные занятия (кроме устного экзамена). Присутствие посторонних лиц в ходе проведения аттестационных испытаний без разрешения ректора или проректора не допускается (за исключением работников университета, выполняющих контролирующие функции в соответствии со своими должностными обязанностями). В случае отсутствия ведущего преподавателя аттестационные испытания проводятся преподавателем, назначенным письменным распоряжением по кафедре (структурному подразделению).

- Инвалиды и лица с ограниченными возможностями здоровья, имеющие нарушения опорно-двигательного аппарата, допускаются на аттестационные испытания в сопровождении ассистентов-сопровождающих.

- Во время аттестационных испытаний обучающиеся могут пользоваться программой учебной дисциплины, а также с разрешения преподавателя справочной и нормативной литературой, калькуляторами.

- Время подготовки ответа при сдаче зачета/экзамена в устной форме должно составлять не менее 40 минут (по желанию обучающегося ответ может быть досрочным).

Время ответа – не более 15 минут.

- При подготовке к устному экзамену экзаменуемый, как правило, ведет записи в листе устного ответа, который затем (по окончании экзамена) сдается экзаменатору.

- При проведении устного экзамена экзаменационный билет выбирает сам экзаменуемый в случайном порядке.

- Экзаменатору предоставляется право задавать обучающимся дополнительные вопросы в рамках программы дисциплины текущего семестра, а также, помимо теоретических вопросов, давать задачи, которые изучались на практических занятиях.

- Оценка результатов устного аттестационного испытания объявляется обучающимся в день его проведения. При проведении письменных аттестационных испытаний или компьютерного тестирования – в день их проведения или не позднее следующего рабочего дня после их проведения.

- Результаты выполнения аттестационных испытаний, проводимых в письменной форме, форме итоговой контрольной работы или компьютерного тестирования, должны быть объявлены обучающимся и выставлены в зачётные книжки не позднее следующего рабочего дня после их проведения.

4. Методические материалы, определяющие процедуры оценивания результатов освоения образовательной программы

Перечень оценочных средств

№	Наименование оценочного средства	Краткая характеристика оценочного средства	Представление оценочного средства в фонде
1.	Коллоквиум	Средство контроля усвоения учебного материала темы, раздела или разделов дисциплины, организованное как учебное занятие в виде собеседования преподавателя с обучающимися.	Вопросы по темам/разделам дисциплины

2.	Задача (практическое задание)	Средство оценки умения применять полученные теоретические знания в практической ситуации. Задача (задание) должна быть направлена на оценивание тех компетенций, которые подлежат освоению в данной дисциплине, должна содержать четкую инструкцию по выполнению или алгоритм действий.	Комплект задач и заданий.
3.	Контрольная работа	Средство проверки умений применять полученные знания для решения задач определенного типа по теме или разделу	Комплект контрольных заданий по вариантам
4.	Тест	Система стандартизированных заданий, позволяющая автоматизировать процедуру измерения уровня знаний и умений обучающегося.	Фонд тестовых заданий

Перечень контрольных заданий и иных материалов, необходимых для оценки знаний, умений, навыков и опыта деятельности

Оценочные материалы для текущего контроля
Оценочные материалы для устного опроса (контролируемая компетенция УК-4)

I. Прочитайте, обращая внимание на произношение звуков:

a)	th	[θ]	mathematics, mathematician, mathematical, theory, theoretical, arithmetic, both, earth, thank, think, thin, thing, three, thirsty, Thursday
		[ð]	the furthest, further, father, mother, brother, either, weather, they, this, that, these, those, there, to-gather, then, with, other, rather.
	s, z	[s]	analysis, system, rigorous, philosopher, discipline, subatomic, serious, simultaneously, most, seem
		[z]	zero, zebra, zone, dizzy, lazy, zenith, zip, zoo, his, has, breeze, freeze, busy, easy, summarize

b) measure ['meʒə], measurable ['meʒ(ə)rəbl], quantity ['kwɔntətɪ], equation [ɪ'kweɪʒ(ə)n], equivalence [ɪ'kwɪv(ə)lən(t)s], particle ['pɑːtɪkl], pre- diction [prɪ'dɪkʃ(ə)n], fibre ['faɪbə], image ['ɪmɪʤ], particularly [pə'tɪkjələlɪ],
,behavior [bɪ'heɪvjər], subatomic [ˌsʌbə'tɔmɪk], multiple ['mʌltɪpl].

II. Прочитайте следующие интернациональные слова и скажите, какие русские слова помогли понять их значение:
analysis, system, philosopher, phenomenon, discipline, physicists, trajectory, theory, theoretical,

optic.

III. Ознакомьтесь с терминами текста:

algebra ['ældʒɪbrə] 1) алгебра; 2) учебник алгебры; analysis [ə'næləsɪs] 1) анализ, изучение, исследование; applied [ə'plaɪd] практический, прикладной;
arithmetic 1. [ə'rɪθmətɪk] 1) арифметика; счёт 2) учебник арифме- тики 2. [ˌærɪθ'metɪk]; = arithmetical
calculate ['kælkjuleɪt] 1) вычислять; подсчитывать; калькулировать; calculus I ['kælkjuləs] исчисление (differential calculus – диффе-
ренциальное исчисление; integral calculus – интегральное исчисление) complex 1. ['kɔmpleks] 1) комплексный, смешанный, составной;
2) трудноразрешимый, сложный; запутанный;
compute [kəm'pjuːt] 1. 1) считать, подсчитывать; вычислять, де- лать выкладки Syn: reckon; 2) работать на компьютере, использовать компьютер;
equation [ɪ'kweɪʒ(ə)n] 1) выравнивание; стабилизация; 2) уравне- ние; равенство; equivalence [ɪ'kwɪv(ə)lən(t)s] = equivalency 1) эквивалентность, равноценность; паритет, равнозначность, равносильность;
geometry [ʤɪ'ɔmɪtrɪ], ['ʤɔmɪtrɪ] геометрия;
gravity ['grævɪtɪ] тяжесть; сила тяжести; тяготение; interaction [ˌɪntər'ækʃ(ə)n] взаимодействие; invention [ɪn'venʃ(ə)n] изобретение;
mathematics [ˌmæθ(ə)'mætɪks] 1) математика – elementary mathe- matics – higher mathematics 2) расчёт, вычисления в обоснование (чего-л.)
measure ['meʒə] 1. 1) мера; единица измерения
notion ['nəuʃ(ə)n] 1) а) идея, представление, понятие, знание; number ['nʌmbə] 1. 1) число; сумма, цифра;
phenomenon [fɪ'nɔmɪnən]; phenomena 1) событие, феномен, явление; quantity ['kwɔntətɪ] 1) количество; численность, число; 2) (quantities) большое количество; 3) величина; размер;
relativity [ˌrelə'tɪvətɪ] 1) относительность; 2) теория относительности; rigorous ['rɪg(ə)rəs] точный (rigorous scientific method – точный
научный метод);
summarize ['sʌm(ə)raɪz] суммировать, резюмировать, подводить итог; system ['sɪstəm] 1) система, устройство; строй 2) а) система, спо-
соб, метод б) система; совокупность идей, принципов 3) система, клас- сификация;
technology [tek'nɔləʤɪ] 1) техника; технические и прикладные науки 2) технология; terminology [ˌtɜːmɪ'nɔləʤɪ] терминология; trajectory [trə'ʤekt(ə)rɪ] 1)
траектория.

IV. Прочитайте и переведите текст:

MATHEMATICS

Mathematics a way of describing relationships between numbers and other measurable quantities can express simple equations as well as interactions among the smallest particles and the farthest objects in the known Universe. Mathematics allows scientists to communicate ideas using universally accepted terminology. It is truly the language of science.

We benefit from the results of mathematical research every day. The fiber-optic network carrying our telephone conversations was designed with the help of mathematics. Our computers are the result of millions of hours of mathematical analysis. Weather prediction, the design of fuel-efficient automobiles and airplanes, traffic control, and medical imaging all depend upon mathematical analysis.

For the most part, mathematics remains behind the scenes. We use the end results without really thinking about the complexity underlying the technology in our lives. But the phenomenal advances in technology over the last 100 years parallel the rise of mathematics as an independent scientific discipline.

Until the 17th century, arithmetic, algebra, and geometry were the only mathematical disciplines, and mathematics was virtually indistinguishable from science and philosophy. Developed by the ancient Greeks, these systems for investigating the world were preserved by Islamic scholars and passed on by Christian monks during the Middle Ages. Mathematics finally became a field in its own right with the development of calculus by English mathematician Isaac Newton and German philosopher and mathematician Gottfried Wilhelm Leibniz during the 17th century and the creation of rigorous mathematical analysis during the 18th century by French mathematician Augustin Louis Cauchy and his contemporaries. Until the late 19th century, however, mathematics was used mainly by physicists, chemists, and engineers.

At the end of the 1800s, scientific researchers began probing the limits of observation, investigating the parts of the atom and the nature of light. Scientists discovered the electron in 1897. They had learned that light consisted of electromagnetic waves in the 1860s, but physicist Albert Einstein showed in 1905 that light could also behave as particles. These discoveries, along with inquiries into the wavelike nature of matter, led in turn to the rise of theoretical physics and to the creation of complex mathematical models that demonstrated physical laws. Einstein mathematically demonstrated the equivalence of mass and energy, summarized by the famous equation E=mc2, in his special theory of relativity in 1905. Later, Einstein's general theory of relativity (1915) extended special relativity to accelerated systems and showed gravity to be an effect of acceleration. These mathematical models marked the creation of modern physics. Their success in predicting new physical phenomena, such as black holes and antimatter, led to an explosion of mathematical analysis. Areas in pure mathematics – that is, theory as op- posed to applied, or practical, mathematics – became particularly active.

A similar explosion of activity began in applied mathematics after the invention of the electronic computer, the ENIAC (Electronic Numerical Integrator and Calculator), in 1946. Initially built to calculate the trajectory of artillery shells, ENIAC was later used for nuclear weapons research, weather prediction, and wind-tunnel design. Computers aided the development of efficient numerical methods for solving complex mathematical systems.

Without mathematics to describe physical phenomena, we might be living in a world with beautiful art, literature, and philosophy, but no technology. Even the medical advances of the last 50 years might not have occurred. Science and technology, in their turn, have provided many of the problems that motivated progress in mathematics. Such problems include the behavior of weather systems, the motion of subatomic particles, and the creation of speedier and smaller computers that can perform multiple tasks simultaneously.

Notes:

The Middle Ages – средние века

Islamic scholars – исламистские учёные Christian monks –
христианские монахи

Mathematics finally became a field in its own right=Mathematics finally became an independent scientific discipline.

V. a) Прочитайте, переведите и запомните следующие выражения: Numbers and other measurable quantities; equations as well as inter- actions; to communicate ideas; universally accepted terminology; to benefit from the results; to depend upon analysis; weather prediction; traffic control; to remain behind the scenes; complexity underlying the technology; phenomenal advances in technology; virtually indistinguishable; systems for investigating the world; the Middle Ages; to become a field in its own right; the creation of rigorous mathematical analysis; contemporary; light consists of electromagnetic waves; light can also behave as particles; to lead; in turn; theory of relativity; efficient numerical methods; to provide.

b) Найдите в тексте английские эквиваленты следующих слов и словосочетаний:
Способ выражения отношений; оптоволоконная сеть; быть сконструированным; в большинстве случаев; независимая научная дисциплина; быть сохранённым; древние греки; исламистские учёные; христианские монахи; пределы результатов научных наблюдений; волновая природа материи; создание сложных математических моделей; равнозначность массы и энергии; обозначили создание современной физики; успех в предсказании; физические явления; чёрные дыры и антиматерия; подобный всплеск активности; исследования ядерного оружия; развитие эффективных числовых методов; успех медицины; служить причиной прогресса в математике.

VI. Просмотрите текст ещё раз. Ответьте на вопросы и выполните задания, используя информацию текста.

1. What do you know about mathematics?
2. What do we benefit from the results of mathematical research every day?
3. What do you know about the history of mathematics?
4. When did mathematics become a field in its own right?
5. What do you know about scientific research in the end of 18th and beginning of the 19th centuries?
6. Name several well-known mathematicians and say what they are famous for.
7. What role does the invention of a computer play in science?
8. Science, technology and mathematics. What can you say about their interplay in modern life?

VII. Найдите в тексте фразы, завершающие предложения:

1. Mathematics is a way of describing___________.
2. Mathematics can express simple equations as well as _______________________________.
3. Mathematics allows scientists to communicate ideas _________________.
4. Areas in pure mathematics – that is,_________.
5. Without mathematicsto describe physical phenomena, _______________.

VIII. Заполните таблицу однокоренными словами. Используйте для справки таблицу словообразования из Приложения:

noun	verb	adjective	adverb
mathematics	–		
	–	phenomenal	
	compute		–
science	–		
	symbolize		
equivalence			
			relatively
universe			
	investigate		–

nature	–		
		observable	–

X. Запомните следующие выражения и используйте их в своих предложениях:
As well as – так же, как
Benefit from – извлекать пользу (выгоду) из…
With the help of – при помощи чего-либо Depend upon – зависеть от…
For the most part – главным образом
Remain behind the scenes – оставаться в тени (за кулисами)
Pass on – передавать дальше (выносить решение)
In (smb's) turn – в свою очередь

X. Составьте пары или группы близких по значению слов из перечня слов, приведённых ниже:
синонимы: numbers, area, creation, investigating, measurable quantities, practical, communicate, advance, calculate, scholars, invention, applied, probing, scientific researchers, progress, field, pass on, compute.
Составьте пары или группы противоположных по значению слов из перечня слов, приведённых ниже:
антонимы: special, applied mathematics, initially, ancient, general, multiple, complex, modern, the only, simple, pure mathematics.

XI. Прочитайте и переведите следующие «цепочки существительных»:
Weather prediction, telephone conversation, traffic control, end result, artillery shell, nuclear weapons research, wind-tunnel design.

XII. Выберите одну из тем для обсуждения в классе:
1. The role of mathematics in the development of technology and in a history of the mankind.
2. Why I want to be a mathematician (My future profession).

В результате устного опроса знания обучающегося оцениваются по следующей шкале:

2 балла, ставится, если обучающийся:
1) полно излагает изученный материал, правильно использует пройденный лексический и грамматический материал
2) обнаруживает понимание материала, может обосновать свои суждения, применить знания на практике, привести необходимые примеры не только по учебнику, но и самостоятельно составленные;
3) излагает материал последовательно и правильно с точки зрения норм литературного языка.

1,5 балла, ставится, если обучающийся даёт ответ, удовлетворяющий тем же требованиям, что и для балла «1», но допускает 1-2 ошибки, которые сам же исправляет, и 1-2 недочёта в последовательности и языковом оформлении излагаемого.

1 балл, ставится, если обучающийся обнаруживает знание и понимание основных положений данной темы, но:
1) излагает материал неполно и допускает неточности;
2) не умеет достаточно глубоко и доказательно обосновать свои суждения и привести свои примеры;
3) излагает материал непоследовательно и допускает ошибки в языковом оформлении излагаемого.

0 баллов, ставится, если обучающийся обнаруживает незнание большей части соответствующего раздела изучаемого материала, допускает ошибки в формулировке.

Баллы «2», «1.5», «1» могут ставиться не только за единовременный ответ, но и за сумму ответов, данных студентом на протяжении занятия

Оценочные материалы для самостоятельной работы обучающегося (контролируемая компетенция УК-4)

I. Прочитайте, обращая внимание на произношение звуков:

a)	-sure, – sion, – ge	[ʒ]	pleasure, measure, treasure, leisure, vision, revision, erasure, television, beige, rouge, mi- rage, garage
		[ʤ]	age, judge, arrange, bridge, edge, large, page, manage, stage, pigeon, ledger, major, danger, subject, stranger
	t, d	[t]	time, town, what, late, twelve, temptation, twenty, after, between, port, passed, asked
		[d]	read, road, side, old, ready, already, head, idea, date, data, ready, body, study, lived, waited
	Silent t	–	christen, chestnut, listen, Christmas, glisten, exactly, castle, soften, wrestle, mustn’t, whistle, cabaret, ballet
	Silent d	–	handsome, handkerchief, handcuff, grand- mother, grandfather, Wednesday

b) measurable ['meʒ(ə)rəbl], wedge-shaped ['weʤʃeɪpt], religious [rɪ'lɪʤəs], knowledge ['nɔlɪʤ], geometry [ʤɪ'ɔmɪtrɪ], ['ʤɔmɪtrɪ], merchan- dise ['mɜːʧ(ə)ndaɪz], well-preserved [ˌwelprɪ'zɜːvd], calendar ['kælɪndə], ['kæləndə], antiquity [æn'tɪkwətɪ], certainly ['sɜːt(ə)nlɪ], quantity ['kwɔntətɪ]

II. Найдите значения слов, выделенных курсивом, в словаре и переведите предложения на русский язык.

1. *Evidence* cannot be hidden. 2. The plain *evidence* of facts is superior to all declarations. 3. The lawyer produced conclusive *evidence* that the accused could not have been at the scene of the crime. 4. His behaviour abundantly *evidences* it. 5. The value of Y depends on X. 6. Whether the game will be played *depends* on the weather. 7. His decision will *depend* on how soon he meets the committee. 8. I knew I could *depend* on you. 9. It (all) *depends*.

III. Ознакомьтесь с терминами текста:

allocate ['æləkeɪt] 1) назначать; ассигновать; 2) распределять, раз- мещать 3) закреплять; локализовывать

clay tablet – глиняная табличка

commerce 1. ['kɔmɜːs] 1) (оптовая) торговля; коммерция cuneiform ['kjuːnɪfɔːm] 1.

клинообразный Syn: wedge-shaped;
2. 1) клинообразный знак (в ассирийских надписях); 2) клинопись

date I [deɪt] (date back / from) датироваться, восходить к опреде- лённой эпохе, существовать с такого-то времени

dominate ['dɔmɪneɪt] 1) управлять, контролировать, господствовать, преобладать, доминировать

early ['ɜːlɪ] human ['hjuːmən] – первобытные люди

enormous [ɪ'nɔːməs] 1) громадный; гигантский, обширный, огромный

evidence ['evɪd(ə)n(t)s] 1. 1) ясность, наглядность, очевидность; 2) основание; знак, признак, симптом; факты, данные; 3) доказательство, подтверждение; свидетельство

exchange [ɪks'ʧeɪnʤ], [eks-] 1) обмен; мена | обменивать; менять; 2) размен (денег) | разменивать (деньги)

henceforth [ˌhen(t)s'fɔːθ] с этого времени, впредь herd [hɜːd] 1. 1) а) стадо; гурт; 2) толпа

involve [ɪn'vɔlv] 1) а) привлекать, вовлекать, втягивать, включать в себя; влечь за собой

predominance [prɪ'dɔmɪnən(t)s] господство, доминирование, превалирование, превосходство, преобладание

reckon ['rek(ə)n] 1) а) = reckon up считать, подсчитывать, вычислять share I [ʃɛə] 1. 1) доля, часть; квота

to keep track of smb. – следить за кем-л., чем-л.

IV. Прочитайте и переведите текст:

THE HISTORY OF MATHEMATICS

Mathematics is a science dealing with numbers and other measurable quantities. Counting was the earliest mathematical activity. Early humans needed counts to keep track of herds and for trade. Primitive counting systems almost certainly used the fingers of one or both hands, as evidenced by the predominance of the numbers 5 and 10 as the bases for most number systems today.

The Babylonians of ancient Mesopotamia and the ancient Egyptians left the earliest records of organized mathematics. Arithmetic dominated their mathematics. Our knowledge of Babylonia comes from well-preserved clay tablets on which people wrote with wedge-shaped marks known as cuneiform. The earliest tablets date from about 3000 BC.

Much of the mathematics on the tablets involved commerce. The Babylonians used arithmetic and simple algebra to exchange money and merchandise, compute simple and compound interest, calculate taxes, and allocate shares of a harvest to the state, temple, and farmer. The building of canals, granaries, and other public works also required using arithmetic and geometry. Calendar reckoning, used to determine the times for planting and for religious events, was another important application of mathematics.

Thales of Miletus and Pythagoras of Sámos, the philosopher Democritus and the mathematician Hippocrates of Chios, Eudoxus of Cnidus, Euclid – they come from ancient Greece. The great Alexandrian mathematicians – Eratosthenes, Archimedes, Apollonius of Perga, Ptolemy, Diophantus, and Hipparchus, Hindu mathematician and astronomer Aryabhata, Arab mathematician al-Khwārizmī, Persian mathematician Omar Khayyam were the most famous mathematicians of antiquity.

Russian mathematics was represented by Nikolay Lobachevsky. Credit for the creation of non-Euclidean geometry is given to him and Hungarian mathematician János Bolyai. Each man published an organized presentation of a geometry that allows an infinite number of parallel lines through a given point. Non-Euclidean geometry was the most impressive intellectual creation of the 19th century.

It showed that mathematics could no longer be regarded as a body of unquestionable truths and that the observable world could not provide all the answers. Mathematicians were henceforth liberated to explore whatever ideas attracted them, and they turned more and more toward abstraction and theory. Individual mathematicians felt free to define their notions and to set up their axioms as they pleased, subject only to the limitation that the axioms do not give rise to theorems that contradict one another. The enormous expansion in mathematical activity in the 20th century was largely the con- sequence of this new freedom.

Notes:

Babylonians [ˌbæbɪ'ləunɪən] – Вавилоняне Egyptians [ɪ'ʤɪpʃ(ə)n], [ə-], [iː-] – Египтяне Hungarian [hʌŋ'gɛərɪən] – Венгерский

Mesopotamia [ˌmesəpə'teɪmɪə] – Месопотамия

Greece [griːs] – Греция

B.C. (Before Christ [kraɪst]) – до нашей эры

V. a) Прочитайте, переведите и запомните следующие выражения: Early humans; to keep track of herds and for trade; primitive counting systems; as evidenced by the predominance of the numbers 5 and 10; as the bases for most number systems today; further progress; were emphasized; with no trace of concepts such as axioms or proofs; our knowledge of Babylonia comes from/date from; credit is given to him; impressive intellectual creation; to be regarded as; a body of unquestionable truths.

b) Найдите в тексте английские эквиваленты следующих слов и словосочетаний:

Обменивать деньги и торговать; подсчитывать простые и сложные проценты; подсчитывать налоги; распределять доли урожая между государством, храмом и фермером; зернохранилище; общественные работы; нуждаться в чём-то; вычисления по календарю; определять время для посадки растений и религиозных событий; рассматриваться как свод неоспоримых истин; были в последствии свободны исследовать любые идеи, которые их привлекали; были в большей степени следствием.

VI. Просмотрите текст ещё раз. Ответьте на вопросы и выполните задания, используя информацию текста.

1. What is mathematics?
2. When did mathematical thought appear?
3. What were the earliest applications and records of organized mathematics?
4. Could you name the most famous ancient mathematicians?
5. Do you know any Russian mathematician of the 18th–19th century? What was she/he famous for?
6. What were the consequences of non-Euclidean geometry creation?

VII. Поставьте вопросы к выделенным словам.

1. The Babylonians inherited the technical achievements of the *Sumerians in irrigation and agriculture. (3)*

2. Non-Euclidean geometry was *the most impressive intellectual* creation of the *19th century*. (2)

3. Preparation of *maps, surveys, and plans* involved *the use of* leveling instruments and measuring rods. (2)

4. Much of the mathematics on *the tablets* involved *commerce*. (3)

5. Our knowledge of Babylonia comes from *well-preserved clay tab- lets* on which people wrote with *wedge-shaped marks* known as *cuneiform*.(4)

VIII. Раскройте скобки и поставьте глаголы в нужную видовременную форму.

When I_______(to begin) planning Robin's home school curriculum, it__(to make) sense to combine art and math, and to do hands- on projects for all subjects wherever possible.

Robin still_____(to do) math problems in traditional workbooks. But we also_ __________________(to use) a book called Family Math, which______(to have) fun, big-picture math exercises that get off the page and into the real world.

There's a wonderful book called Mathographics, by Robert Dixon, that we___(not start) using yet, but that I think____________________(to fascinate) Robin. It___ ____________(to explore) the possibilities of mathematical drawing using a compass or computer graphics.

«In addition to the more usual activities of doing sums, solving equations, and proving theorems, mathematics can also be about doing drawings», the author____(to write) in the preface.

IX. Составьте на русском языке аннотацию к тексту урока. Обратите внимание на то, что стиль аннотаций, как правило, имеет без- личностный характер. Выберите и используйте при работе некоторые из следующих клише:

X.

Статья (текст) посвящена проблеме/ вопросу ...
В начале статьи речь идет о ...;
дается определение...; обосновывается
значимость ...; привлекается внимание к ...
Далее описывается...; рассказывается...;
рассматривается...; излагается ...
В частности, отмечается, например, ...;
подробно излагается...; описывается схема...;
указывается ...; доказывается мысль...
Наконец раскрывается...
В заключение приводятся примеры

XI. Переведите предложения на английский язык:

1. Математика (от греческого mathema – знание, учение, наука), наука о количественных отношениях и пространственных формах окружающего нас мира. 2. Понимание самостоятельного положения математики как особой науки возникло в Древней Греции в 6–5 вв. до нашей эры. 3. Математика объединяет комплекс дисциплин: арифметику (теорию чисел), алгебру, геометрию, математический анализ (дифференциальное исчисление и интегральное исчисление), теорию мно- жеств, теорию вероятностей и многое другое. 4. Математика характеризуется: а) высокой степенью абстрактности ее понятий (точки – без размеров, линии – без толщины, множества любых предметов и т.п).
5. В алгебре буква обозначает любое число. 6. В математической логике рассматриваются произвольные высказывания. 7. Абстрактность и общность понятий математики позволяют один и тот же математический аппарат применять в различных науках.

XII. Выберите одну из тем для обсуждения в классе:

1. The history of mathematics.
2. Tell the biography of the most prominent (from your point of view) mathematician.

В результате устного опроса знания обучающегося оцениваются по следующей шкале:

2 балла, ставится, если обучающийся:

4) полно излагает изученный материал, правильно использует пройденный лексический и грамматический материал
5) обнаруживает понимание материала, может обосновать свои суждения, применить знания на практике, привести необходимые примеры не только по учебнику, но и самостоятельно составленные;
6) излагает материал последовательно и правильно с точки зрения норм литературного языка.

1,5 балла, ставится, если обучающийся даёт ответ, удовлетворяющий тем же требованиям, что и для балла «1», но допускает 1-2 ошибки, которые сам же исправляет, и 1-2 недочёта в последовательности и языковом оформлении излагаемого.

1 балл, ставится, если обучающийся обнаруживает знание и понимание основных положений данной темы, но:

4) излагает материал неполно и допускает неточности;
5) не умеет достаточно глубоко и доказательно обосновать свои суждения и привести свои примеры;
6) излагает материал непоследовательно и допускает ошибки в языковом оформлении излагаемого.

0 баллов, ставится, если обучающийся обнаруживает незнание большей части соответствующего раздела изучаемого материала, допускает ошибки в формулировке.

Баллы «2», «1.5», «1» могут ставиться не только за единовременный ответ, но и за сумму ответов, данных студентом на протяжении занятия

3.1.3. Типовые оценочные материалы для выполнения эссе по дисциплине «Иностранный язык» (английский) (контролируемая компетенция УК-4)

Темы для эссе

1. Приметы и суеверия Великобритании и России.
2. Животные в английских пословицах и поговорках и их русские эквиваленты.
3. Влияние группы "Битлз" на музыку 20 века.
4. Самые известные изобретения британцев.
5. Удивительные праздники.
6. Начальная школа в Британии.
7. Одежда: мода и традиция.
8. Роль английского языка в современном мире.
9. Влияние британской культуры на российское общество.
10. Пути изучения английского языка с помощью Интернет.

Критерии оценки эссе

«отлично» (5 баллов) ставится, если обучающийся проявил инициативу, творческий подход, способность к выполнению сложных заданий, организационные способности. Отмечается способность к публичной коммуникации. Документация представлена в срок. Полностью оформлена в соответствии с требованиями

«хорошо» (4 балла) – обучающийся достаточно полно, но без инициативы и творческих находок выполнил возложенные на него задачи. Документация представлена достаточно полно и в срок, но с некоторыми недоработками.

«удовлетворительно» (3 балла) – обучающийся выполнил большую часть возложенной на него работы. Допущены существенные отступления. Документация сдана со значительным опозданием (более недели). Отсутствуют отдельные фрагменты.

«неудовлетворительно» (менее 2 баллов) – обучающийся не выполнил свои задачи или выполнил лишь отдельные несущественные поручения. Документация не сдана.

Методические указания по подготовке к контрольным, проверочным и самостоятельным работам

В процессе подготовки к контрольной (самостоятельной, проверочной) работе необходимо:

1) изучить методические рекомендации по работе с материалом учебника;
2) проработать грамматический и лексический материал уроков;
3) выполнить упражнения, относящиеся к грамматическому и лексическому материалу уроков;
4) выполнить упражнения по развитию навыков устной речи.

Оценочные материалы для аудирования (контролируемая компетенция УК-4)

1. Can you understand these people in the street?

Listen to five people (Justin Joanna Sarah Jane David Andy)and answer the questions.

1 Justin .
a looks like his mother
b looks like his father
c doesn't look like his father or his mother

2 Joanna's favourite painting is of .
aa landscape
b a person
c an animal

3 Sarah Jane's last holiday was a holiday.
a beach
b walking
c sightseeing

4 David .
a takes a lot of photos
b is in a lot of photos
c has a lot of photos on his phone

5 Andy says .
a he enjoys crying at the end of a film
b he thinks films with a sad ending are more realistic
c most of his favourite films have a sad ending

2. You are going to listen to Mia and Linda talking about the holidays.
a First listen to Mia. Does she agree with Joe about the holiday?
b Listen again. What does Mia say about... ?

1 her relationship with Joe before they went
2 the places where they stayed
3 talking to other travellers
4 photos
5 going on holiday with a boyfriend

c Now listen to Linda. What's her opinion of the holiday?
Then listen again. What does she say about... ?

1 Venice
2 what they did there
3 the cost of her holiday
4 hernextholiday

Требования к аудированию

Аудирование с полным пониманием содержания осуществляется на несложных текстах, построенных на полностью знакомом учащимся языковом материале. Время звучания текстов для аудирования — до 1 мин.

Аудирование с пониманием основного содержания текста осуществляется на аутентичном материале, содержащем наряду с изученными и некоторое количество незнакомых языковых явлений. Время звучания текстов для аудирования – до 2 мин.

Аудирование с выборочным пониманием нужной или интересующей информации предполагает умение выделить значимую информацию в одном или нескольких аутентичных коротких текстах прагматического характера, опуская избыточную информацию. Время звучания текстов для аудирования — до 3 мин.

Критерии оценивания аудирования:

«Отлично»

- Студент детально понимает содержание аудиотекста;
- Умеет выделять значимую/запрашиваемую информацию;
- Справляется со всеми установочными заданиями.

«Хорошо»

- Студент понимает содержание аудиотекста;
- Умеет выделять значимую/запрашиваемую информацию;
- Справляется с 2/3 заданий;
- Допускает не более 1-2 смысловых ошибок (искажение, опущение, добавление информации) при ответе на вопросы к прослушанному тексту (10 вопросов).

«Удовлетворительно»

- Студент слабо понимает основное содержание аудиотекста, справляется не менее чем с 1/2 заданий;
- Слабо выделяет значимую/запрашиваемую информацию;
- Допускает не более 4 смысловых ошибок (искажение, опущение, добавление информации) при ответе на вопросы к прослушанному тексту (10 вопросов).
- «Неудовлетворительно»
- Студент не понимает содержания аудиотекста, справляется менее чем с 1/2 заданий.

Оценочные материалы для коллоквиума (контролируемая компетенция УК-4)

1 семестр
Коллоквиум № 1

1.Переведите следующие слова с русского на английский язык:

addition [ə'dɪʃ(ə)n] 1) добавление, дополнение; прибавление, при- соединение, увеличение; 2) сложение

basic ['beɪsɪk] 1) составляющий основу, сущность, фундамен- тальный; базисный, главный, основной

branch [brɑːnʧ] 1) отделение, филиал, ответвление; 2) отрасль (промышленности, науки и т.п.)

count I [kaunt] 1. 1) вычисление, подсчёт

decimal ['desɪm(ə)l] 1. десятичный decimal numeration – десятич- ная система счисления decimal fraction – десятичная дробь decimal no- tation – обозначение арабскими цифрами decimal coinage – десятичная монетная система decimal point – точка в десятичной дроби, отделяю- щая целое от дроби; 2. десятичная дробь recurring decimal – периоди- ческая десятичная дробь

divide [dɪ'vaɪd] 1. 1) (divide into) = divide up а) делить (на не- сколько частей, групп), разделять

division [dɪ'vɪʒ(ə)n] 1) деление, разделение (чего-л. на части); распределение (чего-л. между группами или лицами)

encompass [ɪn'kʌmpəs], [en-] 1) окружать; заключать; 2) выпол- нять, осуществлять

fraction ['frækʃ(ə)n] 1) дробь to reduce a fraction – сокращать дробь common fraction; simple fraction; vulgar fraction – простая дробь complex fraction; compound fraction – составная дробь decimal fraction – десятичная дробь improper fraction – неправильная дробь irreducible fraction – несократимая дробь proper fraction – правильная дробь;

2) а) доля, порция, часть

integer ['ɪntɪʤə] 1) целое, нечто целое; 2) целое число

manipulate [mə'nɪpjəleɪt] 1) манипулировать; умело обращаться; умело управлять (чем-л.); 2) подтасовывать (факты, цифры)

multiplication [ˌmʌltɪplɪ'keɪʃ(ə)n] 1) умножение – multiplication ta- ble; 2) размножение, разведение (животных и растений); 3) увеличение

negative ['negətɪv] 1. 1) а) отрицательный, негативный

position [pə'zɪʃ(ə)n] 1. 1) а) положение, местоположение; место; позиция, расположение

sequence ['siːkwən(t)s] 1) последовательность; ряд; очерёдность, порядок (следования)

subsequent ['sʌbsɪkwənt] 1) более поздний, последующий, сле- дующий; 2) являющийся результатом

subtraction [səb'trækʃ(ə)n] 1) вычитание to do subtraction – вычи- тать; 2) отнятие, удаление

unit ['juːnɪt] 1) а) единица Syn: unity; б) единица измерения

zero ['zɪərəu] 1. zeroes, zeros 1) нуль, ноль (название числа или условной точки на числовой оси, шкале)

2. Прочитайте, переведите и перескажите текст:

ARITHMETIC

Arithmetic is a branch of mathematics that arises from counting, the most basic mathematical operation. Arithmetic encompasses various ways of counting, or manipulating numbers: addition, subtraction, multiplication, and division. The ancient Greek word arithmētikē combined the words arithmos, meaning «number», and technē, referring to an art or skill. Thus, arithmetic means the art of numbers. The numbers used in arithmetic may be positive integers (whole numbers), negative integers, fractions, or deci- mals for the history of arithmetic and mathematics.

Different civilizations throughout history have developed different kinds of number systems. Although the ancient Babylonians used a system based on the number 60, all modern cultures employ a system in which ob- jects are counted in groups of ten, probably because humans have ten fin- gers and tend to use them in counting. This system is called the decimal or base 10 system.

We generally count with positive integers. This unending sequence of whole numbers starts with 1. Each subsequent number in the sequence is one more than the number before: 1, 2, 3, 4 …. Alternating numbers starting with 1 (1, 3, 5 …) are called odd numbers, while every other number start- ing with 2 (2, 4, 6 …) is called an even number.

In numbers with two or more digits, every digit has a so-called place value. In the

decimal system, the place value increases from units, or ones, to tens, hundreds, thousands, and higher as the number of digits increases from right to left. We can also say that each place increases by a power of 10. A power of a number is the number of times the number is multiplied by itself. In the number 1,111, for example, the place value on the far right is a unit or ones value; the place value just to its left is 10 (1 × 10); the next one to the left is 10 × 10, or 100; and the place value on the far left is 10 × 10 × 10, or 1,000.
The number 2,534, then, is equivalent to (2 × 1,000) + (5 × 100) + (3 × 10) + (4 × 1). Note that each period of digits is separated by a comma.

Let's look at how we use the numeral "0". Arab and Indian scholars were the first to use zero to develop the place-value number system that we use today. When we write a number, we use only the ten numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. These numerals can stand for ones, tens, hundreds, or whatever depending on their position in the number. In order for this to work, we have to have a way to mark an empty place in a number, or the place values won't come out right. This is what the numeral «0» does. Think of it as an empty container, signifying that that place is empty. For example, the number 302 has 3 hundreds, no tens, and 2 ones.

So is zero a number? Well, that is a matter of definition. The number zero obeys most of the same rules of arithmetic that ordinary numbers do, so we call it a number. It is a rather special number, though, because it doesn't quite obey all the same laws as other numbers – you can't divide by zero, for example. In the strict axiomatic field development of the real num- bers both 0 and 1 are singled out for special treatment. Zero is the additive identity, because adding zero to a number doesn’t change the number. Simi- larly, 1 is the multiplicative identity because multiplying a number by 1 doesn’t change it.

3. Ответьте на вопросы, используя информацию текста:

1. What is arithmetic?
2. What was the origin of this word?
3. What number systems do you know?
4. What do we usually count with?
5. What do you know about the place-value system? How does it work?
6. What is zero? Is it a number? Is zero nothing, or is it something?
7. Why are numbers 0 and 1 singled out for special treatment?

1 семестр
Коллоквиум № 2

1.Переведите следующие слова с русского на английский язык:

amount [ə'maunt] 1. 1) величина, количество

arrange [ə'reɪnʤ] 1) приводить в порядок; расставлять 2) класси- фицировать, систематизировать; располагать в определённом порядке, последовательности

arrow ['ærəu] 1. 1) стрела 2) стрелка (на схемах или чертежах); стрелка-указатель

considered [kən'sɪdəd] обоснованный, продуманный

definition [ˌdefɪ'nɪʃ(ə)n] 1) определение, формулирование (про- цесс); дефиниция, формулировка

denominator [dɪ'nɔmɪneɪtə] 1) знаменатель 2) общий знаменатель, сходные характеристики

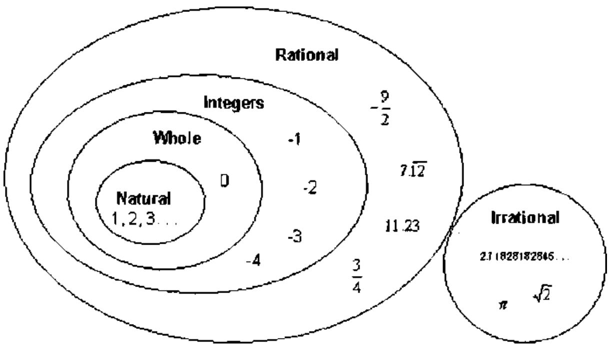
depend [dɪ'pend] 1) зависеть, находиться в зависимости (от кого-л./ чего-л.)

forever [fə'revə] 1. ; = for ever 1) навсегда, навечно
indicate ['ɪndɪkeɪt] 1) показывать, указывать 2) служить призна-ком; означать
infinite ['ɪnfɪnət], ['ɪnfɪnɪt] 1) бесконечный, безграничный 2) ог- ромный, очень большой 3) несметный, бесчисленный
notation [nəu'teɪʃ(ə)n] 1) а) нотация (изображение условными зна- ками, цифрами, буквами); б) условные знаки, условный алфавит (при- меняемые для выражения каких-л. понятий); 2) а) записывание б) за- пись, замечание, примечание, ссылка
notion ['nəuʃ(ə)n] 1) а) идея, представление, понятие, знание numerator ['nju:m(ə)reɪtə] 1) числитель 2) вычислитель 3) нумера- тор, счётчик 4) счётчик (при переписи населения)
owe [əu] 1) быть должным (кому-л.) ; быть в долгу (перед кем-л.) own [əun] 1. 1) свой, собственный 2. собственность, принадлежность property ['prɔpətɪ] 1) а) имущество; собственность
subset ['sʌbset] ; подмножество
terminate ['tɜ:mɪneɪt] 1) а) ставить предел, ограничивать б) огра- ничиваться 2) а) кончать, завершать б) заканчиваться, завершаться
volume ['vɔlju:m] 1) а) объём, масса б) вместительность, ёмкость

1. Прочитайте, переведите и перескажите текст:

THE REAL NUMBER SYSTEM

This is a table of the real number system



The real number system evolved over time by expanding the notion of what we mean by the word «number». At first, «number» meant some- thing you could count, like how many sheep a farmer owns. These are called the natural numbers, or sometimes the counting numbers.

Natural or Counting numbers: 1, 2, 3, 4, 5, 6, ... The use of tree dots at the end of the list is a common mathematical notation to indicate that the list keeps going forever.

At some point, the idea of «zero» came to be considered as a num- ber. If the farmer does not have any sheep that the farmer owns is zero. We call the set of natural numbers plus the number zero the whole numbers.

Whole numbers: 0, 1, 2, 3, 4, 5, 6, ... (natural numbers plus zero)

Even more abstract than zero is the idea of negative numbers. If, in addition to not having any sheep, the farmer owes someone 3 sheep, you could say that the number of sheep that the farmer owns is negative 3. It took longer for the idea of negative numbers to be accepted, but eventually they came to be seen as something we could call «numbers». The strict mathematical definition goes something like that:

For every real number n, there exists its opposite, denoted –n, such that the sum of n and –n is zero, or

$$n+(-n)=0.$$

Note that the negative sign in front of the number is part of the sym- bol for that number.

The expanded set of numbers that we get by including negative ver- sions of the counting numbers is called the integers.

Integers: –4, –3, –2, –1, 0, 1, 2, 3, 4, ... (whole numbers plus negatives)

The next generalization that we can make is to include the idea of fractions. While it is unlikely that the farmer owns a fractional number of sheep, many other things in real life are measured in fractions, like a half- cup of sugar. If we add fractions to the set of integers, we get the set of ra- tional numbers.

Rational numbers: all numbers of the form a/b, where a and b are in- tegers (but b cannot be zero). Rational numbers include what we usually call fractions. Notice that the word «rational» contains the word «ratio», which should remind you of fractions. All integers can also be thought of as rational numbers, with a denominator of 1. This means that all previous sets of numbers (natural numbers, whole numbers, and integers) are subsets of the rational numbers.

Now it might seem as though the set of rational numbers would cover every possible case, but that is not so. There are numbers that cannot be expressed as a fraction, and these numbers are called irrational because they are not rational.

Irrational numbers: cannot be expressed as a ratio of integers; as decimals they never repeat or terminate (rational numbers always do one or the other).

When we put the irrational numbers together with the rational num- bers, we finally have the complete set of real numbers. Any number, that represent an amount of something, such as a weight, a volume, or a distance between two points, will always be a real number.

The real numbers have the property that they are ordered, which means that given any two different numbers we can always say that one is greater or less then the other. A more formal way of saying this is:

For any two real numbers a and b, one and only one of the following three statements is true:

a is less than b, (expressed as a<b) a is equal to b, (
expressed as a=b) a is greater than b, (expressed as
a>b)

2. Ответьте на вопросы, используя информацию текста.

1. What did the notion «number» mean at first?
2. What numbers do we call natural numbers?
3. What numbers do we call whole numbers?
4. What set of numbers is called integers?
5. What numbers do we call rational numbers?
6. What numbers do we call irrational numbers?
7. List the complete set of real numbers, can’t you?

1 семестр

Коллоквиум № 3

1.Переведите следующие слова с русского на английский язык:

align [ə'laɪn] 1) выстраивать в линию, ставить в ряд; выравнивать; 2) (align with) а) равняться на (кого-л. б) присоединяться к (какому-л. движению) , поддерживать (кого-л.);

backward ['bækwəd] 1. прошлое; 2. 1) обратный, направленный или повернутый назад;

beyond [bɪ'jɔnd] 1. далеко, вдали; на расстоянии; 2. 1) за, по ту сторону, за пределами; 2) позже; после; 3) вне; выше, сверх;

borrowing ['bɔrəuɪŋ] 1) одалживание, заимствование; 2) ссуда; за- ём; кредит;

carrying ['kærɪŋ] переноска, перевозка; провоз; транспортировка; column ['kɔləm] 1) колонна – column foot; 2) поддержка; 3) столбец, колонка, графа;

difference ['dɪf(ə)r(ə)n(t)s] 1. 1) разница; несходство; отличие, раз- личие; несовпадение; 2) разрыв, разница (между ценами, курсами); 3) разногласие, расхождение (во взглядах, мнениях); спор; ссора;

either ['aɪðə] 1. 1) любой (из двух); один из двух; тот или другой; 2) и тот и другой; оба; каждый; 2. 1) один из двух; такой или другой; тот или другой; 2) каждый, любой (из двух);

handle ['hændl] 1. 1) рукоять, рукоятка (ножа, топора, молотка); черенок, ручка (двери, инструмента); 2) удобный случай, возможность; повод, предлог; 2) а) управлять (чем-л.), справляться (с чем-л.);

however [hau'evə] 1. как бы ни; какой бы ни; 2. однако, тем не менее, несмотря на (э)то;

individually [ˌɪndɪ'vɪʤuəlɪ] 1) индивидуально; отдельно, по от- дельности; по одному; 2) лично, персонально;list [lɪst] I 1. 1) список, перечень, реестр; 2) каталог;

operation [ˌɔp(ə)'reɪʃ(ə)n] 1) а) деятельность, работа; б) действие, операция

positive ['pɔzətɪv] 1. 1) а) позитивный, реальный, прямо выражен- ный, точный; 2) положительный, позитивный;

procedure [prə'siːʤə] 1) а) процедура, порядок осуществления действия; б) методика, метод (проведения опыта, анализа); 2) процесс, операция; технологический процесс;

provide [prə'vaɪd] 1) а) (provide with) снабжать; доставлять; обес- печивать (кого-л./что-л.); б) давать, предоставлять; обеспечивать; 2) (provide for) обеспечивать средствами к существованию (кого-л.); reverse [rɪ'vɜːs] 1. 1) а) перевёртывать, переворачивать; опрокидывать; ставить с ног на голову – reverse arms; б) давать задний или обратный ход; реверсировать; 2) а) поворачиваться в противополож- ном направлении, разворачиваться; 3) изменять, менять; изменять на прямо противоположное;

row [rəu] 1. 1) а) ряд, линия; б) вереница, ряд; серия; последова- тельность;

shortcut ['ʃɔtkʌt] 1. 1) кратчайшее расстояние; путь напрямик; 2) метод, требующий наименьших затрат времени и сил (для достиже- ния какой-л. цели);

single ['sɪŋgl] 1. 1) один; единственный; 2) одиночный, одинар- ный (состоящий из одной части или предназначенный для одного);

skip I [skɪp] 1. 1) прыжок, скачок; 2) а) пропуск; обход (при чте- нии) б) то, что можно пропустить при чтении;

step [step] 1) а) шаг; б) ступень, ступенька; подножка, приступка; порог; подъём;

sum I [sʌm] 1. 1) сумма, количество; величина, итог, совокуп- ность; 2) суть, существо, сущность; 3) арифметическая задача; 4) (sums) арифметика;

total ['təut(ə)l] 1. 1) весь, целый; общий, совокупный, суммарный; 2) абсолютный, полный, совершенный; 3) всеобщий, тотальный; 2. целое, сумма; итог.

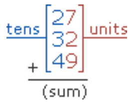
2. Прочитайте, переведите и перескажите текст:

ADDING AND SUBTRACTING POSITIVE INTEGERS

The arithmetic operation of addition is basically a means of counting quickly and is indicated by the plus sign (+). We could place 4 apples and 5 more apples in a row, then count them individually from 1 to 9. Addition, however, makes it possible to count all of the apples in a single step (4 + 5 = 9).

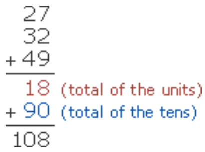
We call the end result of addition the sum or total of the numbers. The simplest sums are usually memorized. The numbers to be added are called addends.

We can easily add long lists of numbers with more than one digit by repeatedly adding one digit at a time. For example, if the numbers 27, 32, and 49 are listed in a column so that all the units are in a line, all the tens are in a line, and so on, finding their



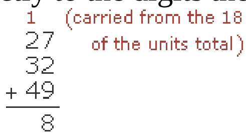
sum is relatively simple:

First add the units (7 + 2 + 9); they total 18. Then add the digits in the tens place (2 + 3 + 4); they total 9, but this means 9 tens, or 90. In the last step, add the total of the



units to the total of the tens:

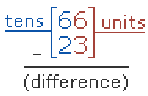
We can skip the second step, adding the sum of the units to the sum of the tens, by using a shortcut called carrying. Carry the 1 in 18, which stands for 1 ten, over to the tens column and add it directly to the digits there:



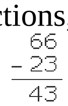
Add the digits in the tens column, including the carried 1, and place the sum, 10, just to the left of the units sum. The result is 108. Similarly, when adding numbers with three or more places, we can carry digits to the hundreds place, thousands place, or beyond.

The arithmetic operation of subtraction is the opposite of addition and is indicated by the minus sign (–). If we take 5 apples away from 9 ap- ples, subtraction tells how many apples remain without our actually count- ing them. The simple sums memorized for addition are used in reverse for subtraction. For example, the result of 9 minus 5 is 4 because 4 is the num- ber we would have to add to 5 for a sum of 9. In subtracting whole numbers, the number which is to be made smaller, or diminished is called the minuend. The number which is subtracted is called subtrahend. The end result of subtraction is called the difference.

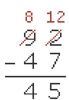
It is possible to subtract 23 from 66 by counting backward 23 inte- gers from 66, one number at a time, or by taking away 23 items from a col- lection of 66 and counting the remainder. Either way we would reach 43. The rules of arithmetic for subtraction, however, provide a much quicker method for obtaining the answer. We can subtract large numbers by repeat- edly subtracting one digit at a time. First align the numbers under one an- other, units under units, tens under tens, as in addition:



Subtract the units: 6 – 3 = 3. Then subtract the tens column: 6 – 2 = 4. The results of these two single-digit subtractions, written side by side, pro- vide the answer:



Subtraction is a bit more complicated if we need to subtract a larger digit from a smaller one. For example, when subtracting 47 from 92, the units value (7) of 47 is



greater than the units value (2) of 92. We can handle this situation using a procedure called borrowing, which is like carrying in reverse. Ten units can be borrowed from the tens column – that is, from the 9 of 92 – leaving 8 in the tens column. Bring the 10 over to the units column and add it to the 2 already there, giving 12 in that column from which 7 can then be subtracted:

Complete the subtraction by taking 4 away from 8 in the tens col- umn, which gives 4. The answer, or difference, is 45.

3. Ответьте на вопросы, используя информацию текста.

1. What is the arithmetic operation of addition?
2. What is sum?
3. How can we easily add long lists of numbers? Give one example.
4. What is carrying?
5. What is the definition of the term *subtraction*?
6. When do we use the procedure called borrowing in subtraction? Give one example.
7. What do we call the end result of subtraction?

2 семестр

Коллоквиум № 1

1. Переведите следующие слова с русского на английский язык:

1 common denominator – общий знаменатель;
2 common fraction; simple fraction; vulgar fraction – простая дробь; complex fraction; compound fraction – составная дробь;
3 decimal fraction – десятичная дробь; denominator [dɪ'nɔmɪneɪtə] 1) знаменатель; factor in common – общий сомножитель;
4 flip [flɪp] переворачивать; перекидывать (резким движением) flipped upside down – перевернутый вверх дном;
5 fraction ['frækʃ(ə)n] 1) дробь; 2) а) доля, порция, часть; improper fraction ['ɪmprɔpə `frækʃ∂n] неправильная дробь irreducible fraction – несократимая дробь;
6 lowest common denominator – наименьший общий знаменатель; mixed fraction [mɪkst `frækʃ∂n] смешанная дробь;
7 numerator ['njuːm(ə)reɪtə] 1) числитель;
8 proper fraction ['prɔpə `frækʃ∂n] правильная дробь rational ['ræʃ(ə)n(ə)l] fraction – рациональная дробь; reciprocal [rɪ'sɪprək(ə)l] 1) взаимный, обоюдный;
9 remainder [rɪ'meɪndə] 1) остаток; остатки, оставшаяся часть; to reduce a fraction – сокращать дробь;
10 to reduce to a common denominator – приводить к общему знаменателю; upside ['ʌpsaɪd] верхняя сторона, верхняя часть;

2. Прочитайте, переведите и перескажите текст:

FRACTIONS

Numbers that represent parts of a whole are called fractions or ra- tional numbers. Simple fractions are familiar: a dime is the tenth part of a dollar; 1/3 of a pie plus 1/3 of a pie is 2/3 of a pie; and so on. In general, we can express fractions as the quotient of two

integers a and b:

The top number in a fraction is called the numerator and the bottom number is called the denominator. Two types of fractions exist: proper and improper. A proper fraction is one in which the numerator is smaller than the denominator;1/2, – 3/4, and 5/8 are all proper fractions. An improper fraction is one in which the numerator is larger than the denominator; 7/3, – 3/2, and 6/5 are improper fractions. We can convert improper fractions to mixed fractions or whole numbers (for example, $1y^2/y = 1y$, – 4/2 = – 2, and 5/2 = 2 1/2) by dividing the numerator by the denominator and expressing any remainder as a fraction of the denominator.

A fraction is said to be reduced to lowest terms if neither the numera- tor nor the denominator has a factor in common. A factor is a number by which another number can be divided evenly. For example, 6/8 is not re- duced to lowest terms because both 6 and 8

$$\frac{6}{8} = \frac{2 \cdot 3}{2 \cdot 4} = \frac{3}{4}$$

have 2 as a factor:

Since a number divided by itself is always equal to 1, $\frac{2}{2} = 1$. Multiplying any number by 1 does not change the number, so $\frac{2}{2} \times 1 = \frac{2}{2}$. Reduced to lowest terms, then, $\frac{2}{2}$ is 1.

To add or subtract fractions that have the same denominators, add or subtract the numerators according to the rules for integers, and express the result as a fraction of the denominator. The result is normally reduced to lowest terms. For example,

$$\frac{2}{3} + \frac{4}{3} = \frac{2+4}{3} = \frac{6}{3} = 2$$

$$\frac{5}{8} - \frac{1}{8} = \frac{5-1}{8} = \frac{4}{8} = \frac{1}{2}$$

Only fractions with equal denominators may be added or subtracted as they stand. If the denominators of fractions to be added are unequal, we must find a common denominator. In the expression 2/3 + 3/4, for example, the denominators 3 and 4 are different. One quick way to obtain a common denominator for two fractions is to multiply their denominators. In this case that multiplication gives us 12. Thus, to add 2/3 and 3/4, we should change the fractions into their equivalents with 12 as a common denominator. To do so, multiply both the numerator and denominator of each fraction by the denominator of the other fraction:

$$\frac{2}{3} = \frac{2 \cdot 4}{3 \cdot 4} = \frac{8}{12}$$

$$\frac{3}{4} = \frac{3 \cdot 3}{4 \cdot 3} = \frac{9}{12}$$

Multiplying both the numerator and denominator by the same num- ber does not change the overall value of a fraction. Now we can add

$$\frac{2}{3} + \frac{3}{4} = \frac{8}{12} + \frac{9}{12} = \frac{8+9}{12} = \frac{17}{12} = 1\frac{5}{12}$$

Subtracting fractions requires the same procedure:

$$\frac{7}{10} - \frac{3}{5} = \frac{7}{10} - \frac{3 \cdot 2}{5 \cdot 2} = \frac{7}{10} - \frac{6}{10} = \frac{1}{10}$$

Multiplying two fractions, a/b and c/d, is straightforward. Simply multiply numerators together and multiply denominators together:

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$$

For example,

$$\frac{6}{5} \cdot \frac{2}{3} = \frac{12}{15} = \frac{4}{5}$$

The answer has been reduced to its lowest term, in this case 4/5.

The rules for multiplying signed (positive or negative) fractions are the same as those for multiplying signed integers. The same is true for the rules governing addition, subtraction, and division of signed fractions:

$$\left(-\frac{2}{3}\right)\left(\frac{4}{5}\right) = -\frac{8}{15}$$

$$\left(-\frac{2}{3}\right)\left(-\frac{4}{5}\right) = \frac{8}{15}$$

The division of fractions is most easily understood in terms of recip- rocals. Every number (except 0) has a reciprocal, or another number such that the product of the number and its reciprocal equals one. The reciprocal of 3, for example, is – 3. Zero (0) has no reciprocal, because no number can be multiplied by it to equal 1. Any number multiplied by zero equals zero.

To divide 1 a/b by c/d, multiply a/b by the reciprocal of c/d:

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$$

Division is equivalent to multiplying by the reciprocal – that is, y ÷ 1/4, is the same as y ×

$$\frac{\frac{a}{b} \cdot \frac{d}{c}}{\frac{c}{d} \cdot \frac{d}{c}} = \frac{\frac{a}{b} \cdot \frac{d}{c}}{\frac{cd}{cd}} = \frac{\frac{a}{b} \cdot \frac{d}{c}}{1} = \frac{a}{b} \cdot \frac{d}{c}$$

4 because both the numerator and the denominator can be multiplied by the same nonzero number without affecting the overall value of the fraction. Multiply both numerator and denominator in the graphic above by d/c:

This division is equivalent to multiplying the first number, a/b, by the re- ciprocal of the second number – by d/c. The reciprocal of a fraction is simply the fraction flipped upside down. Here is an example that uses actual numbers:

$$\frac{2}{3} \div \frac{5}{8} = \frac{2}{3} \cdot \frac{8}{5} = \frac{16}{15} = 1\frac{1}{15}$$

Dividing a whole number by a fraction works the same way:

$$1 \div \left(-\frac{3}{2}\right) = 1 \cdot \left(-\frac{2}{3}\right) = -\frac{2}{3}$$

3. Ответьте на вопросы, используя информацию текста.

1. What numbers are called fractions?
2. What types of fractions exist?
3. How do we add and subtract fractions?
4. What is the quick way to obtain the common denominator for two fractions?
5. Multiplying two fractions is straightforward, isn’t it? What does it mean?
6. What must we know about the division of fractions?

2 семестр

Коллоквиум № 2

1. Переведите следующие слова с русского на английский язык:

assumption [ə'sʌmpʃ(ə)n] 1) принятие на себя (обязанностей), вступление (в должность); 2) предположение, допущение;

calculate ['kælkjuleɪt] 1) вычислять; подсчитывать; калькулировать; calculating ['kælkjuleɪtɪŋ] 1) счётный, считающий Syn: computing;
2) расчётливый; экономный, бережливый;

component [kəm'pəunənt] 1. 1) компонент; составная часть, со- ставной элемент; ингредиент;

concept ['kɔnsept] понятие, идея; общее представление; концепция; conceptual [kən'septʃuəl] 1) абстрактный, отвлечённый Syn: specu-
lative; 2) понятийный, когнитивный; концептуальный;

deal with – рассматривать (тему) , касаться (темы);

experience [ɪk'spɪərɪən(t)s], [ek-] 1. 1) (жизненный) опыт; 2) опыт- ность; опыт работы, стаж работы;

formula ['fɔːmjələ] ; formulae , formulas 1) формула (в различных отраслях науки) chemical formula – химическая формула; 2) формули- ровка, формула;

intuitive [ɪn'tjuːɪtɪv] 1) интуитивный, подсознательный Syn: intuitional; 2) обладающий интуицией;

involve [ɪn'vɔlv] 1) а) привлекать, вовлекать, втягивать; б) касать- ся, затрагивать; 2) запутывать; 3) вызывать; приводить (к чему-л.);

mode [məud] 1) метод, методика, способ; 2) образ действий, ма- нера поведения; 3) вид, форма; 4) состояние, режим;

postulate 1. ['pɔstjələt] 1) а) аксиома Syn: axiom; б) постулат;
2. ['pɔstjəleɪt]; 1) а) постулировать Syn: suppose; б) принимать без дока- зательства, теоретически допустить;

property ['prɔpətɪ] 1) а) имущество; собственность; 4) а) свойство, качество; б) отличительная черта, особенность;

reasoning ['riːz(ə)nɪŋ] 1. 1) рассуждение, умозаключение faulty reasoning – ошибочное рассуждение;

refer [rɪ'fɜː] (refer to) 1) направлять; отсылать (к кому-л. / чему-л.);
2) обращаться (за помощью, советом и т.п.); 7) ссылаться, опираться (на кого-л. / что-л., на чьи-л. слова и т.п.).

relate [rɪ'leɪt] 1) а) (relate to) относиться, иметь отношение, затра- гивать; быть связанным; б) (relate to) устанавливать связь, определять соотношение; соотносить;

representation [ˌreprɪzen'teɪʃ(ə)n] 1) а) изображение, образ, карти- на; б) представление (в каком-л. свете);

similarly ['sɪmɪləlɪ] так же, подобным образом; space [speɪs] 1. 1) пространство

stretched string [`stretʃd striŋ] растянутая веревка, нить, струна; theorem ['θɪərəm] теорема to deduce a theorem – выводить теорему
to formulate a theorem – формулировать теорему to prove a theorem – доказывать теорему to test a theorem – проверять теорему

two-dimensional [ˌtuːdɪ'men(t)ʃ(ə)n(ə)l] 1) дву(х)мерный; плоский; поверхностный;

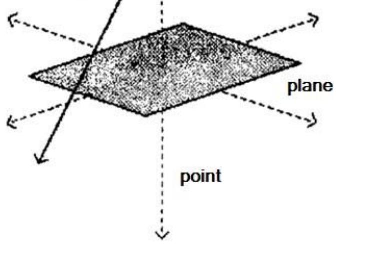
undefined 1) неопределённый, неустановленный, не получивший определения;

volume ['vɔljuːm] 1) а) объём, масса;

2. Прочитайте, переведите и перескажите текст:

GEOMETRY

Geometry, branch of mathematics that deals with shapes and sizes may be thought of as the science of space. Just as arithmetic deals with ex- periences that involve counting, so geometry describes and relates experi- ences that involve space. Basic geometry allows us to determine properties such as the areas and perimeters of two-dimensional shapes and the surface areas and volumes of three-dimensional shapes. People use formulas de- rived from geometry in everyday life for tasks such as figuring how much paint they will need to cover the walls of a house or calculating the amount of water a fish tank holds.



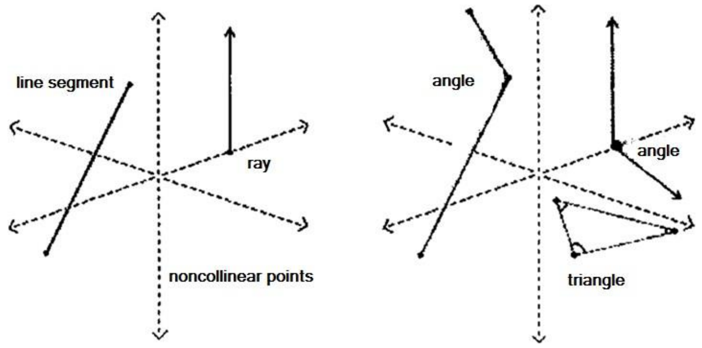
Geometry combines simple conceptual building blocks to construct complex logical structures. These building blocks include undefined terms, defined terms, and postulates. Combining these components creates chains of reasoning that support conclusions called theorems.

Some concepts central to geometry are not defined in terms of sim- pler concepts. The most familiar of these undefined terms are point, line, and plane.

These fundamental concepts arose from everyday experiences. Thus, the experience of where an object is leads to the idea of an exact, fixed loca- tion. This is the intuitive idea to which the term point refers. Many physical objects suggest the idea of a point. Examples include the corner of a block, the tip of a pencil, or a dot on a sheet of paper. Such things are called mod- els or representations or pictures of points, although they show only ap- proximately the idea in mind. Similarly, a row of points suggested by a tightly stretched string, the edge of a desk, or a flagpole, extended infinitely in both directions, is called a line. The word plane describes a flat surface – such as a floor, desktop, or chalkboard – but it is imagined as extending infinitely in all directions. This means that a plane has no edges just as a line has no ends.

Other undefined terms describe relations among points, lines, and planes, such as the relation described by the phrase «a point that lies on a line».

Undefined terms can be combined to define other terms. Noncollin- ear points, for example, are points that do not lie on the same line. A line segment is the portion of a line that includes two particular points and all points that lie between them, while a ray is the portion of a line that includes a particular point, called the end point, and all points extending infinitely to one side of the end point.



Defined terms can be combined with each other and with undefined terms to define still more terms. An angle, for example, is a combination of two different rays or line segments that share a single end point. Similarly, a triangle is composed of three noncollinear points and the line segments that lie between them.

Postulates, or axioms, are unproven but universally accepted assump- tions, such as «there is one and only one line that passes through two dis- tinct points». A system consisting of a set of noncontradictory postulates concerning the undefined terms point, line, and plane, together with the theorems deduced from these postulates, is called geometry. Different sets of postulates determine whole different systems of geometry.

If the postulates selected are suggested by experience with physical space, then it is reasonable to expect that the conclusions will also corre- spond closely to experiences related to space. However, since any set of postulates must be selected on the basis of incomplete and approximate ob- servation, they quite possibly apply only approximately to actual space Thus, it is no surprise if any particular geometry should turn out to be inap- plicable, or only approximately applicable, to problems in actual space.

Theorems are logically deduced from postulates. This process of de- duction is called a proof. Each step of a proof must be justified by one of the postulates or by a theorem that has already been proved. One simple theorem, for example, asserts that a line that is parallel to one of a pair of parallel lines is parallel to both lines. Parallel lines are lines that are equally far apart from each other along their entire lengths. In proving a theorem in geometry, we deduce a conclusion from a set of assumptions.

3. Ответьте на вопросы, используя информацию текста.

1. What is Geometry?
2. What does Geometry deal with?
3. What does basic geometry allow us to determine?
4. What are the most familiar undefined terms in geometry?
5. What does the word «plane» describe?
6. What other undefined terms expect points, lines, and planes do you?
7. Can undefined terms be combined to define other terms? Know?
8. Look at the upper figure on page 2 what is a line segment?
9. What are non collinear points?
10. What is an angle?
11. How many lines are there passing through two distinct points?
12. What are lines that are equally far apart from each other along their entire lengths?

2 семестр

Коллоквиум № 3

1. Переведите следующие слова с русского на английский язык:

apart from [ə'pɑːt frɔm] – не говоря (уже) о; кроме; не считая; axiom ['æksɪəm] аксиома, постулат;

concern [kən'sɜːn] 1. 1) проблема; вопрос, требующий решения; забота, дело (какого-л. лица)

definition [ˌdefɪ'nɪʃ(ə)n] 1) определение, формулирование (про- цесс) ; дефиниция, формулировка;

encompass [ɪn'kʌmpəs], [en-] 1) окружать; заключать; 2) выпол- нять, осуществлять;

eventually [ɪ'venʧuəlɪ], [-tju-] в конечном счёте, в итоге, в конце концов; со временем;

extend [ɪk'stend], [ek-] 1) а) простираться, тянуться; длиться; fallacious [fə'leɪʃəs] 1) ложный, неверный, неправильный, оши-
бочный (о доказательстве, доводе); 2) вводящий в заблуждение, об- манчивый, иллюзорный;

fallacious peace – иллюзорный мир;

fallacious proof – ошибочное доказательство;

gain I [geɪn] 1. 1) а) добывать, зарабатывать; б) выигрывать, до- биваться, выгадывать в) получать, приобретать;

problem ['prɔbləm] 1. 1) проблема; вопрос; задача

problem ['prɔbləm] 1. 1) проблема; вопрос; задача; 2) а) сложная ситуация; трудный случай; б) трудность, затруднение, осложнение;
3) математическая задача; шахматная задача;

prove [pruːv] ; proved; прич. proved, proven 1) а) доказывать; б) удостоверять; подтверждать документами; 3) осуществлять провер- ку (вычислений);

reveal I [rɪ'viːl] 1) открывать; разоблачать

solution [sə'luːʃ(ə)n] 1) а) решение, разрешение (проблемы и т.п.); разъяснение

treatise ['triːtɪz] 1) трактат; 2) научный труд; курс (учебник);

2. Прочитайте, переведите и перескажите текст:

EUCLID AND HIS ELEMENTS

One of the most influential mathematicians of ancient Greece, Euclid flourished around 300 B.C. Not much is known about the life of Euclid. One story which reveals something about Euclid's character concerns a pu- pil who had just completed his first lesson in geometry. The pupil asked what he would get from learning geometry. So Euclid told his slave to give the pupil a coin so he would be gaining something from his studies. In- cluded in the many works of Euclid is Data, concerning the solution of problems through geometric analysis, *On Divisions (of Figures), the Optics, the Phenomena*, a treatise on spherical geometry for astronomers, several lost works on higher geometry, and the Elements, a thirteen volume text- book on geometry.

The Elements, which surely became a classic soon after its publica- tion, eventually became the most influential textbook in the history of civi- lization. In fact, it has been said that apart from the *Bible*, the *Elements* is the most widely read and studied book in the world. It has also been said that the Greeks used to post over the doors of their schools the inscription:

``Let no one come to our school who has not learned the *Elements* of Euclid." Probably every great Western mathematician to arise in the last two thousand years has studied Euclid's *Elements.*

In writing the *Elements* Euclid collected and extended many of the ideas of other Greek mathematicians before him. The *Elements* is basically a chain of 465 propositions encompassing most of the geometry, number theory, and geometric algebra of the Greeks up to that time. Book I contains twenty-three definitions, five common notions (axioms), five postulates, and forty-eight propositions of plane geometry.

The definitions of Book I include those of points, lines, planes, an- gles, circles, triangles, quadrilaterals, and parallel lines. The five postulates may be translated into the following:

Two points determine a straight line.

A line segment extended infinitely in both directions produces a straight line.

A circle is determined by a center and distance. All right angles are equal to one another.

If a straight line falling on two straight lines forms interior angles on the same side less than 180 degrees, the two straight lines, if produced in- definitely, will meet on that side.

The last of these, commonly known as the «parallel postulate», is by far the most important of the five. Through manipulation, the following statement may be derived:

«The sum of the angles in a triangle is equal to 180 degrees». Chang- ing «equal to» to «less than» or «greater than» results in entirely different geometries – non-Euclidean geometries. In spherical geometry, for exam- ple, this would read: «The sum of the angles in a triangle is greater than 180 degrees». In hyperbolic geometry it would read: «The sum of the angles in a triangle is less than 180 degrees». Hyperbolic geometry was invented by the Russian mathematician Nicolai Ivanovitch Lobachevsky.

Postulates, by definition, are not and cannot be proven. However, some mathematicians have claimed that postulate four can be proven; and many have believed that postulate five, partly because of its length and complexity, can be proven. Lobachevsky's geometry grew out of his unsuc- cessful attempts to prove Euclid's parallel postulate. Zeno of Sidon in the first century B.C. believed that Euclid's list of postulates was incomplete. He claimed that one must postulate that two distinct straight lines cannot have a segment in common. Without this, he claimed, some of the proposi- tions in Book I are fallacious.

Unlike the specialized nature of the postulates, the five common no- tions, or axioms, were essentially taken to be universal truths in all of mathematics and the sciences. The fifth axiom breaks down when exposed to the concept of infinite sets. For example, the set of all integers is not lar- ger than the set of all even integers.

The final section of Book I includes the forty-eight postulates. In- cluded in these are the familiar results on triangles, such as proposition 5 [that the angles at the base of an isosceles triangle are equal], as well as the four congruence theorems for triangles: side-angle-side (prop. 4), side-side- side (prop. 8), angle-side-angle (prop. 26), and side-angle-angle (prop. 26, also). The last two propositions are the Pythagorean theorem and its converse.

Donald Lancon Jr

3.Ответьте на вопросы, используя информацию текста.

1) What do you know about Euclid?
2) What works is Euclid famous for?
3) Why is the Elements called the most influential textbook in the history of civilization?
4) What ideas does «The Elements» contain?
5) What definitions does Book I include?
6) Do you remember the five postulates of Euclid?
7) Why is the last of the postulates, commonly known as the «paral- lel postulate», regarded to be the most important of the five?

What does the final section of Book I include.

3 семестр
Коллоквиум № 1

1. Переведите следующие слова с русского на английский язык:

acute [ə'kjut] 1) остроконечный, острый; 2) острый, сильный; 3) силь- ный, резкий; крайний, критический 4) проницательный; сообразительный;

acute angle – острый угол;

equilateral ['iːkwɪ'læt(ə)r(ə)l]; равнобочный, равносторонний; scalene ['skeɪliːn] неравносторонний

isosceles [aɪ'sɔs(ə)liːz]; равнобедренный;

obtuse [əb'tjuːs] 1) а) тупой, тупоугольный; convex [ˌkɔn'veks] выпуклый;

concatenate [kən'kæt(ə)neɪt]; объединять, связывать, соединять, сцеплять;

adjacent [ə'ʤeɪs(ə)nt] 1) (adjacent to smb./smth.) расположенный ря- дом, смежный, соседний (с кем-л./чем-л.) Syn: neighbouring; 2) смежный;

unique [juː'niːk] 1. 1) уникальный, единственный в своём роде, исключительный; 2) единственно возможный; однозначный, одно- значно определяемый;

inexhaustible [ˌɪnɪg'zɔːstəbl] 1) неистощимый, нескончаемый, не- исчерпаемый; 2) неутомимый, не знающий усталости;

triangle of reference – координатный треугольник; straightedge ['streɪteʤ] линейка, правило;

encircle [ɪn'sɜːkl], [en-] окружать; делать круг;

circumcircle, circumscribed circle, escribed circle – описанная ок- ружность;

permute [pə'mjuːt]; переставлять; менять порядок; polygon ['pɔlɪgɔn]; полигон, многоугольник;

perpendicular [ˌpɜːp(ə)n'dɪkjulə] 1. 1) нормаль, перпендикуляр, перпендикулярная линия;

bisector [baɪ'sektə] биссектриса;

vertex ['vɜːteks] 1) вершина (угла, кривой);

coordinate [kəu'ɔːdɪneɪt] 1) координировать, согласовывать; 2) коор- динироваться, согласовываться; осуществлять согласованные действия;

determine [dɪ'tɜːmɪn] 1) определять, устанавливать;

determinant [dɪ'tɜːmɪnənt] 1. 1) определяющий фактор; детерминант; specify ['spesɪfaɪ] 1) точно определять, устанавливать, предписы-вать; детально излагать;

segment 1. ['segmənt] отрезок, сегмент; сектор;

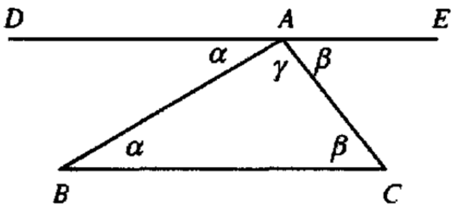
property ['prɔpətɪ] а) свойство, качество б) отличительная черта, особенность;

2. Прочитайте, переведите и перескажите текст:

TRIANGLE

A triangle is a 3-sided polygon sometimes (but not very commonly) called the trigon. All triangles are convex. An acute triangle is a triangle whose three angles are all acute. A triangle with all sides equal is called equi- lateral. A triangle with two sides equal is called isosceles. A triangle having an obtuse angle is called an obtuse triangle. A triangle with a right angle is called right. A triangle with all sides a different length is called scalene.

In 1816, while studying the Brocard points of a triangle, Crelle ex- claimed, «It is indeed wonderful that so simple a figure as the triangle is so inexhaustible in properties. How many as yet unknown properties of other figures may there not be?» *(Wells 1991, p. 21).*



The sum of angles in a triangle is 180° = π radians (at least in Euclid- ean geometry: this statement does not hold in non-Euclidean Geometry). This can be established as follows.

Let DAE//BC (DAE be parallel to BC) in the above diagram, then the angles α and β satisfy

□ =□DAB= □ABC and β = □EAC – □ACB, as indicated. Adding □, it follows that

□ + □ + □= 180°, (1)

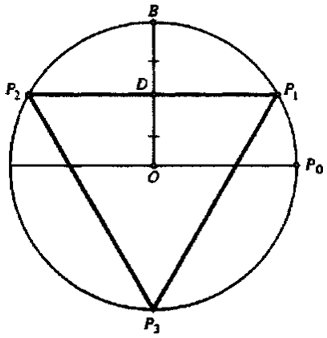
since the sum of angles for the line segment must equal two right angles. Therefore, the sum of angles in the triangle is also 180°.

Let S stand for a triangle side and A for an angle, and let a set of Ss and As be concatenated such that adjacent letters correspond to adjacent sides and angles in a triangle. Triangles are uniquely determined by specify- ing three sides (SSS theorem), two angles and a side (AAS theorem), or two sides with an adjacent angle (SAS theorem). In each of these cases, the un- known three quantities (there are three sides and three angles total) can be uniquely determined. Other combinations of sides and angles do not uniquely determine a triangle: three angles specify a triangle only modulo a scale size (AAA theorem), and one angle and two sides not containing it may specify one, two, or no triangles (ASS theorem).

Allowable side lengths a, b, and c for a triangle are given by the set of inequalities

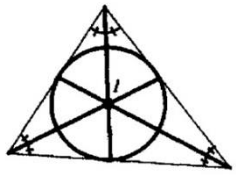
$a > 0$, $b > 0$, $c>0$, and

a + b >c, b + c > a, a + c>b

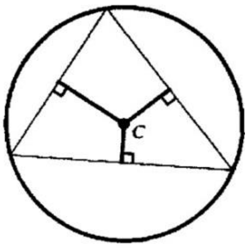


equilateral triangle construction

The straightedge and compass construction of the triangle can be ac- complished as follows. In the above figure, take OP0 as a radius and draw OB □ OPo. Then bisect OB and construct P2P1|| OP0. Extending BO to locate P3 then gives the equilateral triangle ΔP1P2P3. Another construction proceeds by drawing a circle of the desired radius r centered at a point O. Choose a point B on the circle's circumference and draw another circle of radius r centered at B. The two circles intersect at two points, P1 and P2, and P3



inscribe

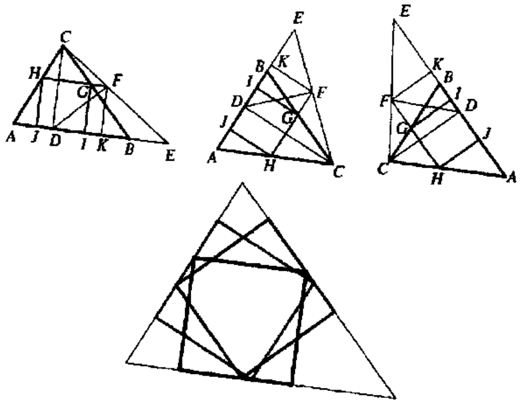


circumcircle

is the second point at which the line B0 intersects the first circle.

In Proposition IV.4 of the Elements, Euclid showed how to inscribe a circle (the incircle) in a given triangle by locating the incenter I as the point of intersection of angle bisectors. In Proposition IV.5, he showed how to circum- scribe a circle (the circumcircle) about a given triangle by locating the cir- cumcenter O as the point of intersection of the perpendicular bisectors.

Unlike a general polygon with n>4 sides, a triangle always has both a circumcircle and an incircle. such polygons are called bicentric polygons.



Casey (1888, pp. 10-11) illustrates how to inscribe a square in an ar- bitrary triangle ΔABC. Construct the perpendicular CD □ AB and the line segment BE = AD. Bisect □BDC, and let F be the intersection of the bisec- tor with BC. Then draw FK and FH through F, perpendicular to and parallel to AB, respectively. Let G be the intersection of FH and BC, and then con-
struct FK and HJ through F and Я perpendicular to AB. Then □GH JI is an inscribed

square. Permuting the order in which the vertices are taken gives an additional two congruent squares. These squares, however, are not nec- essarily the largest inscribed squares. Calabi's triangle is the only triangle (besides the equilateral triangle) for which the largest inscribed square can
be inscribed in three different ways.

In the above figure, let the circumcircle passing through a triangle's vertices have radius r, and denote the central angles from the first point to the second θ1, and to the third point by θ2.

3.Ответьте на вопросы, используя информацию текста.

1) What is a triangle?
2) What triangle do we call equilateral?
3) What triangle do we call isosceles?
4) What is the difference between acute and obtuse triangles?
5) What instrument do we use to measure segments?
6) How many theorems are there in the text?
7) Name the theorems you’ve learnt. What definitions from the text do you know?
8) What three angles specify a triangle?
9) How are allowable side lengths a, b, and c for a triangle given?
10) How did Euclid show the incircle in a given triangle?
11) How do you distinguish a general polygon and a triangle?
12) What must you do to inscribe a square in an arbitrary triangle?

3 семестр

Коллоквиум № 2

1. Переведите следующие слова с русского на английский язык: angle ['æŋgl] угол;

congruous ['kɔŋgruəs] 1) (congruous to / with) соответствующий; гар- монирующий; подходящий; 2) конгруэнтный; совпадающий, сравнимый;

deductive [dɪ'dʌktɪv]; дедуктивный;

hence [hen(t)s] 1. 1) отсюда, прочь; 2) поэтому, следовательно; hypotenuse [haɪ'pɔt(ə)njuːz]; гипотенуза;

measure ['meʒə] 1. 1) мера; единица измерения; nonetheless [ˌnʌnðə'les] несмотря на, однако;

property ['prɔpətɪ] а) свойство, качество б) отличительная черта, особенность;

rigorous ['rɪg(ə)rəs] 1) строгий; неумолимый; безжалостный; 3) доскональный, скрупулёзный, тщательный; неукоснительный;

state [steɪt] а) формулировать; излагать; б) формулировать, вы- ражать знаками;

statement ['steɪtmənt] 1) заявление, утверждение; 2) изложение, формулировка 3) а) официальный отчёт, бюллетень;

vertex ['vɜːteks] 1) вершина (угла, кривой);

2. Прочитайте, переведите и перескажите текст:

PYTHAGOREAN THEOREM

The Pythagorean Theorem is one of the most famous in all of mathe- matics. It states:

Theorem: *The square of the length of the hypotenuse of a right trian- gle is equal to the sum of the squares of the legs.*

There are many different proofs of the theorem (even one supplied by President Garfield in 1876!), and we know that the Babylonians knew about the Pythagorean

Theorem about 1000 years before the time of Pythagoras (born in 572 B.C.). Nonetheless, a rigorous, general proof of the theorem requires the development of deductive geometry, and thus it is thought that Pythagoras probably supplied the first proof. The Greek philosopher and mathematician Pythagoras noticed the relationship and is credited with the proof of this property known as the Pythagorean Theorem or the Pythago- rean Property. Each side of a right triangle being used as a side of a square, the sum of the areas of the two smaller squares is the same as the area of the largest square.

Proof of the Pythagorean Theorem

We should like to show that the Pythagorean Property is true for all right triangles, there being several proofs of this property. Let us discuss one of them.

Before giving the proof let us state the Pythagorean Property in mathematical language. In the triangle below, c represents the measure of the hypotenuse, and *a* and *b* represent the measures of the other two sides. If we construct squares on the three sides of the triangle, the area-measure will be a^2, b^2 and c^2.

Then the Pythagorean Property could be stated as follows: $a^2 + b^2 = c^2$. This proof will involve working with areas. To prove that $a^2 + b^2 = c^2$. for the triangle above, construct two squares each side of which has a measure a + b as shown below. Separate the first of the two squares into two squares and two rectangles as shown. Its total area is the sum of the areas of the two squares and the two rectangles. A= a^2 + 2ab + b^2. In the second of the two squares construct four right triangles. Are they con- gruent? Each of the four triangles being congruent to the original triangle, the hypotenuse has a measure **c**. It can be shown that it is a square, and its area is c^2. The total area of the second square is the sum of the areas of the four triangles and the square with the area . A = c^2 + 4(1/2 ab). The two squares being congruent to begin with, their area measures are the same. Hence we may conclude the following:

3. Ответьте на вопросы, используя информацию текста.

1) What does the Pythagorean Theorem state?
2) How many proofs of the theorem do there exist?
3) How did the Pythagorean Theorem or the Pythagorean Property appear?
4) What will be the area-measure if we construct square on the three sides of the triangle?
5) How could the Pythagorean Property be stated?

3 семестр

Коллоквиум №3

1. Переведите следующие слова с русского на английский язык:

point [pɔɪnt] 1. 1) а) точка, пятнышко, крапинка; б) точка, отмет- ка, точка деления (на шкале);

equidistant ['iːkwɪ'dɪst(ə)nt], ['ekwɪ-]; равноотстоящий, равноуда- лённый, эквидистантный;

circumference [sə'kʌmf(ə)r(ə)n(t)s] 1) окружность; замкнутая кри- вая 2) длина окружности; длина замкнутой кривой;

secant ['siːk(ə)nt] 1. секущая; секанс; 2. пересекающий, секущий; semicircle ['semɪˌsɜːkl] полукруг; полукруглая структура, форма; полукруглый инструмент;

diameter [daɪ'æmɪtə] ; d, diam. диаметр; perimeter [pə'rɪmɪtə] 1) периметр;

distance ['dɪst(ə)n(t)s] 1. 1) расстояние; дистанция;

radius ['reɪdɪəs]; radii, radiuses 1) R, r радиус (расстояние от цен- тра окружности до любой из её точек);

equal ['i:kwəl] 1. 1) равный, одинаковый; идентичный, равно- сильный, тождественный;

curved ['kɜ:vd] изогнутый, кривой;

bisect [baɪ'sekt] а) разрезать, делить пополам; б) разветвляться, раздваиваться;

particular [pə'tɪkjələ], [pə'tɪkjulə] 1. 1) редкий, особенный, специ- фический;

conversely ['kɔnvɜ:slɪ] обратно; вспять, назад; наоборот;

arc [ɑ:k] 1. 1) дуга (линия или вещь, образующая кривизну); necessary ['nesəs(ə)rɪ] 1. 1) необходимый, нужный, требуемый; sufficient [sə'fɪʃ(ə)nt] 1. достаточный; обоснованный;

condition [kən'dɪʃ(ə)n] 1. 1) состояние, положение; 2) (conditions) обстоятельства, условия;

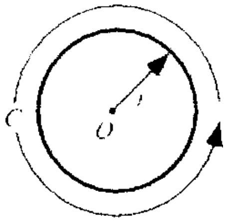
locus ['ləukəs]; loci; 1) а) место, местоположение; 3) геометриче- ское место точек;

radian ['reɪdɪən] радиан; wedge [weʤ] 1. 1) клин;

subtend [səb'tend]; стягивать (о дуге); противолежать (о стороне треугольника).

2. Прочитайте, переведите и перескажите текст:

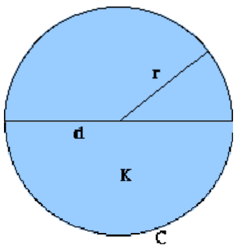
CIRCLE



A circle is the set of points equidistant from a given point O. The dis- tance r from the center is called the radius, and the fixed point O is called the center. All radii of the same circle have the same length. Twice the radius is known as the diameter d=2r. A diameter divides a circle into two congruent parts which are called semicircles. The perimeter C of a circle is called the circumference, and is given by

$$C = \pi d = 2\pi r.$$

The angle a circle subtends from its center is a full angle, equal to 360° or 2π radians.



Radius: r

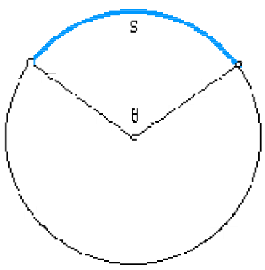
Diameter: d Circumference: C Area: K

d = 2r

C = 2 Pi r = Pi d

K = Pi r2 = Pi d2/4C = 2 sqrt(Pi K) K = C2/4 Pi = Cr/2

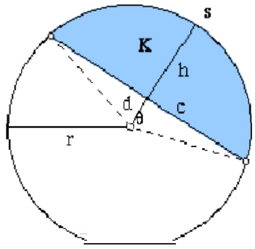
Arc of a Circle



A curved portion of a circle. Length: s
Central angle: theta (in radians), alpha (in degrees)

s = r theta = r alpha Pi/180

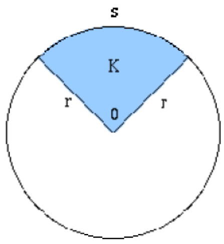
Segment of a Circle



Either of the two regions into which a secant or a chord cuts a circle. A chord that passes through the center of the circle is called a diameter. A diameter that is perpendicular to a chord bisects the chord.

Chord length: c Height: h
Distance from center of circle to chord's midpoint: d Central angle:
theta (in radians), alpha (in degrees) Area: K
Arc length: s
theta = 2 arccos(d/r) = 2 arctan(c/(2d)) = 2 arcsin(c/(2r)) h = r – d
c = 2 sqrt(r2–d2) = 2r sin(theta/2) = 2d tan(theta/2) = 2 sqrt[h(2r–h)] d = sqrt(4r2–c2)/2 = r cos(theta/2) = c cot(theta/2)/2
K = r2[theta–sin(theta)]/2 = r2arccos([r–h]/r) – (r–h)sqrt(2rh–h2)
= r2arccos(d/r) – d sqrt(r2–d2) theta = s/r
K = r2[s/r – sin(s/r)]/2

Sector of a Circle



The pie-shaped piece of a circle 'cut out' by two radii. Central angle:
theta (in radians), alpha (in degrees)
Area: K
Arc length: s
K = r2theta/2 = r2alpha Pi/360 theta = s/r
K = rs/2

Other properties of circles:

If a line intersects a circle of center O at points A and B, the seg- ments OA and OB make equal angles with the line. In particular, a tangent line is perpendicular to the radius that goes through the point of tangency.

Given a fixed circle and a fixed point P in the plane, and a line through P that intersects the circle at A and B (with A=B for a tangent). Then the product of the distances PA×PB is the same for all such lines. It is called the power of P with respect to the circle.

If the central angle AOB equals□, the angle ACB, where C is any point on the circle, equals ½□ or 180°–½□ (Figure 2, left). Conversely, given a segment AB, the set of points that ``sees'' AB under a fixed angle is an arc of a circle (Figure 2, right). In particular, the set of points that see AB under a right angle is a circle with diameter AB.

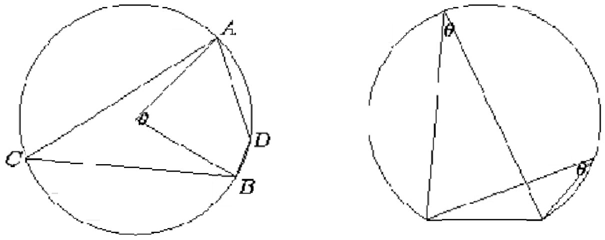


Figure 2: Left: The angle ACB equals ½□ for any C in the long arc AB; and ADB equals 180°–½□ for any D in the short arc AB.

Right: The locus of points from which the segment AB subtends a fixed angle □is an arc of circle.

Let P^1, P^2, P^3, P^4 be points in the plane, and let d_{ij}, for 1 i, j 4, be the distance between P_i and P_j. A necessary and sufficient condition for the points to all lie on the same circle (or line) is that one of the following equalities be satisfied:

$$\pm d^{12}d^{34}\pm d^{13}d^{24}\pm d^{14}d^{23}=0.$$

This is equivalent to Ptolemy's formula for cyclic quadrilaterals

In oblique coordinates with angle □, a circle of center (x^0, y^0) and ra- dius r has equation

$$(x-x^0)^2+ (y-y^0)^2+ 2(x-x^0)(y-y^0) \cos □=r^2.$$

In polar coordinates, a circle centered at the pole and having radius a has equation r=a.

A circle of radius a, passing through the pole, and with center at the point (r,□)=(a,□ ^{0}) has equation

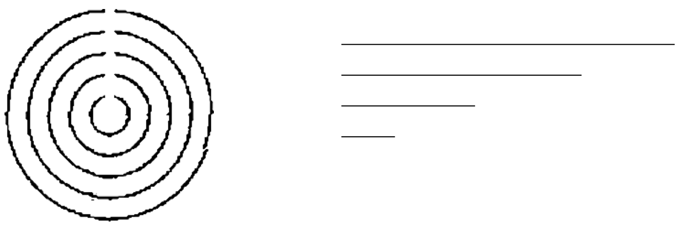
$$r=2a \cos(□-□^0).$$

A circle of radius a and with center at the point (r, □)=(r^0,□ ^{0}) has equation

$$r^2-2r^0r \cos(□-□^0)+r^{02}-a^2=0.$$

Now for a few geometrical derivations.

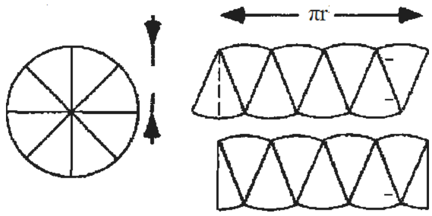
Two circles with the same center are concentric circles.



As the number of concentric strips, illustrated above, increases to in- finity, we are left with a triangle on the right, so

$$A = ½ (2\pi r) r = \pi r^2.$$

This derivation was first recorded by Archimedes in Measurement of a Circle (ca. 225 BC).



If the circle is instead cut into wedges, as the number of wedges in- creases to infinity, a rectangle results, so

$$A = (\pi r)\ r = \pi r^2.$$

2. Ответьте на вопросы, используя информацию текста.
3.
4. What is a circle?
5. What is called the center of a circle?
6. What is called the radius of a circle?
7. What is called the diameter of a circle?
8. What is called the circumference of a circle?
9. What other parts of a circle do you know? Name them and give definitions.
10. What is the length of the circumference of a circle equal to?
11. What is the area of a circle equal to?

4 семестр
Коллоквиум № 1

1. Переведите следующие слова с русского на английский язык:

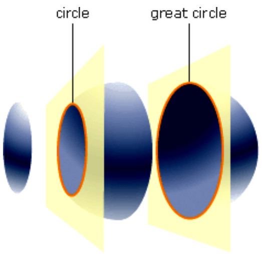
трёхмерный,
объёмный шар
многогранник
призма пирамида
цилиндр конус
параллелепипед
параллелограмм
вершина
верхушка
эллипс
наклонный
непрямой
парабола
гипербола
директриса
направляющая линия
фокус
фокусы
матрица

2. Прочитайте, переведите и перескажите текст:

THREE-DIMENSIONAL EUCLIDEAN FIGURES

Figures commonly encountered in three-dimensional geometry include spheres, polyhedrons, prisms, pyramids, cylinders, and cones. Cylinders are actually special cases of prisms; cones are special cases of pyramids.

A sphere is a surface where all points are equidistant from one point, called the center. If a plane cuts a sphere, the points where they intersect form a circle. The largest circle (called a great circle) is produced when the plane passes through the center of the sphere.



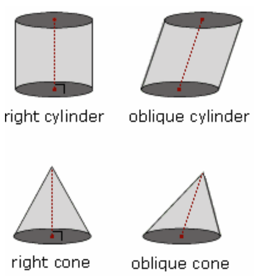
The equator on Earth is a great circle. The surface area of a sphere is given by A = 4pr2, its volume by V = 4/3pr3.

A polyhedron is a figure bounded by plane surfaces. If the faces of the polyhedron are all congruent regular polygons, the polyhedron is said to be regular. It has been proven that the five regular polyhedrons – the tetra- hedron (four sides), cube (six sides), octahedron (eight sides), dodecahedron (12 sides), and icosahedron (20 sides) –are the only ones possible. These five polyhedrons were known to the ancient Greek geometers. All polyhe- drons (regular or not) have the remarkable property that the number of faces (the flat sides) plus the number of vertices (the angles where edges inter- sect) equals the number of edges plus 2. Up to relatively recent times, poly- hedrons were believed to have mystic associations with natural phenomena.

A prism is a polyhedron that has parallel and congruent polygons, called bases, for two faces and parallelograms for all other faces. A paral- lelepiped is a variety of prism whose bases are parallelograms. A right prism has rectangles for sides (but not necessarily for bases). The volume of any prism is equal to the area of one of its bases times its height: V = bh.

A pyramid is a polyhedron that has a polygon as its base and sides that consist of triangles having a common vertex, called the apex. A pyra-mid is a regular right pyramid if its base is a regular polygon and if a line joining the center of its base to its apex is perpendicular to its base. The volume of any pyramid is equal to one-third the area of its base times its height: V = ⅓bh.

A cylinder is a prism with circular bases. The formula for the volume of a cylinder is therefore the same as for a prism: A = bh. If the line con- necting the centers of the two bases is perpendicular to those bases, the cyl- inder is a right cylinder; otherwise, it is oblique.

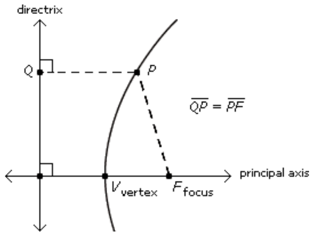


A cone is a pyramid with a circular base. A cone is a right cone if a line joining the center of its base to its apex is perpendicular to its base. The formula for the volume of a cone is the same as for a pyramid: V = ⅓bh.

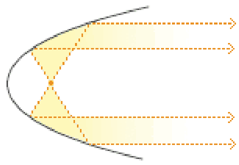
Conic sections are curves formed by the intersection of a plane with the surface of a cone. (When discussing conic sections, cone means two right circular cones placed apex to apex.) The surface of the cone on either side of the apex is called a nappe of the cone. If A is the angle between the axis of the cone and its surface and the cone is cut by a plane that makes an angle with the axis that is greater than A, the intersection is a closed curve called an ellipse. If the plane and the axis are perpendicular, the intersection is a circle, which is considered a special case of the ellipse.

If the plane intersects the axis at an angle equal to A, so that the plane is parallel to the surface of the cone, the intersection is an open curve of infinite extent called a parabola. If the cone is intersected by a plane that is either paral- lel to the axis or makes an angle with it that is smaller than A, and if the plane does not contain the apex of the cone, the intersection is called a hyperbola. In this case the cone is necessarily intersected in both nappes, and it follows that the hyperbola has two branches, each of which is infinite in extent.

Conic sections are two-dimensional or plane curves, and therefore a desirable definition of conic sections avoids the notion of a cone, which is three-dimensional. A conic section may be two-dimensionally defined as the set of points of which the distances from some fixed point are in a con- stant ratio to the distances of the points from a fixed line that does not pass through the fixed point. The fixed point is called the focus, and the fixed line is called the directrix. The constant ratio is called the eccentricity of the conic section and is usually denoted by the letter e. If P is a point and Q is the foot of a line from P perpendicular to the directrix, the point P is on the conic section if and only if [FP] = e[QP], in which [FP] and [QP] are the distances between the respective points. When e = 1, the conic section is a parabola; when e > 1, it is a hyperbola; and when e < 1, it is an ellipse.



The conic sections have numerous mathematical properties that give them important applications in mathematical physics. For example, light reflected by mirrors molded to the curve of a conic section has particular characteristics: Rays emanating in any direction from



the center of a circle are reflected back to the center; rays emanating in any direction from one of the two foci (geometrical cen- ters) of an ellipse are reflected to the other focus. Parabolic mirrors are often used in spotlights because the rays emanating from the focus of a parabola are reflected out in parallel lines, minimizing spread:

Rays emanating from one focus of a hyperbola are reflected in such a direction that they appear to emanate from the other focus.

3. Ответьте на вопросы, используя информацию текста.

1) What three – dimensional figures do you know?
2) What is a sphere?
3) What is a polyhedron?
4) What is a prism?

5) What is a pyramid?

6) What are cylinders and cones?

7) What are conic sections? What is the difference between conic sections and cones?

8) What properties of conic sections are applied in mathematical physics? Give one example.

4 семестр

Коллоквиум № 2

1. Переведите следующие слова с русского на английский язык:

an approximate equivalent – примерный эквивалент, модель; an exact equivalent – точная копия;

appendix [ə'pendɪks]; appendixes 1) добавление, дополнение Syn: addendum, supplement, addition; 2) appendices приложение (содержащее библиографию, примечания);

assume [ə's(j)uːm] 1) принимать, брать на себя (ответственность, управление); 2) принимать, обретать (характер, форму); 3) допускать, предполагать;

deduce [dɪ'djuːs]; 1) приходить к заключению, делать вывод; вы- водить; 2) проследить (например, логическую цепь); установить про- исхождение;

derive [dɪ'raɪv] 1) получать, извлекать; 2) выводить, получать;
3) устанавливать происхождение, возводить (к чему-л.);

equivalent [ɪ'kwɪv(ə)lənt] 1. эквивалент 2. равноценный, равнозна- чащий; равносильный; равнозначный, эквивалентный

Euclid ['juːklɪd] 1) Евклид, Эвклид (древнегреческий математик);
2) труды Евклида; «Начала» Евклида; 3) геометрия;

hypothesis [haɪ'pɔθəsɪs]; hypotheses гипотеза, догадка, предположение; inaugural [ɪ'nɔːgjər(ə)l, ɪ'nɔːgjur(ə)l] 1. инаугурационный, относящий- ся к вступлению в должность; вступительный; знаменующий начало;
2. 1) вступление в должность; 2) речь при вступлении в должность; postulate 1. ['pɔstjələt] 1) а) аксиома; б) постулат; 2) предварительное условие; важное допущение; вероятное предположение 2. ['pɔstjəleɪt] 1) а) пос- тулировать; б) принимать без доказательства, теоретически допустить;

property ['prɔpətɪ] а) свойство, качество; б) отличительная черта, особенность;

proposition [ˌprɔpə'zɪʃ(ə)n] 1) а) предложение; 2) а) заявление, ут- верждение; б) суждение, высказывание; 3) теорема; 4) пропозиция, суждение;

prove [pruːv]; proved; прич. proved, proven 1) а) доказывать; б) удостоверять; подтверждать документами; 2) осуществлять провер- ку (вычислений);

trigonometric(al) [ˌtrɪgənə'metrɪk(əl)] тригонометрический;

2. Прочитайте, переведите и перескажите текст:

NON – EUCLIDEAN GEOMETRY

In about 300 BC Euclid wrote The Elements, a book which was to become one of the most famous books ever written. Euclid stated five pos- tulates on which he based all his theorems:

To draw a straight line from any point to any other.

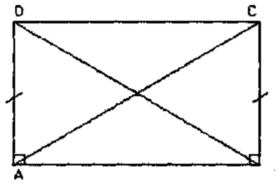
To produce a finite straight line continuously in a straight line. To describe a circle with any centre and distance.

That all right angles are equal to each other.

That, if a straight line falling on two straight lines make the interior angles on the same side less than two right angles, if produced indefinitely, meet on that side on which are the angles less than the two right angles.

It is clear that the fifth postulate is different from the other four. Playfair's Axiom: – Given a line and a point not on the line, it is pos-
sible to draw exactly one line through the given point parallel to the line.

Many attempts were made to prove the fifth postulate from the other four, many of them being accepted as proofs for long periods of time until the mistake was found. Invariably the mistake was assuming some 'obvious' property which turned out to be equivalent to the fifth postulate. One such 'proof was given by Wallis in 1663 when he thought he had deduced the fifth postulate, but he had actually shown it to be equivalent to:-



Saccheri's quadrilateral

To each triangle, there exists a similar triangle of arbitrary magnitude.

One of the attempted proofs turned out to be more important than most others. It was produced in 1697 by Girolamo Saccheri. The impor- tance of Saccheri's work was that he assumed the fifth postulate false and attempted to derive a contradiction.

ΔABD is congruent to ΔBAC (Two sides and included □) Hence AC = BD so ΔADC is congruent to ΔBCD
(Three sides)
Therefore □ADC = □BCD.

Here is the Saccheri quadrilateral

In this figure Saccheri proved that the summit angles at D and C were equal.
Saccheri has shown:

a) The summit angles are > 90° (hypothesis of the obtuse angle).
b) The summit angles are < 90° (hypothesis of the acute angle).
c) The summit angles are = 90° (hypothesis of the right angle).

Euclid's fifth postulate is c). Saccheri proved that the hypothesis of the obtuse angle implied the fifth postulate, so obtaining a contradiction.

In 1766 Lambert followed a similar line to Saccheri. However he did not fall into the trap and investigated the hypothesis of the acute angle with- out obtaining a contradiction. Legendre proved that Euclid's fifth postulate is equivalent to:-

The sum of the angles of a triangle is equal to two right angles Legendre showed, as Saccheri had over lOO years earlier,'that the
sum of the angles of a triangle cannot be greater than two right angles and never realised his error himself.

Gauss began work on the fifth postulate in 1792 while only 15 years old, at first attempting to prove the parallels postulate from the other four. By 1813 he had made little progress and wrote:

In the theory of parallels we are even now not further than Euclid.
This is a shameful part of mathematics.

Gauss began to work out the consequences of a geometry in which more than one line can be drawn through a given point parallel to a given line.

Gauss discussed the theory of parallels with his friend, the mathema- tician Farkas Bolyai who made several false proofs of the parallel postulate but without success. Gauss, after reading the 24 pages, described Janos Bolyai in these words while writing to a friend: 7 regard this young geom- eter Bolyai as a genius of the first order. However in some sense Bolyai only assumed that the new geometry was possible.

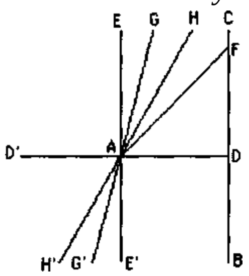
Nor is Bolyai's work diminished because Lobachevsky published a work on non-Euclidean geometry in 1829. Neither Bolvai nor Gauss knew of Lobachevsky's work, mainly because it was only published in Russian in the Kazan Messenger a local university publication. Lobachevsky's attempt to reach a wider audience had failed when his paper was rejected by Ostrogradski.

In fact Lobachevsky fared no better than Bolyai in gaining public recognition for his momentous work. He published Geometrical investiga- tions on the theory of parallels in 1840 which, in its 61 pages, gives the clearest account of Lobachevsky's work.

In Lobachevsky's 1840 booklet he explains clearly how his non- Euclidean geometry works.

All straight lines which in a plane go out from a given straight line in the same plane, can be divided into two classes – into cutting and non- cutting. The boundary lines of the one and the other class of those lines will be called parallel to the given line.

Here is the Lobachevsky's diagram



AD is the perpendicular from A to BC. AE is perpendicular to AD.

Within the angle EAD, some lines (such as AF) will meet BC. Assume that AE is not the only line which does not meet BC, so let AG be another such line.

AF is и cutting line and AG is a non-cutting line.

There must be a boundary between cutting and non-cutting lines and we may take AH as this

Hence Lobachevsky has replaced the fifth postulate of Euclid by: Lobachevsky's Parallel Postulate. There exist two lines parallel to a given line through a given point not on the line.

Lobachevsky went on to develop many trigonometric identities for triangles which held in this geometry, showing that as the triangle became small the identities tended to the usual trigonometric identities.

Riemann who wrote his doctoral dissertation under Gauss's supervi- sion, gave an inaugural lecture on 10 June 1854 in which he reformulated the whole concept of geometry which he saw as a space with enough extra structure to be able to measure things like length. Riemann briefly discussed a 'spherical' geometry in which every line through a point P not on a line AB meets the line AB. In this geometry no parallels are possible.

It is important to realize that neither Bolyai's nor Lobachevsky's de- scription of their new geometry had been proved to be consistent.

The first person to put the Bolyai – Lobachevsky non-Euclidean ge- ometry on the same footing as Euclidean geometry was Eugenio Beltrami (1835–1900). In 1868 he wrote a paper Essay on the interpretation of non- Euclidean geometry which produced a model for 2-dimensional non- Euclidean geometry within 3-dimensional Euclidean geometry. The model was obtained on the surface of revolution of a tractrix about its asymptote. This is sometimes called a pseudo-sphere.

Beltrami's work on a model of Bolyai – Lobachevsky's non-Euclidean geometry was completed by Klein in 1871. Klein went further than this and gave models of other non-Euclidean geometries such as Riemann's spherical geometry. Klein's work was based on a notion of distance defined by Cayley in 1859 when he proposed a generalized definition for distance.

Klein showed that there are three basically different types of geome- try. In the Bolyai – Lobachevsky type of geometry, straight lines have two infinitely distant points. In the Riemann type of spherical geometry, lines have no (or more precisely two imaginary) infinitely distant points. Euclid- ean geometry is a limiting case between the two where for each line there are two coincident infinitely distant points.

3. Ответьте на вопросы, используя информацию текста.

1) When did Euclid write his book «The Elements»?
2) What were the five postulates, which Euclid stated?
3) Who wrote a commentary on the Elements?
4) Whom Gauss discussed the theory of parallels with?
5) Why did Gauss decide, that Bolyai was a «genius of the first order»?
6) When did Lobachevsky publish a work on non-Euclidean geometry?
7) What is pseudo-sphere?

4 семестр

Коллоквиум № 3

1. Переведите следующие слова с русского на английский язык:

1. to be performed without using – быть выполненным без использования to figuring out – вычислять
2. at a certain speed – с определённой скоростью to stand for – означать
3. to satisfy the conditions of the theorem – отвечать условиям теоремы
4. to cover all possible values – включать в себя все возможные значения to fulfill certain conditions – выполнять определённые условия
5. to be valid – быть справедливым, верным to be concerned with – быть связанным с
6. to handle symbols – использовать символы

2. Прочитайте, переведите и перескажите текст:

ALGEBRA

Algebra, branch of mathematics in which symbols (usually letters) represents unknown numbers in mathematical equations. Algebra allows the basic operations of arithmetic, such as addition, subtraction, and multiplica- tion, to be performed without using specific numbers. People use algebra constantly in everyday life, for everything from calculating how much flour they need to bake a certain number of cookies to figuring out how long it will take to travel by car at a certain speed to a destination that is a specific distance away. Arithmetic alone cannot deal with mathematical relations such as the Pythagorean theorem, which states that the sum of the squares of the lengths of the two shorter sides of any right triangle is equal to the square of the length of the longest side. Arithmetic can only express specific instances of these relations. A right triangle with sides of length 3, 4, and 5, for example, satisfies the conditions of the theorem: 32 + 42 = 52. (32 stands for 3 multi- plied by itself and is termed «three squared»). Algebra is not limited to ex- pressing specific instances; instead it can make a destination l statement that covers all possible values that fulfill certain conditions – in this case, the theorem: a2 + b2 = c2.

One of the earliest mathematical concepts was to represent a number by a symbol and to represent rules for manipulating numbers in symbolic form as equations. For example, we can represent the numbers 2 and 3 by the symbols x and y. From observation we know that it does not matter in which order we add the numbers (2 + 3 = 3 + 2), and we can represent this equivalence as the equation x + y = y + x. The equation is valid no matter what numbers x and y represent. Because algebra uses symbols rather than numbers, it can produce general rules that apply to all numbers. What most people commonly think of as algebra involves the manipulation of numbers and the solving of equations.

The classical algebra is concerned with solving equations, uses sym- bols instead of specific numbers, and uses arithmetic operations to establish ways of handling symbols. The word algebra is also used, however, to de- scribe various modern, more abstract mathematical topics that also use symbols but not necessarily to represent numbers.

An area of mathematics research is also called algebra, or modern al- gebra. It developed after the discovery that laws such as the commutative law (x + y = y + x) held true not only for the addition of real numbers (rational and irrational numbers) but could extend to more complex operations and objects. Interest eventually focused on the concepts themselves and the conclusions that could be drawn about sets of objects with certain properties. Among the objects studied by modern algebra are groups, rings, and fields. Algebra also can be com- bined with other areas of pure mathematics such as geometry and a branch of geometry called topology. Mathematicians consider modern algebra a set of ob- jects with rules for connecting or relating them. As such, in its most general form, algebra may fairly be described as the language of mathematics.

3. Ответьте на вопросы, используя информацию текста.

1. What is algebra?
2. What differs algebra from arithmetic?
3. Where do people use algebra?
4. Why can algebra produce general rules that apply to all numbers?
5. What is the difference between the classical and modern algebras?
6. What is modern algebra concerned with?

Критерии оценки коллоквиума:

Оценка «5»

- глубокое и прочное усвоение программного материала;
- полные, последовательные, грамотные и логически излагаемые ответы при видоизменении задания;
- свободно справляющиеся с поставленными задачами, знания материала;
- правильно обоснованные принятые решения;
- владение разносторонними навыками и приемами выполнения практических работ.

Оценка «4»

- знание программного материала;
- грамотное изложение, без существенных неточностей в ответе на вопрос;
- правильное применение теоретических знаний;
- владение необходимыми навыками при выполнении практических задач.

Оценка «3»

- усвоение основного материала;
- при ответе допускаются неточности;
- при ответе недостаточно правильные формулировки;

- нарушение последовательности в изложении программного материала;
- затруднения в выполнении практических заданий;

Оценка «2»

- незнание программного материала;
- при ответе возникают ошибки;
- затруднения при выполнении практических работ.

Методические рекомендации по подготовке к коллоквиуму

Для успешной сдачи коллоквиума, получения по его итогам высокой оценки к нему необходимо правильно подготовиться. Прежде всего, необходимо заранее ознакомиться с темами коллоквиума, вопросами, которые будут обсуждаться на нем. Затем подбирается литература по этой тематике, ищутся ответы на вопросы. Можно пользоваться такими основными источниками информации как: библиотечный материал и Интернет. Стоит регулярно освежать в памяти пройденный материал, перечитывать свои записи. Так знания постепенно, а главное – надежно, откладываются и накапливаются в голове. А при приближении даты коллоквиума будет достаточно лишь бегло просмотреть ответы на вопросы, чтобы уверенно дать ответ на занятии.

Оценочные материалы для проведения тестирования (контролируемая компетенция УК-4)

V1: Non-Euclidean geometry
I: 1
S: In about 300 BC … wrote The Elements, a book which was to become one of the most famous book ever written
+: Euclid
-: Archimedes
-: Ptolemy
-: Tolstoy
I: 2
S: Euclid stated five … on which he based all his theorems
+: postulated
-: sentences
-: equations
-: sentences
I: 3
S: You can draw a … line from any point to any other
-: curved
+: straight
-: finite
-: thin
I: 4
S: You can produce a … straight line continuously in a straight line
+: finite
-: infinite
-: curved
-: thick
I: 5
S: You can describe a … with any centre and distance
+: circle
-: polygon
-: square
-: triangular

I: 6
S: All right … are equal to each other
-: points
+: angles
-: triangles
-: lines
I: 7
S: If a straight line falling on two straight lines make the … angles on the same side less than two right angles, if produced indefinitely, meet on that side on which are the angles less than the two right angles
+: interior
-: close
-: outer
-: further
I: 8
S: It is clear that the fifth … is different from tha other four
+: postulate
-: theorem
-: axiom
-: approval
I: 9
S: Given a line and a point not on the line, it is possible to draw exactly one line through the given point …. to the line
+: parallel
-: distant
-: far
-: opposite
I: 10
S: Many attempts were made … the fifth postulate from the other four, many of them being accepted as proofs for long periods of time until the mistake was found
+: to prove
-: to describe
-: to represent
-: to distribute
I: 11
S: Invariably the mistake was assuming some "obvious" … which turned out to be equivalent to the fifth postulate
+: property
-: activity
-: attempt
-: prompt
I: 12
S: One such "proof" was given by Wallis in 1663 when he thought he had … the fifth postulate, but he had actually shown it to be equivalent to Saccheri's quadrilateral
+: deduced
-: reduced
-: assessed
I: 13
S: To each triangle, there exists a similar triangle of arbitraly …
+: magnitude
-: property
-: importance

-: length
I: 14
S: One of the attemted proofs … to be more important than most others
+: turned out
-: assumed
-: postulated
-: deduced
I: 15
S: The importance of Saccheri’s work was that he assumed the fifth postulate false and attempted to derive a …
+: contradiction
-: addition
-: proposition
-: adjustment
I: 16
S: Saccheri proved that the summit anglers at Dand C were …
+: equal
-: similar
-: infinite
-: absolute
I: 17
S: Saccheri proved that the hypothesis of the … angle implied the fifth postulate, so obtaining a contradiction
+: obtuse
-: acute
-: finite
-: great
I: 18
S: In 1766 Lambert …. a similar line to Saccheri
+: followed
-: written
-: proved
-: described
I: 19
S: However he did not fall into the trap and investigated the … of the acute angle without obtaining a contradiction
+: hypothesis
-: postulate
-: theorem
-: proposition
I: 20
S: The … of the angles of a triangle is equal to two right angles
+: sum
-: right
-: obtuse
-: deduction
I: 21
S: Legendre showed that the sum of the angles of a triangle can not be greater than two right angles and never realized his … himself
+: error
-: mistake
-: contradiction

-: approval
I: 22
S: Gauss began work on the fifth postulate in 1792 write only 15 years old, at first … to prove the parallels postulate from the other four
+: attempting
-: trying
-: progressing
-: underluing
I: 23
S: In the theory of … we are even now not further
+: parallels
-: triangles]
-: squares
-: rounds
I: 24
S: Gauss began to work out the … of a geometry in which more than one line can be drawn through a given point parallel to a given line
+: consequences
-: sophisticated
-: allowances
-: prepositions
I: 25
S: Gauss discussed the theory of parallels with his friend, the mathematician Farkas Bolyai who made several false proofs of the parallel postulate but without …
-: access
+: success
-: assessment
-: calculation
I: 26
S: However in some sense Bolyai only … that the new geometry is possible
+: assumed
-: consumed
-: agreed
-: proposed
I: 27
S: Lobachevski's attempt to a wider audience had failed when his paper was … by Ostrogradsky
-: objected
+: rejected
-: determined
-: outlined
I: 28
S: In fact Lobachevsky fared no better than Bolyai in gaining public … for his momentous work
-: acquisition
-: interrogation
+: recognition
-: attribution
I: 29
S: All straight lines which in a plane go out from a given straight line the same …, can be divided into 2 classes into cutting and noncutting
+: plane

-: curve
-: triangle
-: round
I: 30
S: The …. Lines of the one and the other class of those lines will be called parallel to the given line
+: boundary
-: secondary
-: curved
-: absolute
I: 31
S: Lobachevsky went on to develop many … identities for triangles
+: trigonometric
-: square
-: arithmetic
-: mathematical
I: 32
S: He showed that as the triangle became small the … tented to the usual trigonometric identities
+: identities
-: quantities
-: qualities
-: interrogation
I: 33
S: Riemann who wrote his doctoral dissertation under Gauss's supervision, gave an inaugural lecture in which he reformulated the whole concept of …
-: algebra
-: trigonometry
+: geometry
-: physics
I: 34
S: He saw geometry as a space with enough extra structure to be able to measure things like …
-: width
+: length
-: square
-: round
I: 35
S: Riemann briefly discussed a "…" geometry in which every line through a point P not on a line AB meets the line AB
-: triangle
+: spherical
-: round
-: square
I: 36
S: It is important to realize that neither Bolya's not Lobachevsky's description of their new geometry had been proved to be …
-: persistent
+: consistent
-: sophisticated
-: deduced
I: 37

S: Eugenio Beltrami made the interpretation of non-Euclidean geometry which produced a model for … non-Euclidean geometry within 3-dimensional Euclidean geometry
+: 2-dimensional
-: accurate
-: rigorous
-: round
I: 38
S: This model was obtained on the surface of revolution of a … about its asymptote
-: triangle
-: polygon
+: tractrix
-: unanimous
I: 39
S: This is sometimes called a …
+: pseudo-sphere
-: sphere
-: square
-: round
I: 40
S: In the Bolyai-Lobachevsky type of geometry, straight lines have two infinitely .. points
-: close
+: distant
-: far
-: further
I: 41
S: Euclidean geometry is a limiting case between the two where for each line there are two … infinitely distant points
+: coincident
-: convinced
-: independent
-: outrageous
I: 42
S: Algebra, branch of mathematics in which symbols (usually letters) represents unknown numbers in mathematical …
-: illustrations
+: equation
-: alteration
-: deduction
I: 43
S: Algebra allows the basic operations of arithmetic, such as addition, subtraction and …. to be performed without using specific
-: division
-: calculation
-: application
+: multiplication
I: 44
S: People … use algebra in every day life
-: seldom
+: constantly
-: absolutely
-: deprived
I: 45

S: Arithmetic alone cannot deal with mathematical relations such as the Pythagorean ….
+: theorem
-: axiom
-: postulate
-: sentence
I: 46
S: Pythagorean theorem … that the sum of the squares of the lengths of the two shorter sides of any right triangle is equal to the square of the length of the longest side
+: states
-: rejects
-: proves
-: deduces
I: 47
S: Arithmetic can only express specific … of the these relations
+: instanced
-: opportunities
-: operations
-: accommodations
I: 48
S: One of the earliest mathematical concepts was to represent a number by a symbol and to represent rules for manipulating numbers in … form as equations
-: elementary
+: symbolic
-: compound
-: rigorous
I: 49
S: The classical algebra is concerned with solving equations, uses symbols instead of specific numbers, and uses … operations to establish way of handling symbol
+: arithmetic
-: trigonometric
-: physical
-: artificial
I: 50
S: The word algebra is also used, however, to describe various modern, more abstract mathematical topics that also use symbols but not necessarily to represent …
+: numbers
-: shapes
-: formulas
-: deductions

Критерии формирования оценок по тестовым заданиям:

По итогам выполнения тестовых заданий оценка производится по пятибалльной шкале. При правильных ответах на:
89-100% заданий – «5» (баллов);
70-88% заданий – «4» баллов);
50-69% заданий – «3» (балла);
30-49% заданий – «2» (балла);
10-29% заданий – «1» (балл);
менее 10% заданий – «0» (баллов).